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Ord River Irrigation Development - Clearing for Geotechnical Investigations

Preliminary Environmental Impact
Assessment

Prepared for
Main Roads WA
by Strategen

June 2009

Ord River Irrigation Development - Clearing for Geotechnical Investigations

Preliminary Environmental Impact
Assessment

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June 2009

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Client: Main Roads WA

Report	Version	Prepared by	Reviewed by	Submitted to Client	
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EXECUTIVE SUMMARY

Main Roads Western Australia (MRWA) proposes to undertake geotechnical surveys at a number of sites in the Kununurra vicinity during the 2009 dry season. The surveys will determine the suitability of each site for extraction of material required for upgrade and realignment of Weaber Plain Road and construction of 'Loop Road' and associated roads in the Ord River Irrigation Area. Approval to undertake clearing for materials extractions will then be obtained via a clearing permit under Section 51 of the EP Act.

Upgrade and realignment of Weaber Plain Road and construction of 'Loop Road' form part of the M2 proposal, which was granted approval to be implemented by the WA Minister for the Environment in February 2002 by the issue of Statement No. 585. In January 2007 this approval was extended to February 2012.

The M2 proposal approved to be implemented in Western Australia was for clearing and development of 32 000 ha of agricultural land, as well as 3000 ha for associated infrastructure. The M2 proposal also identified 42 500 ha of land to be managed as buffer areas between agricultural areas and conservation reserves and watercourses.

The EPASU advised LandCorp in May 2009 that the proposed geotechnical surveys are subject to the conditions of Statement No. 585, but are not constrained by them. That is, the EPASU does not consider the proposed geotechnical surveys to be 'ground disturbance'. Based on this advice, MRWA would be authorised under Statement No. 585 to undertake geotechnical surveys within the M2 development area, although the EPASU also advised LandCorp in May 2009 that it does not support the conduct of geotechnical surveys and material extraction within the M2 buffer area. Nonetheless, it may be possible to establish reserves within the buffer where material extraction could occur and further discussion with the EPASU is recommended to clarify this position.

In contrast to the above position of the EPASU, the Ord Final Agreement, which was finalised in September 2005 and resolved Native Title and heritage matters affecting approximately 65 000 ha of land around Kununurra and Lake Argyle, states that extraction of raw materials may occur in the M2 buffer area (e.g. refer to Division 4B Clause 31(7) in the Ord Final Agreement)¹.

For all sites outside the M2 Area, the geotechnical surveys are proposed to be undertaken under the provisions of the Main Roads WA State-wide Purpose Permit CPS 818/4. The Permit requires that MRWA prepare a PEIA to assess the proposal activities against the 10 clearing principles listed in Schedule 5 of the EP Act.

This PEIA outlines potential environmental impacts of clearing and assesses the proposed geotechnical surveys against the 10 clearing principles listed in Schedule 5 of the EP Act. The scope of the PEIA includes 14 Material Investigation Areas (MIAs), five road alignments, and 30 borrow pits. The report outlines the findings of a desktop study undertaken in accordance with Condition 7(b) of the Permit based on available information.

¹ Note that, while the Ord Final Agreement was released after Statement No. 585, it does not take precedence over the Statement. The proposed geotechnical investigations must meet the requirements of both documents.

The key findings of the PEIA were:

1. The proposed clearing activities are not anticipated to require referral to the EPA under the EP Act, subject to the recommendations made in the PEIA and the points outlined below.
2. The proposed clearing activities are considered unlikely to have a significant impact to matters of national environmental significance and therefore are not anticipated to require referral to DEWHA under the EPBC Act.
3. Assessment of clearing against the 10 clearing principles found the proposed clearing is only unlikely to be at variance with eight clearing principles and may not be at significant variance with two principles (6 and 8) if appropriate management measures are implemented.
4. The potential to be at variance but not at significant variance with clearing principles 6 and 8 was due to:
 - (a) the location of proposed clearing areas within existing and potential conservation areas
 - (b) the proximity of proposed clearing areas to wetlands, rivers, creeks and drainage lines.
5. Clearing is unlikely to be at variance with clearing principles 1, 2, 7 and 9, provided appropriate management protocols are implemented.
6. Clearing is unlikely to be at variance with clearing principles 3, 4, 5 and 10.
7. Clearing that is unlikely to be at variance with the clearing principles should be the focus of initial works, with adherence to appropriate management protocols.
8. Areas where there is potential to be at variance (but not at significant variance) with principles 6 and 8 should be subject to more detailed assessment or investigation to determine management measures which ensure that variance from clearing principles is not significant.

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1. INTRODUCTION

1.1 BACKGROUND AND APPROVALS CONTEXT

Main Roads Western Australia (MRWA) proposes to undertake geotechnical surveys at a number of sites in the Kununurra vicinity during the 2009 dry season (Figure 1; Figure 2). The surveys will determine the suitability of each site for extraction of material required for upgrade and realignment of Weaber Plain Road and construction of 'Loop Road' and associated roads in the Ord River Irrigation Area.

Upgrade and realignment of Weaber Plain Road and construction of 'Loop Road' form part of the M2 proposal, which is subject to the conditions of Statement No. 585 (Section 1.2). The Environmental Protection Authority Service Unit (EPASU) advised LandCorp in May 2009 that the proposed geotechnical surveys are also subject to the conditions of Statement No. 585, but are not constrained by them. That is, the EPASU does not consider the proposed geotechnical surveys to be 'ground disturbance'.

Based on this advice, MRWA would be authorised under Statement No. 585 to undertake geotechnical surveys within the M2 development area, although the EPASU also advised LandCorp in May 2009 that it does not support the conduct of geotechnical surveys and material extraction within the M2 buffer area. Nonetheless, it may be possible to establish reserves within the buffer where material extraction could occur and further discussion with the EPASU is recommended to clarify this position.

In contrast to the above position of the EPASU, the Ord Final Agreement (Section 1.3) states that extraction of raw materials may occur in the M2 buffer area (e.g. refer to Division 4B Clause 31(7) in the Ord Final Agreement)².

For all sites outside the M2 Area, the geotechnical surveys are proposed to be undertaken under the provisions of the Main Roads WA State-wide Purpose Permit CPS 818/4 (the Permit). On 8 November 2007, the Department of Environment and Conservation (DEC) issued the Permit to the Commissioner of MRWA for the period up to 12 December 2010 to enable MRWA to carry out 'proposal activities' as defined within the Permit.

The Permit requires that MRWA prepare a Preliminary Environmental Impact Assessment (PEIA) to assess the proposal activities against the 10 clearing principles listed in Schedule 5 of the *Environmental Protection Act 1986 (WA)* (EP Act).

1.2 THE M2 PROPOSAL

The M2 Area comprises over 76 000 ha (including buffer areas) across the Weaber, Keep River and Knox Creek plains and extends to the Keep River estuary in the Northern Territory. A proposal to develop the M2 Area for irrigated agriculture (primarily for sugar production) was considered by the Western Australian and Northern Territory governments in 2002. An Environmental Review and

² Note that, while the Ord Final Agreement was released after Statement No. 585, it does not take precedence over the Statement. The proposed geotechnical investigations must meet the requirements of both documents.

Management Programme/Draft Environmental Impact Statement (ERMP/Draft EIS) was submitted for the M2 proposal (Kinhill 2000) and assessed under the *Environmental Protection Act 1986* (WA) (EP Act). The M2 proposal was granted approval to be implemented by the WA Minister for the Environment in February 2002 by the issue of Statement No. 585. In January 2007 this approval was extended to February 2012.

Statement No. 585 applies to only the Western Australian portion of the M2 Area. This includes land across the Weaber Plain and part of the Knox Creek Plain. The statement does not apply to the Northern Territory portion of the proposal (notwithstanding that Schedule 1 of the statement shows a portion of the proposal area in the Northern Territory). Development in the Northern Territory will require separate authorisation from the Northern Territory government.

The M2 proposal approved to be implemented in Western Australia was for clearing and development of 32 000 ha of agricultural land, as well as 3000 ha for associated infrastructure. The M2 proposal identified 42 500 ha of land to be managed as buffer areas between agricultural areas and conservation reserves and watercourses.

Existing Proponent Commitments and Implementation Conditions in Statement No. 585 to be fulfilled to the requirements of the Environmental Protection Authority (EPA) prior to ground disturbing activities³ within the M2 Area are outlined below.

1. Establishment of an Environmental Management System (EMS) conforming to the requirements of the AS/NZ ISO 14000 series of standards.
2. Preparation of an Environmental Management Program (EMP).
3. Preparation of a Buffer Management Plan.
4. Preparation of a Flora and Fauna Protection Plan.
5. Preparation of a Hydrodynamic Survey Plan.
6. Preparation of a Final Project Design Plan.
7. Preparation of a Preliminary Decommissioning Plan.
8. Establishment of an Environmental Management Entity (EME).

1.3 THE ORD FINAL AGREEMENT AND THE ORD GLOBAL NEGOTIATIONS AGREEMENT

The Ord Final Agreement was finalised in September 2005 and resolved Native Title matters affecting approximately 65 000 ha of land around Kununurra and Lake Argyle, paving the way for expansion of the ORIA and other agricultural, industrial and residential developments. The signing of the Ord Final Agreement followed extensive and complex negotiations between the State and the Miriuwung Gajerrong people.

Amongst other matters addressed in the Ord Final Agreement, the Agreement allows for the extraction of raw materials within the M2 Area, including within both the M2 development area and the M2 buffer area.

³ Note that, as outlined in Section 1.1, the EPASU does not consider geotechnical surveys to be “ground-disturbing activities”.

In parallel with, but as a separate process to, development of the Ord Final Agreement, the Ord Global Negotiations Heritage Agreement was established, which resolved heritage matters over a number of 'Inspection Areas' and 'Priority Inspection Areas'. The Ord Global Negotiations Heritage Agreement was signed in July 2004 in heritage surveys of the Inspection Areas and Priority Inspection Areas were undertaken in accordance with the Agreement at various dates from August 2004 to June 2005.

The Priority Inspection Areas comprised the following areas as defined in the Ord Global Negotiations Heritage Agreement:

1. M2 Development Area
2. Irrigation Infrastructure
3. M2 Raw Materials Land
4. Planned Infrastructure
5. Infrastructure Corridor
6. M2 Identified Borrow Pits
7. Proposed M2 Channel.

The Inspection Areas comprised the following areas as defined in the Ord Global Negotiations Heritage Agreement:

1. Green swamp
2. Kununurra Land
3. Existing and Proposed Roads and Roads Raw Materials Land
4. Packsaddle Plain
5. Ord East Bank
6. Ord West Bank
7. Government Land.

Archaeological surveys of the Inspection Areas and Priority Inspection Areas are reported on by Hammond et al. (2004, 2005). Ethnographic surveys of the Inspection Areas and Priority Inspection Areas are reported on by Barber and Rumley (2005a, b).

Strategen understands that all areas assessed in this PEIA, with the exception of MIAs 12, 13 and 14, were surveyed in accordance with the Ord Global Negotiations Heritage Agreement.

1.4 PURPOSE AND SCOPE OF THIS REPORT

This report is a PEIA outlining potential environmental impacts of clearing and assessing the proposed geotechnical surveys against the 10 clearing principles listed in Schedule 5 of the EP Act. The scope of the PEIA includes 14 Material Investigation Areas (MIAs), five road alignments, and 30 borrow pits (Figure 2).

The report outlines the findings of a desktop study undertaken in accordance with Condition 7(b) of the Permit based on available information. The report meets the requirements of both the DEC Draft

Guide to Assessment: Clearing of Native Vegetation, under the EP Act and the MRWA Environmental Standard Brief for Preliminary Environmental Impact Assessment (Main Roads 2005).

The scope of the report is limited to assessment of the proposed geotechnical surveys and does not include assessment of the proposed future materials extraction from the MIAs or borrow pits. Materials extraction will occur at locations to be determined based on the findings of the geotechnical surveys and is at this stage intended to be approved through a clearing permit to be applied for and issued under Section 51 of the EP Act.

1.5 PROPOSED CLEARING

The proposed geotechnical surveys will require clearing of approximately 49 ha of native vegetation within the eastern Kimberley region. The geotechnical surveys will determine areas suitable for materials extraction for road building activities. The MIAs, road alignments and borrow pits are referred to collectively in this report as proposed geotechnical exploration areas. The land containing these areas is referred to as the Proposal Area. The proposal area is approximately 350 000 ha.

Consistent with Part I, Section 1 of the Permit, clearing will be conducted for 'proposal activities' involving 'searching for and extracting road building materials'.

1.5.1 Clearing locations

MRWA has identified 14 MIAs, five road alignments, and 30 borrow pits suitable for geotechnical surveys based on soil mapping (Figure 2).

The location of the 14 MIAs and five road alignments in relation to key environmental features is summarised in Table 1 and Table 2 respectively. Borrow pits are scattered throughout Proposal Area (Figure 2).

1.5.2 Methodology

Materials Investigation Areas

Within each of the 14 MIAs, the proposed geotechnical surveys will involve excavation of test pits at 100 m intervals (on average) on a grid plan over the MIA. Across the 14 MIAs, this will result in excavation of approximately 22 000 test pits. Each test pit will involve clearing an area of approximately 5 m², resulting in total area of 11 ha of clearing for test pits within the 14 MIAs.

Clearing will also be required to facilitate vehicle access to the sites. In most cases existing fence lines, tracks and firebreaks will be used; however, it is anticipated that 105 km of 2.5 m wide tracks will be required, resulting in approximately 26 ha clearing for tracks.

To allow for some extra clearing based on a number of assumptions relating to investigation activities, a 20% contingency has been added to the estimated clearing for MIAs. Including this contingency, approximately 44.4 ha of native vegetation clearing is expected to be required for the 14 MIAs (Table 1).

Road alignments

Along each of the five road alignments, the proposed geotechnical surveys will involve excavation of test pits at approximately 100 m intervals. Test pits will be similar to those for the MIAs (i.e. 5 m²). The total length of the five road alignments is approximately 175 km, which will require approximately 1750 pits and will result in a total of 0.875 ha of clearing. With an additional 20% contingency, this results in approximately 1 ha of clearing for the five road alignments.

Borrow Pits

Sampling of borrow pits will most likely be determined on site. Test pits cleared will be approximately 5 m² each, and the number of pits required will depend on the size of the borrow pit. The borrow pits are roughly circular and are of two sizes, with 23 borrow pits at approximately 20 ha each and seven at approximately 78 ha each, totalling an area of approximately 1000 ha. It is likely that a combined total of approximately 0.5 ha will be cleared within borrow pits. An estimated 10 km of 2.5 m wide tracks will be required, resulting in approximately 2.5 ha clearing for tracks. The total area of clearing for borrow pits and associated tracks plus 20% contingency is approximately 3.6 ha.

Table 1 Clearing for geotechnical investigations in Material Investigation Areas

MIA	Total area (ha)	Predicted clearing area (ha)	Located within ESA	Located within Ramsar wetland	Located within conservation area	Description / Characteristics
1	230	0.3 vv	Yes	Yes	Yes	South of the Ord River, bounded by Parry Creek Rd to the north and Old Halls Creek Rd to the east, L-shaped area, drainage line lies 1.3 km to the east
2	490	0.5	Yes	Yes	Yes	South of the Ord River, south of and adjacent to Parry Creek Rd, rectangular area, drainage line crosses north-east corner of the area, Goose Hill is to the west.
3	700	0.8	No	Partially	Partially	South of the Ord River, south of Parry Creek Rd, rectangular area, crossed by tracks and small drainage lines. Situated adjacent to the Mantinea Proposal Area (potential future irrigation area as part of Ord Stage 2).
4	230	0.3 vv	No	No	No	South of the Ord River, south of Parry Creek Rd, rectangular area, very sparse trees, hilly area to the south
5	550	0.6	No	No	No	South of and adjacent to the Ord River, north of Parry Creek Rd, rectangular area, very sparse trees, small drainage lines and existing roads within the area. Situated adjacent to the Mantinea Proposal area (potential future irrigation area as part of Ord Stage 2).
6	114	0.1	No	No	No	Immediately south of Parry Creek Road adjacent to the western bank of the Ord River. One drainage line traverses the site.
7	970	1.1	No	No	No	North of the Ord River, irregularly shaped area (due to avoidance of hilly outcrop - False House Roof Hill), several existing roads in the area

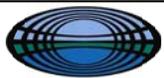
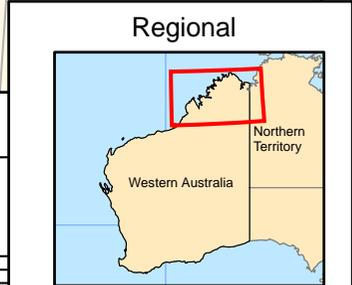
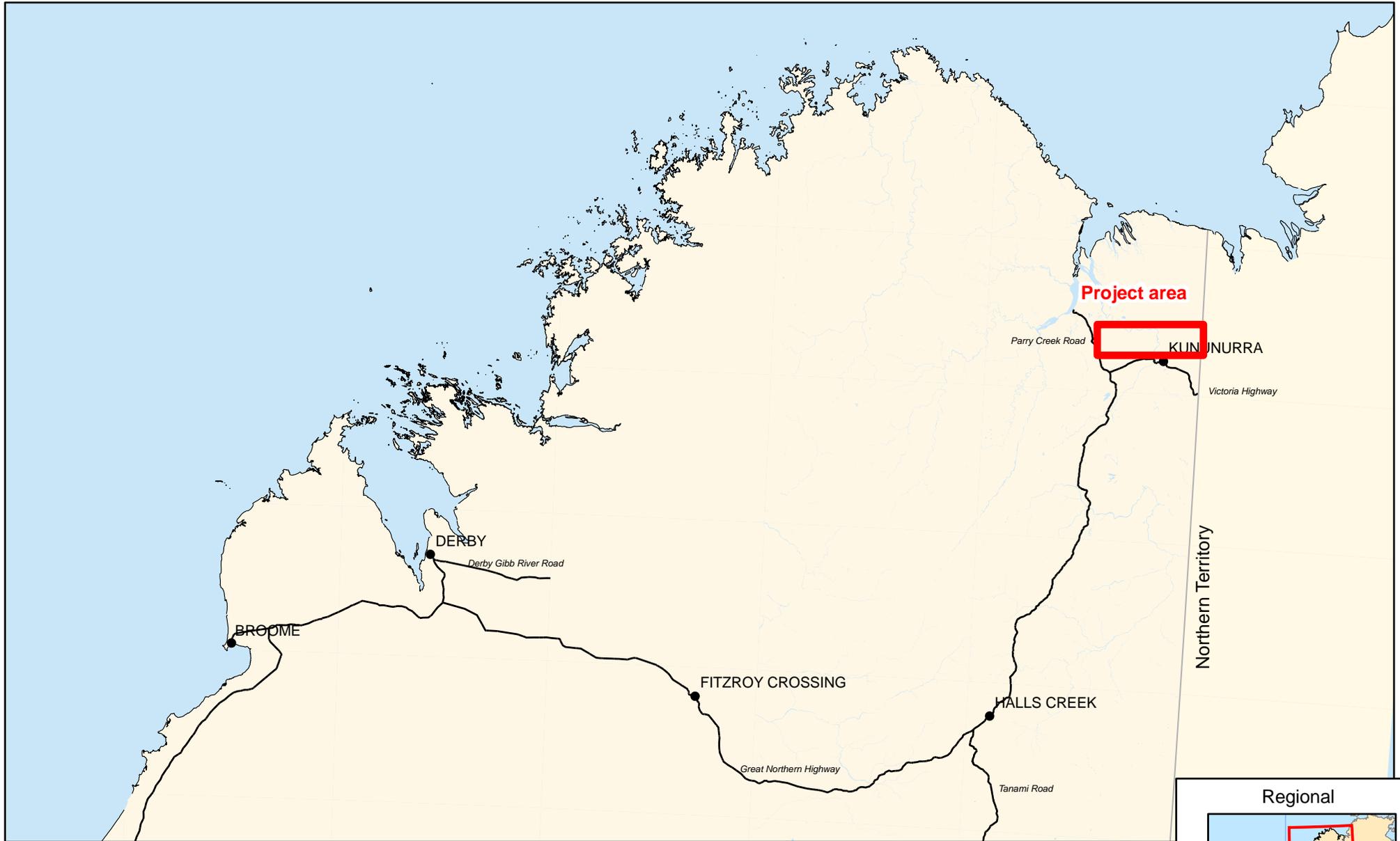
MIA	Total area (ha)	Predicted clearing area (ha)	Located within ESA	Located within Ramsar wetland	Located within conservation area	Description / Characteristics
8	1070	1.2	No	No	No	On the northern side of Carlton Plains, approximately 8 km west of the Carlton Plain / Weaber Plain Road intersection. Two drainage lines traverse the site. Priority flora species <i>Euphorbia stevenii</i> , (P3) recorded as occurring along the north-eastern border of the site and <i>Fuirena incrassate</i> (P1) recorded as occurring 2 km to the east of the site.
9	300	0.3	No	No	Yes (proposed conservation area)	Approximately 4 km south of the Carlton Plain / Weaber Plain Road intersection, on the eastern side of Weaber Plain Road, at the southern end of the Cave Springs Ranges.
10	200	0.2	No	No	No	Approximately 4 km south of MIA 9, south of the Pincombe Ranges. <i>Euphorbia stevenii</i> (P3) recorded 2 km north-east of the site.
11	570	0.6	No	No	Yes (proposed conservation area)	Approximately 8 km north of the Carlton Plain / Weaber Plain Road intersection, along the south-eastern side of Weaber Plain Road, adjacent to Cave Springs Ranges
12	270	0.3	No	No	No	On the southern side of Weaber Plains Road on the WA and NT border
13	1030	1.2	No	No	Yes (proposed conservation area)	North-east of MIA 11 and south-west of MIA 12, within a few hundred metres of the western bank of Knox Creek. Unnamed tributary of Knox Creek traverses the site.
14	3160	3.5	No	No	No	Approximately 3.5 km south-east of MIA 10, within a few hundred metres of the west bank of Eight Mile Creek. A number of unnamed tributaries and drainage lines traverse this site. Priority flora species <i>Desmodium flagellare</i> (P1) recorded as occurring in the centre of the site.
Sub Total	9884	11				
Tracks		26				
20% contingency		7.4				
Total		44.4				

* ESA: Environmentally Sensitive Area as defined under the Environmental Protection (Clearing of Native Vegetation) Regulation 2004

Table 2 Clearing for Geotechnical investigation for road alignments

Road alignment	Length (km)	Predicted clearing area (ha)	Located within ESA	Located within Ramsar wetland	Located within conservation area	Description / Characteristics
Parry Creek Road	60	0.3	Partially	Partially	Partially	Existing road south of the Ord River, runs in east-west alignment, from ORIA Stage 1 to Great Northern Hwy, central section of road adjacent to the Ord River
Carlton Plain Road	30	0.15	No	No	No	Existing road, north of the Ord River, runs in roughly an east-west alignment, from ORIA Stage 1 to Carlton Plain

Road alignment	Length (km)	Predicted clearing area (ha)	Located within ESA	Located within Ramsar wetland	Located within conservation area	Description / Characteristics
Valentine Spring Road	15	0.075	No	No	No	Existing road, runs in roughly north-south alignment, from West Bank to Victoria Hwy
Weaber Plain Road	35	0.175	No	No	No	Existing road, runs roughly in a south-west to north-east alignment, through proposed Weaber Plain irrigation area
Loop Road	35	0.175	No	No	No	Proposed road, near Weaber Plain Rd, runs through proposed Weaber Plain irrigation area
20% contingency		0.175				
Total	175	1 ha				



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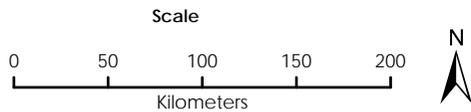
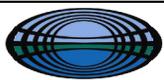
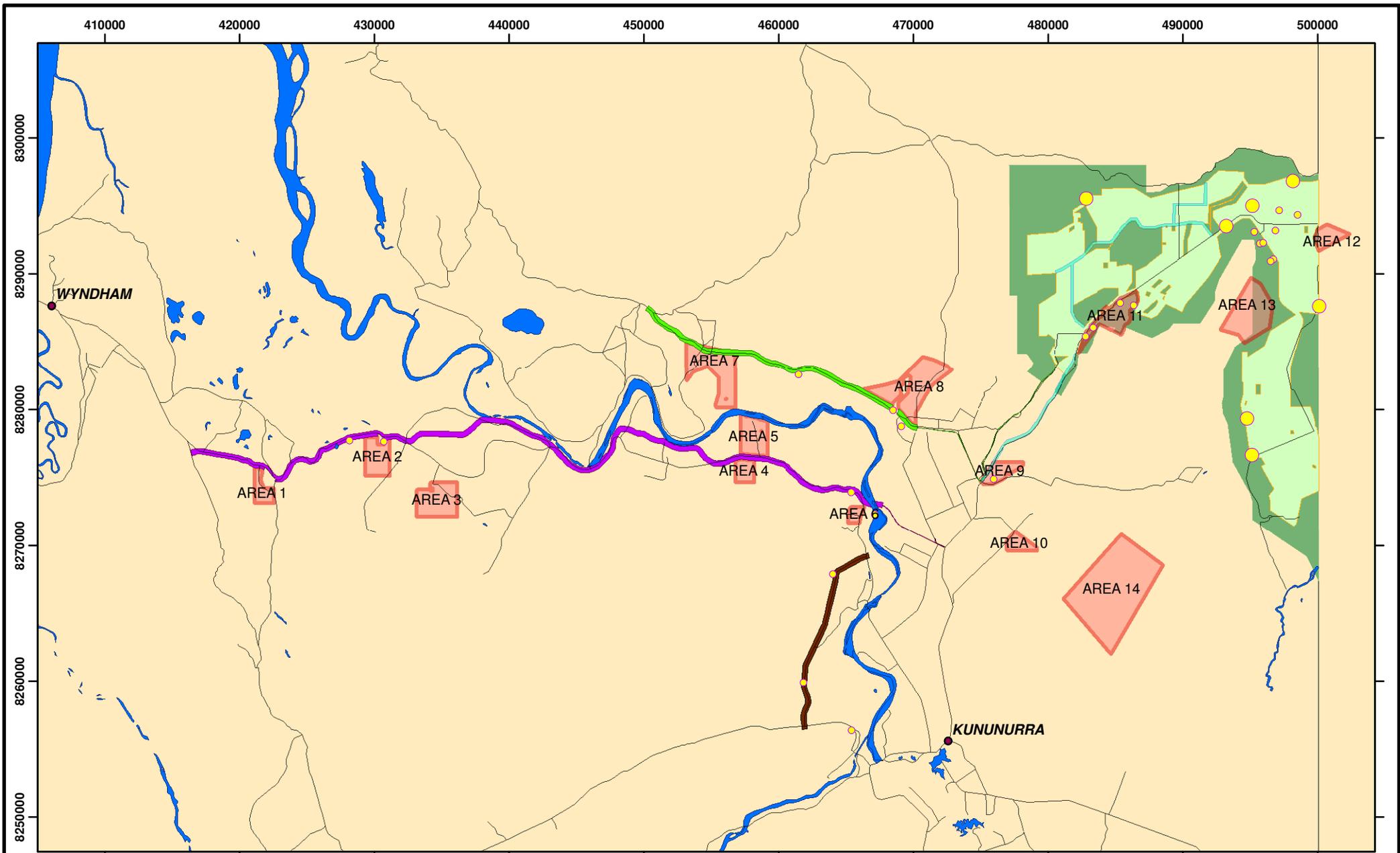


Figure 1 Regional location

Coordinate system: GDA 1994 MGA Zone 50	Original scale: 1:4,000,000 at A4
Date: 15/05/2009	Source: Geoscience Australia 2006
Prepared by: DLE	
File: LAN09025.01\Jess\Figure 1 Regional location.mxd	Note that positional errors may occur in some areas



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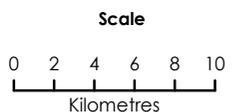


Figure 2 Areas of proposed geotechnical investigations

Coordinate System: Transverse Mercator	Original scale: 1:375,000, at A4
Date: 14/05/2009	Source:
Prepared by: J/je	
File: I:\N092925.01\less\Figure 2 Areas of proposed geotech.mxd	Note that positional errors may occur in some areas.

- Legend**
- Borrow pits
 - M2 buffer area
 - M2 development area
 - Loop Road (and M2 channel)
 - Valentine Spring Road
 - Parry Creek Road
 - Carlton Plain Road (Section 1)
 - Carlton Plain Road (Section 2)
 - Material area

2. APPROVALS

2.1 PURPOSE PERMIT CONDITIONS

The Permit authorises MRWA to clear native vegetation for project activities, including but not limited to *searching for and extracting road building materials* subject to Permit conditions.

The Permit requires that MRWA prepare a Preliminary Environmental Impact Assessment (PEIA), which is a desktop study that assesses the proposed clearing against each of the clearing principles listed under Schedule 5 of the EP Act.

Where the desktop study indicates that clearing is not likely to be at variance or seriously at variance with the 10 clearing principles, clearing may proceed under the Permit.

Where the information available is insufficient to allow MRWA to assess the proposed clearing against one or more of the clearing principles, or where the desktop study indicates that the clearing may be at variance or seriously at variance with one or more of the clearing principles, MRWA must undertake an Environmental Impact Assessment (EIA) and prepare an EIA report.

2.2 STATE AND AUSTRALIAN GOVERNMENT REFERRAL

With the exception of the proposed geotechnical exploration areas located within the M2 Area, the project which is the subject of this assessment procedure has not been referred to the Environmental Protection Authority (EPA) because geotechnical investigations were not considered to have a significant adverse effect on the environment. The proposed geotechnical surveys are required to facilitate activities that were included in the proposal (i.e. road construction), and consequently, the EPASU has recently advised that it considers the geotechnical surveys within the M2 area to be part of the M2 proposal. Areas outside the M2 Proposal Area are not within the scope of that proposal and therefore geotechnical investigations outside the M2 Proposal Area are not subject to the existing Statement for the M2 Area.

A search of the Australian Government Department of the Environment, Water, Heritage and the Arts (DEWHA) 'Protected Matters' database conducted in April 2009 identified that two wetlands of international significance occur within Ord River area and that habitat for a number of threatened and migratory species also occur within the region. Given the Proposal Area is located some distance from the identified wetlands and due to the small scale of the proposed clearing the Proposal is not likely to affect these matters of National Environmental Significance. The proposal therefore does not require referral under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act).

Proposed materials extraction (which is not the subject of this assessment) is at this stage intended to be approved through a clearing permit to be applied for and issued under Section 51 of the EP Act. Based on an estimated nine month timeframe for the clearing permit to be granted following submission of the application, the application is intended to be submitted before the findings of the geotechnical surveys are known. As such, the precise location of clearing for materials extraction will not be known at the time of submitting the application and therefore the application will be for a 'purpose permit' rather than an 'area permit'.

3. PURPOSE PERMIT ASSESSMENT REQUIREMENTS

3.1 AUTHORISATION

Section 2 of the Permit does not authorise the permit holder to clear native vegetation for proposal activities where:

- i. *it does not have the power to clear native vegetation for those proposal activities under the Main Roads Act 1930 or any other written law*
- ii. *the clearing may be seriously at variance with the clearing principles; or*
- iii. *the proposal activities are incorporated in a proposal that has been referred to and assessed under Part IV of the EP Act by the EPA.*

In this regard, it is noted:

1. There is no express provision within the *Main Roads Act 1930* (WA) which prohibits MRWA from clearing native vegetation for the purpose of searching for and extracting road building materials.
2. Based on the findings of the desktop assessment, outlined herein, it is considered that the proposed clearing is not likely to be at variance with the clearing principles.
3. With the exception of proposed geotechnical exploration areas located within the M2 Area, the proposed geotechnical activities for which the clearing is proposed have not been referred to the EPA and have not been subject to an assessment as a part of any other proposal by the EPA pursuant to Part IV of the EP Act.

3.2 CLEARING LIMIT

Clearing of native vegetation is authorised (subject to a PEIA) providing the amount of clearing proposed together with all prior clearing conducted within the region under the permit, does not exceed the total regional limit outlined within Schedule 1 of the Permit.

In this case clearing is proposed within the Kimberley region of Western Australia, for which there is a regional limit of 500 ha per calendar year (CPS 818/4).

3.3 MITIGATION PRINCIPLES

Consistent with Part II, section 6 of the Permit, in considering the location of the proposed clearing, the proponent had regard for the following principles:

- (a) avoid the clearing of native vegetation
- (b) minimise the amount of native vegetation to be cleared
- (c) reduce the impact of clearing on any environmental value.

MRWA proposes to avoid and minimise the clearing of native vegetation through the use of existing access tracks and firebreaks within MIAs where practicable and through the adoption and implementation of the recommendations outlined within this report.

3.4 STANDARD BRIEF FOR PRELIMINARY ENVIRONMENTAL IMPACT ASSESSMENT

This report has been prepared with reference to the requirements of the MRWA Standard PEIA Brief and the conditions set out within the Permit, both of which prescribe the content and form of the PEIA.

This document is consistent with the requirements of the Standard PEIA Brief and the Permit insofar as they relate to the assessment of the proposal against the ten clearing principles.

4. ENVIRONMENTAL IMPACT ASSESSMENT

Environmental factors considered in determining the scope of this PEIA are presented in Table 3.

Factors not considered relevant due to a limited potential for environmental impact as the result of clearing activities are listed under 'other factors'. This has been determined through assessment of the inherent nature of clearing activities and the characteristic impacts and effects of vegetation clearing, as well as taking into account project-specific factors such as size and density of proposed clearing areas, and current land use and the local biophysical environment.

Factors considered relevant and requiring further desktop investigation as part of the PEIA are listed under 'relevant factors'. A detailed assessment of key aspects along with potential impacts is presented in Section 5.

Table 3 Environmental factors

Relevant factors	Other factors
Vegetation and flora	Noise and vibration
Terrestrial fauna	Visual amenity and European cultural heritage
Surface water/drainage and wetlands	Public safety and risk
Reserves and conservation areas	Contaminated sites
Aboriginal heritage	Dust and air quality
	Groundwater
	Salinity and acid sulphate soils
	Aquatic fauna, stygofauna, and troglofauna

5. RELEVANT ENVIRONMENTAL FACTORS

5.1 VEGETATION AND FLORA

5.1.1 Existing environment

The MIAs, road alignments and borrow pits contain the following vegetation communities (Astron 1999):

- Mixed *Bauhinia cunninghamii*/ *Eucalyptus microtheca* sparse low woodland over mixed *Astrebla*/ *Dichanthium*/ *Sorghum* high grass
- Mixed *Eucalyptus tectifica*/ *E. foelscheana* woodland over mixed *Themeda australis*/ *Sehima nervosum* grass
- Mixed *Eucalyptus tectifica*/ *E. foelscheana* woodland over mixed upland *Triodia* hummock/ *Sorghum* high grass
- Mixed *Eucalyptus pruinosa*/ *Melaleuca* open woodland over open *Triodia* hummock grass
- Mixed *Eucalyptus dichromophloia* (bloodwood sub-alliance)/ *E. terodonta* woodland over mixed upland *Triodia* hummock/ *Sorghum* high grass
- Mixed *Eucalyptus tectifica*/ *E. confertiflora*/ *E. foelscheana* woodland over mixed *Sehima nervosum*/ *Sorghum* high grass
- Mixed *Eucalyptus dichromophloia* (bloodwood sub-alliance)/ *E. terodonta*/ *E. miniata* woodland over mixed upland *Triodia* hummock/ *Sorghum* high grass
- Mixed *Eucalyptus dichromophloia* (bloodwood sub-alliance)/ *E. terodonta* woodland over mixed upland *Triodia* hummock/ *Sorghum* high grass interspersed with mixed *E. tectifica*/ *E. foelscheana* woodland over mixed upland *Triodia* hummock/ *Sehima nervosum* high grass
- Mixed *Eucalyptus papuana*/ *E. polycarpa* woodland over mixed *Triodia* hummock/ *Sorghum* high grassland
- Riverine vegetation
- Wetland vegetation.

Department of Environment and Conservation database searches were undertaken for areas which disturbance of native vegetation may occur including some additional “buffer” areas. No Threatened Ecological Communities (TECs) or Declared Rare Flora (DRF) have been recorded within the areas where disturbance may occur. From a place name search the DRF species *Eucalyptus ceracea* was listed as potentially occurring in the areas where disturbance may occur, although no specimens have previously been recorded in the areas where disturbance may occur. *Eucalyptus ceracea* is found predominantly on skeletal sandy soils, sandstone ridges and scree slopes, and distribution maps indicate that it is found in coastal regions of the north Kimberley (Florabase 2009). It is therefore considered unlikely to occur within the areas where disturbance may occur. Details and discussion of Priority Flora can be found in Section 6.1

Declared weeds occurring in the Ord River Irrigation Area or along the Ord River include *Ziziphus mauritiana*, *Parkinsonia aculeate*, *Sorghum alum*, *Datura stramonium*, *Xanthium occidentale*, and

Calotropis procera. Weeds that are listed as environmental weeds for the area include *Phoenix dactylifera*, *Hyptis suaveolens*, *Alternanthera pungens*, *Lantana camara*, *Leucaena leucocephala* and *Acacia nilotica* (OLW 2008).

Weeds are common within the areas in which disturbance may occur, especially in previously disturbed areas. For example, 32 weed species were recorded along road verges of the Proposal Area (Astron 2001), with the most common weeds including *Stylosanthes hamata*, *Passifloa foetida* and *Clitoria ternatea*.

Although the majority of the areas in which disturbance may occur are uncleared, weeds, erosion and degradation are present, mainly due to the historical use of much of the land for cattle grazing.

5.1.2 Potential impacts

The potential impacts of the proposed clearing on vegetation include:

- the loss of individuals of Threatened or Priority flora species
- the reduction in extent of vegetation associations and communities
- the spread and/or introduction of weeds, diseases and pathogens.

5.2 FAUNA

5.2.1 Existing environment

Previous investigations (e.g. Ecologia 1997; Biostat 2001) have identified the following general fauna habitat types in the region:

- grassland
- eucalypt woodland
- bauhinia woodland
- riverine woodland
- vine thickets
- wetlands
- rock outcrops.

Woodlands make up the largest habitat type in the areas in which disturbance may occur. Faunal assemblages in woodland habitats are determined by the density and structure of the vegetation and the soil and landform types.

A DEC fauna database search recorded nine Schedule 1 fauna species, three Schedule 4 fauna species and six Priority 4 fauna species as potentially occurring in the areas in which disturbance may occur (Table 4).

Table 4 Significant fauna

Fauna species	Status	Description	Records
<i>Dasyurus hallucatus</i> Northern Quoll	Schedule 1	This carnivorous marsupial occurs across much of northern Australia with a disjunct population in the Pilbara. Occurs in a wide range of habitats but most suitable habitat appear to be rocky areas.	1 record (1908) Wyndham
<i>Rhinonictis aurantius</i> Orange Leaf-nosed Bat	Schedule 1	This species of bat occurs in a few scattered locations in the Pilbara, as well as the Kimberley. It roosts in caves and is sensitive to human disturbance.	7 records (1964–2006) Kununurra, Ivanhoe, Spirit Hills
<i>Erythrotriorchus radiatus</i> Red Goshawk	Schedule 1	A rare inhabitant of well-wooded country, this species nests in large trees and preys largely on birds but also on reptiles and mammals.	1 record (1956) Ivanhoe
<i>Rostratula benghalensis australis</i> Australian Painted Snipe	Schedule 1	A rare summer visitor to the watered areas of the north-west and swamps on the Swan Coastal Plain.	4 records (1986–1995) Wyndham
<i>Erythrura gouldiae</i> Gouldian Finch	Schedule 1	This species of finch inhabits savanna woodlands around permanent waters and has declined dramatically across its range.	3 records (1955-1998) Ivanhoe, Lake Argyle
<i>Falcunculus frontatus whitei</i> Crested Shrike-tit (northern subsp.)	Schedule 1	This species is a rare inhabitant of woodlands.	2 records (1955-1956) Ord River, Ivanhoe
<i>Cristilabrum isolatum</i>	Schedule 1	A gastropod (land snail)	6 records (1980–1986) Ningbing Ranges, Limestone Mill
<i>Cristilabrum spectaculum</i>	Schedule 1	A gastropod (land snail)	9 records (1980 – 1996) Ningbing Ranges, Jeremiah Hills
<i>Ordtrachia elegans</i>	Schedule 1	A gastropod (land snail)	1 record (1988) Point Spring
<i>Falco peregrinus</i> Peregrine Falcon	Schedule 4	This species is uncommon and prefers areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land.	1 record (1956) Ivanhoe
<i>Tadorna radjah rufitergum</i> Burdekin Duck	Schedule 4	This uncommon species inhabits freshwater lagoons and river pools and occurs along the middle and lower Ord River.	1 record (1999) Kununurra
<i>Macroderma gigas</i> Ghost Bat	Priority 4	This species is Australia's only carnivorous bat and has a patchy distribution across northern Australia. It shelters in caves, mine shafts and deep rock fissures and is sensitive to disturbance.	1 record (1999) Milligans Lagoon
<i>Hydromys chrysogaster</i> Water-rat, Rakali	Priority 4	This species occurs in waterways and wetlands that support its main prey items such as molluscs and crustaceans.	7 records (1982-2002) Kununurra
<i>Burhinus grallarius</i> Bush Stonecurlew	Priority 4	A well camouflaged, ground nesting bird which prefers to 'freeze' rather than fly when disturbed. It inhabits lightly timbered open woodlands.	21 records (1956-2005) Lake Argyle, Kununurra, Wyndham
<i>Numenius madagascariensis</i> Eastern Curlew	Priority 4	This species is a migratory visitor and has been observed on reef flats and sandy beaches along the West Australian coast and in coastal estuaries.	1 record (1956) Ivanhoe
<i>Geophaps smithii smithii</i> Partridge Pigeon (eastern subsp.)	Priority 4	Medium sized ground-dwelling pigeon, mostly feeds on seeds, nests on the ground in grassy areas, occurs principally in lowland eucalypt open forests and woodlands with grassy understoreys.	1 record (1902) Kununurra
<i>Phaps histrionica</i> Flock Bronzewing	Priority 4	Medium sized ground-dwelling pigeon, highly nomadic, ranges throughout open woodland and treeless grass plains, eats seeds	3 records (1985-1988) Kununurra, Wyndham

* Schedule 1: Fauna that is rare or is likely to become extinct; Schedule 4: Other specially protected fauna; Priority 4: taxa in need of monitoring.

5.2.2 Potential impacts

The potential impacts of the proposed geotechnical surveys on fauna include:

- direct loss of habitat due to clearing of vegetation
- degradation of habitat due to surface hydrology alterations disturbance and/or the introduction/spread of weeds, diseases and/or plant pathogens.

5.3 SURFACE WATER/DRAINAGE AND WETLANDS

5.3.1 Existing environment

Although average annual rainfall in the Ord area is greater than 700 mm, precipitation is highly seasonal and evaporation rates are high (in the order of 2000 mm/year). In combination with rapid runoff this means that nearly all streams in the area (except the Ord, which is artificially supplemented) are intermittent (i.e. they stop flowing in the dry season), although sheltered pools may retain some water (Ecologia 1997). Numerous lower order ephemeral drainage lines dissect the Proposal Area, as well as the major waterway, the Ord River.

No major or perennial waterways are contained within the MIAs, although the Ord River is situated adjacent to MIAs 5, 6 and 7. From analysis of aerial photography it appears that MIAs 10–14 are generally free of drainage lines, and MIAs 1–9 contain minor drainage lines. In steep areas such as within MIA 7, overland ‘sheet’ flow is expected to occur.

The western side of the areas in which disturbance may occur, including some of Parry Creek Road, and MIAs 1, 2 and part of 3, is within a the Ord River Floodplain Ramsar wetland. This area has been designated for conservation as a wetland of international importance.

No major or perennial waterways are crossed by the Proposal Area road alignments, although parts of Parry Creek Road are adjacent to the Ord River. Most roads have been built where possible on higher land and avoid wetland vegetation and low-lying land. Numerous lower order ephemeral drainage lines and minor waterways are crossed by the road alignments of the Proposal Area.

Borrow pits may also include some small ephemeral waterways and drainage lines. The borrow pit near MIA 6 is very close to the Ord River (Figure 2).

There are no public drinking water source areas in the vicinity of the areas in which disturbance may occur.

5.3.2 Potential impacts

The potential impacts of clearing on surface water include increased run-off, or change in runoff characteristics, sedimentation and sediment transport from erosion.

5.4 RESERVES AND CONSERVATION AREAS

5.4.1 Existing environment

Three Nature Reserves exist in the general vicinity of the areas in which disturbance may occur: Parry Lagoons Nature Reserve, Point Spring Nature Reserve, and Mirima National Park (Figure 5).

MIAs 1, 2, and part of 3 are within Parry Lagoons Nature Reserve. The reserve includes a variety of important habitats such as rainforest, freshwater springs, grasslands, woodland, rugged sandstone and floodplain, together supporting a rich faunal assemblage. One of the main values of this reserve is the variety and abundance of waterbirds. The reserve comprises the southern portion of the Ord River Floodplain Ramsar wetland, which has been designated for conservation as a wetland of international importance.

Point Springs Nature Reserve is a small conservation area north of the Weaber Plain. Mirimar (Hidden Valley) National Park is located over 10 km to the south-east of the Proposal Area and is unlikely to be affected by the proposed clearing.

Proposed conservation areas occurring in proximity to the areas in which disturbance may occur include the M2 buffer area, which will be set aside for conservation purposes, Pincombe Conservation Area, which will cover 14 500 ha and include Cave Springs and the Pincombe Ranges, Livistona Conservation Area, which will cover 55 700 ha, and Weaber Plain Conservation Area, north of the M2 Area, which will cover 22 800 ha.

5.4.2 Potential impacts

The potential impacts of the proposed disturbance on reserves and conservation areas are predominantly on the conservation values of the areas, such as detrimental effects on the diversity of important habitats, and species biodiversity. The potential for the introduction or spread of weeds into conservation areas is also a potential impact.

5.5 ABORIGINAL HERITAGE

5.5.1 Existing environment

A search of the Department of Indigenous Affairs Heritage Enquiry System (DIA 2009) indicated that approximately 115 ethnological and archaeological sites are registered within an area of approximately 320 000 ha containing the areas for proposed geotechnical investigations. Of the registered ethnological and archaeological Aboriginal sites in the area, 43 have been determined as potentially occurring in the vicinity of areas in which disturbance may occur (Table 5).

Archaeological sites are more common than ethnographic sites, and generally refer to places where there is substantial, *in situ* evidence of past Aboriginal occupation or activity (Waru 2009). Artefacts may include discarded stone tools, culturally marked or scarred trees, stone arrangements, and any other physical evidence of Aboriginal occupation, and often represent campsites.

Almost half of the registered sites are classified as Artefacts/Scatter. Small artefact scatters and single artefacts are now not considered to be heritage sites, but many were recorded several decades ago, and

with no accurate information about their exact location or contents to allow a re-evaluation they remain on the Register.

Ethnographic sites include ceremonial, mythological, historical or burial sites, or any combination of these types, and are generally more likely to have cultural significance for Aboriginal people and groups. Ethnographic sites are identified by initiated Elders or senior spokespersons for Indigenous communities, and are not always obvious or discernable (Waru 2009).

Several multi-type ethnographic sites covering a large area, including Gunanurreng - Ord River, Yalijba-Minggirrinja Complex, Jungil Complex, Riverfarm Road and Buttons Crossing, Darrarraba, Ngurrinmi B / Buttons X, Tjaliwong, and Ngundarruba Complex are present within the Proposal Area. Exact coordinates are not available for many of these sites as they are closed sites.

The East Kimberley is generally a relatively undisturbed area due to its remoteness, and little intensive land use. Modification from pre-European condition is minimal in many areas, so the possibility of intact sites existing in these areas is high. Aboriginal heritage sites are generally more likely to be associated with hills or stone outcrops, places of water, or in areas of remnant native vegetation.

Despite the relatively high potential for Aboriginal heritage sites in the east Kimberley, the likelihood that these sites are registered is often low. This is in part due to the isolation of many areas, and also to limited development in the region resulting in limited requirements for heritage surveys. For example, the number of registered sites along roads is often comparatively high compared to surrounding areas, because surveys were necessary as part of the construction process.

Table 5 Registered Aboriginal heritage sites

site ID	site name	status	site type	MIA	pit	road
15153	Gunanurreng - Ord River	P C N	Ceremonial, Mythological, Skeletal material/Burial, Modified Tree, Painting, Engraving, Quarry, Artefacts / Scatter, Grinding patches / grooves	Y	Y	Y
15427	Jungil Complex.	P C N	Ceremonial, Mythological, Repository / cache, Skeletal material/Burial, Man-Made Structure, Modified Tree, Painting, Engraving, Quarry, Artefacts / Scatter, Midden / Scatter, Grinding patches / grooves	Y	Y	Y
15499	Yalijba-Minggirrinja Complex	P C N	Ceremonial, Mythological, Painting, Engraving, Artefacts / Scatter, Grinding patches / grooves	Y	Y	Y
12381	Darrarraba.	L C N	Ceremonial, Mythological	Y	Y	Y
21379	Riverfarm Road And Buttons Crossing	P C N	Ceremonial, Mythological	Y	Y	Y
12383	Ngurrinmi B / Buttons X	L C N	Ceremonial, Mythological	Y	Y	Y
14053	Ord Valley	P O N	Painting	Y		Y
15498	Ngundarruba Complex	P C N	Ceremonial, Mythological, Painting, Engraving	Y		Y
12955	Jigilmirri	P C N	Ceremonial, Mythological	Y		Y
13998*	Tjaliwong	P C N	Mythological		Y	Y
12385	Jabaying/duguyung.	I O N	Ceremonial, Mythological			Y
13746	Djibilyul	P C N	Mythological			Y
12952	Ivanhoe Station Burials	P C N	Skeletal material/Burial			Y
14695	Wyndham	I O N	Man-Made Structure			Y
12993	Mulanba.	P C M	Ceremonial, Mythological			Y
12953	Mulanba	I C N	Skeletal material/Burial			Y
15152	Nganjuwarrm - Dunham River	P C N	Ceremonial, Mythological, Repository / cache, Modified Tree, Painting, Engraving, Quarry, Artefacts / Scatter		Y	
12384	Ngurrinmi C / Buttons X	L C N	Ceremonial, Mythological		Y	

site ID	site name	status	site type	MIA	pit	road
12383	Ngurrinmi B / Buttons X	L C N	Ceremonial, Mythological		Y	
12578	Kununurru.	S C N	Unknown		Y	
12798	Meekama Junction.	P C N	Ceremonial		Y	
13124	Migima / Mikema	P C N	Mythological, Artefacts / Scatter		Y	
12380	Button'S Crossing 03	L O N	Artefacts / Scatter		Y	
17933	Site 5	P O N	Quarry, Artefacts / Scatter			Y
17934	Site 6 Valentine Springs	P O N	Artefacts / Scatter			Y
17935	Site 7	P O N	Artefacts / Scatter	Y	Y	Y
17936	Site 8	P O N	Artefacts / Scatter			Y
17937	Site 9	P O N	Artefacts / Scatter			Y
17938	Site 10	P O N	Artefacts / Scatter			Y
17939	Site 11	P O N	Artefacts / Scatter			Y
17940	Site 12	P O N	Artefacts / Scatter			Y
17941	Site 13	P O N	Artefacts / Scatter			Y
17942	Site 14	P O N	Artefacts / Scatter			Y
17943	Site 15	P O N	Artefacts / Scatter			Y
17944	Site 16	P O N	Artefacts / Scatter			Y
17945	Site 17	P O N	Artefacts / Scatter			Y
17946	Site 18	P O N	Artefacts / Scatter	Y		Y
17947	Site 19	P O N	Artefacts / Scatter			Y)
17948	Site 20	P O N	Artefacts / Scatter			Y
17949	Site 21	P O N	Artefacts / Scatter			Y
17950	Site 22	P O N	Artefacts / Scatter			Y)
17951	Site 23	P O N	Artefacts / Scatter			Y

P=permanent register I=insufficient information L=lodged O=open C=closed N= no restriction M= male access only

Source: DIA Aboriginal Heritage Enquiry System

5.5.2 Potential impacts

The main potential impact to Aboriginal heritage areas resulting from the proposed clearing is disturbance to heritage sites.

As part of the Ord Final Agreement process (Section 1.3), most of the road alignments, borrow pits and materials areas were inspected. Heritage sites identified within the areas inspected were either excluded from the disturbance footprint, or granted consent to be disturbed under section 18 of the *Aboriginal Heritage Act 1972* (WA).

6. ASSESSMENT AGAINST CLEARING PRINCIPLES

The Permit requires that a desktop study be conducted to assess the proposed clearing (within the Proposal Area) against each of the ten clearing principles as set out within Schedule 5 of the EP Act.

The clearing principles state that native vegetation should not be cleared if —

1. it comprises a high level of biological diversity
2. it comprises the whole or a part of, or is necessary for the maintenance of a significant habitat for fauna indigenous to Western Australia
3. it includes, or is necessary for the continued existence of, Rare flora
4. it comprises the whole or a part of, or is necessary for the maintenance of, a Threatened Ecological Community
5. it is significant as a remnant of native vegetation in an area that has been extensively cleared
6. it is growing in, or in association with, an environment associated with a watercourse or wetland
7. the clearing of the vegetation is likely to cause appreciable land degradation
8. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area
9. the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water
10. the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The Proposal has been assessed against each of these clearing principles. The outcomes of the assessment are summarised in Table 6.

Table 6 Assessment of proposal against clearing principles

No.	Principle	Elements	Assessment	Conclusion
1	Biological diversity	Priority Ecological Communities (PECs)	No PECs were identified as occurring within the Proposal Area. The closest recorded PEC is several kilometres from the nearest exploration area and will not be affected.	Not likely to be at variance, but management recommended
		Priority flora	Numerous Priority flora species are known from the Ord locality and may occur in the Proposal Area. It is recommended that clearing avoid where practicable significant known populations of Priority flora	
2	Indigenous fauna	Habitat of conservation significant fauna	Due to the avoidance of rocky outcrops and wetlands, and the mobility of many species, and the likelihood of other species to inhabit the project area, no conservation significant fauna are considered to be at significant risk due to proposed clearing. The main possible risk is direct removal of nesting habitat through clearing activities. Due to the flexibility of clearing locations, if a nest is identified in a particular location it can in most cases be avoided.	Not likely to be at variance, but management recommended
		Abundance of similar fauna habitat in local and regional area	The proposed clearing is unlikely to significantly adversely affect habitat of indigenous fauna at a local or regional scale as the vegetation types (and the habitat that they provide) within the Proposal Area are well represented within the local	

No.	Principle	Elements	Assessment	Conclusion
			area and the small scale of the proposed clearing .	
3	Rare flora	DRF as defined by section 23 F of the <i>Wildlife Conservation Act 1950</i> (WA)	No DRF have previously been recorded within the local area. A place name search (DEC 2009a) identified the DRF species <i>Eucalyptus ceracea</i> as having the potential to occur in the area, but as this species is found predominantly on skeletal sandy soils, sandstone ridges and scree slopes, and distribution maps indicate that it is found in coastal regions of the north Kimberley (Florabase 2009), it is considered unlikely to occur in the Proposal Area	Not likely to be at variance
4	Threatened Ecological Community (TEC)	TEC as defined by EPBC Act, and endorsed by the Minister for the Environment	No TECs occur within the areas in which disturbance may occur.	Not likely to be at variance
5	Significant remnant of native vegetation in extensively cleared area	Significance and abundance of vegetation associations at local and regional scale Vegetation condition	Vegetation within the areas in which disturbance may occur are not a remnant of native vegetation in an extensively cleared area given that: <ul style="list-style-type: none"> vegetation associations that occur within the Proposal Area have in excess of 98% of their pre-European extent remaining vegetation types that occur within the Proposal Area are well represented within the local and regional area Historical agricultural activities have to various extents altered the condition of the vegetation within the areas in which disturbance may occur.	Not likely to be at variance
6	Associated with a watercourse or wetland	Known watercourses and wetlands within the area	MIAs 5, 6, and 7 are adjacent to the Ord River. A 200 m buffer between these MIAs and the Ord River is proposed to protect riverine and riparian vegetation. Clearing within MIAs 13 and 14 has the potential to affect Eight Mile Creek, Knox Creek and their tributaries. A 200 m buffer is proposed between these watercourses and clearing activities. In other MIAs, roads and borrow pits contain or cross smaller ephemeral creeks and drainage lines. No clearing should occur within these minor waterways or their riparian vegetation. As most drainage lines within the areas in which disturbance may occur are small and clearing locations somewhat flexible it will be practicable to avoid clearing in minor drainage lines in . The Ramsar wetland 'Ord River Floodplain' contains MIAs 1, 2 and part of 3.	Unlikely to be significantly at variance with application of management
7	Likely to cause appreciable land degradation	Erosion, acid sulphate soils, salinity	Acid sulphate soils are not likely to occur within the areas in which disturbance may occur. Due to the nature of clearing activities proposed (low scale, low impact, small areas of clearing on relatively flat land) land degradation from erosion is considered unlikely, providing standard erosion protocols are followed and clearing is minimised near natural drainage lines.	Not likely to be at variance, but management recommended
8	Environmental values of conservation area	Existing and proposed conservation areas	MIAs 1, 2 and part of 3, part of Parry Creek Rd, and two borrow pits occur within Parry Lagoons Nature Reserve, which is also a Ramsar wetland and an ESA. MIAs 11 and 13 are located within the M2 development buffer (an area proposed for conservation) and the proposed Pincombe Conservation Area. Several borrow pits are also located in the M2 buffer. MIAs 4 and 6 and a borrow pit are located adjacent to proposed Livistona Conservation Area, and part of Parry Creek Rd runs through this area. The small amount of clearing within MIAs adjacent to or on the periphery of existing or proposed conservation areas is	Potentially at variance but may not be significantly so given small extent of clearing – management proposed

No.	Principle	Elements	Assessment	Conclusion
			<p>unlikely to affect the environmental values of these areas</p> <p>Clearing within the following areas is potentially at variance to Clearing Principle 6, and the impact of clearing on the environmental values of proposed and existing conservation areas requires further investigation.</p> <ul style="list-style-type: none"> MIAs 1, 2, 3, the western end of Parry Creek Road and the two borrow pits located within Parry Lagoons Nature Reserve MIAs 11 and 13 and several borrow pits located in the M2 buffer and/or the proposed Pincombe Conservation Area The length of Parry Creek Rd running through the proposed Livistona Conservation Area 	
9	Deterioration in water quality	<p>Surface water run-off</p> <p>Impacts to groundwater</p>	<p>A number of watercourses, creek and drainage lines traverse the Proposal Area and therefore the potential exists for silty run-off from disturbed soils to enter the surface water system.</p> <p>It is proposed that clearing not occur within 200 m of any significant watercourse, or within riparian vegetation of smaller creeks and drainage lines, and that spoil and erosion management measures be implemented to minimise the likelihood of silty run-off entering the surface water system.</p>	Not likely to be at variance, but management recommended
10	Flooding	Alteration to landform, creek lines and natural drainage lines	The scale and nature of the proposed clearing is such that it will not significantly affect landform and therefore is unlikely to cause or exacerbate the incidence or intensity of flooding.	Not likely to be at variance

6.1 CLEARING PRINCIPLE 1

Clearing principle 1 provides that native vegetation should not be cleared if it comprises a high level of biological diversity. Biological diversity is defined in EPA Position Statement No. 2 (2000), *Environmental Protection of Native Vegetation in Western Australia with particular reference to the Agricultural area* as follows:

Biodiversity is the variety of all forms of life - the different plants, animals and microorganisms, the genes they contain and the ecosystems of which they form a part. Consequently, biodiversity is considered at three levels: ecosystem diversity, species diversity and genetic diversity.

The components of biological diversity assessed for the purpose of this report include Priority Ecological Communities (PECs) and Priority flora species. Other elements of biodiversity such as fauna habitat, Declared Rare Flora (DRF) and Threatened Ecological Communities (TECs) are addressed specifically by other clearing principles.

All riparian communities and wetlands are considered to have ecological value that makes them important and worthy of special consideration. In addition a significant vegetation assemblage identified by Astron (1999) is the *Corymbia polycarpa / Fimbristylis* spp community which was recorded along Weaber Plain Road near MIA 11.

Priority flora species

A DEC database search for Priority flora was conducted within the areas in which disturbance may occur including a search buffer. The results of this search indicated that 28 Priority flora species have been recorded within the wider search area, including 10 Priority 1 species, five Priority 2 species, 12 Priority 3 species, and one Priority 4 species. These species are listed in Table 6, with locations provided in Figure 4.

Table 7 Priority Flora species

Species	Records	Priority	No. of locations/ plants	Vegetation description	Distribution (regions) - Florabase
<i>Acacia richardsii</i>	DEFL WAherb	3	22	Sandstone. Hills, creek beds, rocky areas.	VB.
<i>Brachychiton incanus</i>	DEFL WAherb	3	7	Sandy soils over sandstone or quartzite. Rocky slopes, scarps & ridges.	CK, NK, VB
<i>Brachychiton tuberculatus</i>	DEFL WAherb	3	11	Red or yellow sand. Undulating plains.	VB
<i>Desmodium flagellare</i>	DEFL WAherb	1	1	Cracking clay.	VB
<i>Echinochloa kimberleyensis</i>	DEFL WAherb	1	5	Black soils. Swamps	CK, VB
<i>Eucalyptus ordiana</i>	WAherb	2	1	Skeletal soils over sandstone or quartzite. Steep rocky outcrops.	CK, OVP, VB.
<i>Euphorbia stevenii</i>	WAherb	3	6	Clay, sandy soils.	VB, PIL.
<i>Ficus lilliputiana</i>	WAherb	4	2	Sandstone. Rocky sites	VB.
<i>Fimbristylis laxiglumis</i>	DEFL WAherb	2	2	Black clay.	VB.
<i>Fuirena incrassata</i>	DEFL	3		Sand, sandy clay. Swamps, creek beds, claypans, semi-saline lakes	CK, DL, OVP, GSD, PIL.
<i>Fuirena nudiflora</i>	DEFL WAherb	1	1	Sand. Swamps, creek beds.	VB; CR
<i>Gardenia sericea</i>	WAherb	3	1	Sandstone	NK, VB
<i>Goodenia brachypoda</i>	WAherb	1	3	Red sandy loam	NK, VB.
<i>Goodenia byrnesii</i>	DEFL WAherb	1	2	Sand. Edge of creek.	DL, NK, OVP, VB.
<i>Goodenia durackiana</i>	DEFL WAherb	1	1	Black clay. Grassland.	CK, NK, VB
<i>Goodenia purpurascens</i>	WAherb	3	1	Clay, mud. Swamps & seasonally wet depressions	NK, VB; LSD.
<i>Jacquemontia</i> sp. Keep River (J.L. Egan 5051)	DEFL WAherb	1	1	Description unavailable	VB
<i>Minuria macrorhiza</i>	WAherb	2	1	Red clay or loam, laterite, bauxite. Sandstone gullies, exposed sheets basalt, among tumbled boulders, in grasslands	CK, NK, VB.
<i>Phyllanthus aridus</i>	WAherb	3	1	Sandstone, gravel, red sand.	CK, DL, NK, OVP, VB, GSD, PIL
<i>Pityrodia obliqua</i>	WAherb	3	3	Sandstone or quartzite. Rocky faces in mountain ranges	CK, DL, VB
<i>Platysace saxatilis</i>	DEFL WAherb	2	12	Sand, sandstone. Valleys and hills, in crevices in the rock face, on sides of gorges, on cliffsides	VB
<i>Scaevola</i> sp. Cockburn Range (G.W. Carr 3369 & A.C. Beauglehole 471)	DEFL WAherb	1	2	Description unavailable	VB
<i>Stylidium prophyllum</i>	WAherb	3	1	Sandy, black silty or clayey sandy soils, loam. Seasonally wet floodway depressions & seepage areas.	CK, NK, VB
<i>Trachymene</i>	DEFL	1	1	Limestone or sandstone on inland ranges	DL, VB.

Species	Records	Priority	No. of locations/plants	Vegetation description	Distribution (regions) - Florabase
<i>oleracea</i> subsp. <i>sedimenta</i>	WAherb				
<i>Typhonium</i> sp. Kununurra (A.N. Start ANS 1467)	DEFL WAherb	1	2	Dark grey clay, black soil. Sites which are waterlogged in summer and inundated after rain	VB
<i>Utricularia aurea</i>	DEFL WAherb	2	2	River edges	NK, VB.
<i>Vigna</i> sp. silver leaf (T.E.H. Aplin 6300)	WAherb	3	1	Description unavailable	VB, PIL
<i>Whiteochloa capillipes</i>	WAherb	3	1	Description unavailable	DL, NK, VB; PIL

DEFL = The Threatened Flora Database, WAherb = WA Herbarium data

VB = Victoria Bonaparte, P = Pilbara, CR = Central Ranges, NK = Northern Kimberley, CK = Central Kimberley, LSD = Little Sandy Desert, DL = Dampierland, OVP = Ord Victoria Plains, GSD = Great Sandy Desert.

Priority 1 = Taxa which are known from one or a few populations which are under threat

Priority 2 = Taxa which are known from one or a few populations, at least some of which are not believed to be under immediate threat

Priority 3 = Taxa which are known from several populations, and the taxa are not believed to be under immediate threat

Priority 4 = Taxa which are considered to have been adequately surveyed and which, whilst rare, are not currently under threat

According to DEC database records, Priority Flora occurring in or near areas of proposed geotechnical exploration include:

- *Fimbristylis laxiglumia* (P2): one occurrence at the northern border of MIA 8.
- *Euphorbia stevenii* (P3): one occurrence within MIA 14
- *Brachychiton tuberculatus* (P3): one occurrence on Valentine Springs Rd
- *Acacia richardsii* (P3): one occurrence on Weaber Plains Road.

Astron (1999) recorded the Priority 3 Flora species *Brachychiton tuberculatus* at six sites along Carlton Plain Rd, with the abundance of these small trees varying from isolated to frequent occurrences along the road alignment.

Vegetation surveys and investigations have recently been conducted for MIAs 6, 8 and 11 in the eastern portion of the areas in which disturbance may occur, with the main findings as follows (Brolga's Environment 2009; Appendix 1).

Several *Brachychiton tuberculatus* individuals were recorded in MIA 6. The northern portion of this MIA is described as disturbed, containing existing gravel pits, and unlikely to be an area necessary for the continued existence of Priority Flora. The southern part of MIA 6 was considered to be generally more diverse, with a running creek, and containing some specimens of the genus *Goodenia*, which were not ruled out as being Priority species.

MIA8 was also found to contain several *Brachychiton tuberculatus* individuals, with the greatest abundance and most intact habitat occurring in the south-west leg of the MIA. This area also exhibited the greatest diversity in *Goodenia* species, with a potential match for Priority flora. The rest of the site was of a degraded and disturbed in nature. MIA 8 was considered unlikely to be an area necessary for the continued existence of Priority Flora.

A recent survey report (GHD 2008) suggests that *Brachychiton tuberculatus* is widely distributed in MIA 9 and 10, with a large number of plants under 2 m in height recorded.

Material Investigation Area 11 contains a high diversity of landforms although relatively low vegetation diversity. Most *Goodenia* observed were considered unlikely to be priority flora, although one specimen found had the potential to be a priority listed *Goodenia* species. No other Priority flora species were recorded in this MIA.

From previous and recent surveys it appears likely that *Brachychiton tuberculatus* is much more widespread and abundant in the area than the records held by the DEC indicate. This has implications for the significance of the loss of individuals of this species, which is not likely to be as critical as the DEC search data suggests. The main threat to this species is considered to be altered fire regimes arising from existing land uses (GHD 2006).

All of the Priority Flora species previously recorded within the proposal search area have also been recorded as occurring elsewhere. Additionally all of the Priority Flora species previously recorded within the areas of potential disturbance occur within vegetation associations that are well represented throughout the region.

On this basis and given the small scale of the proposed clearing, it is considered unlikely that clearing will significantly affect biodiversity within the local or regional area.

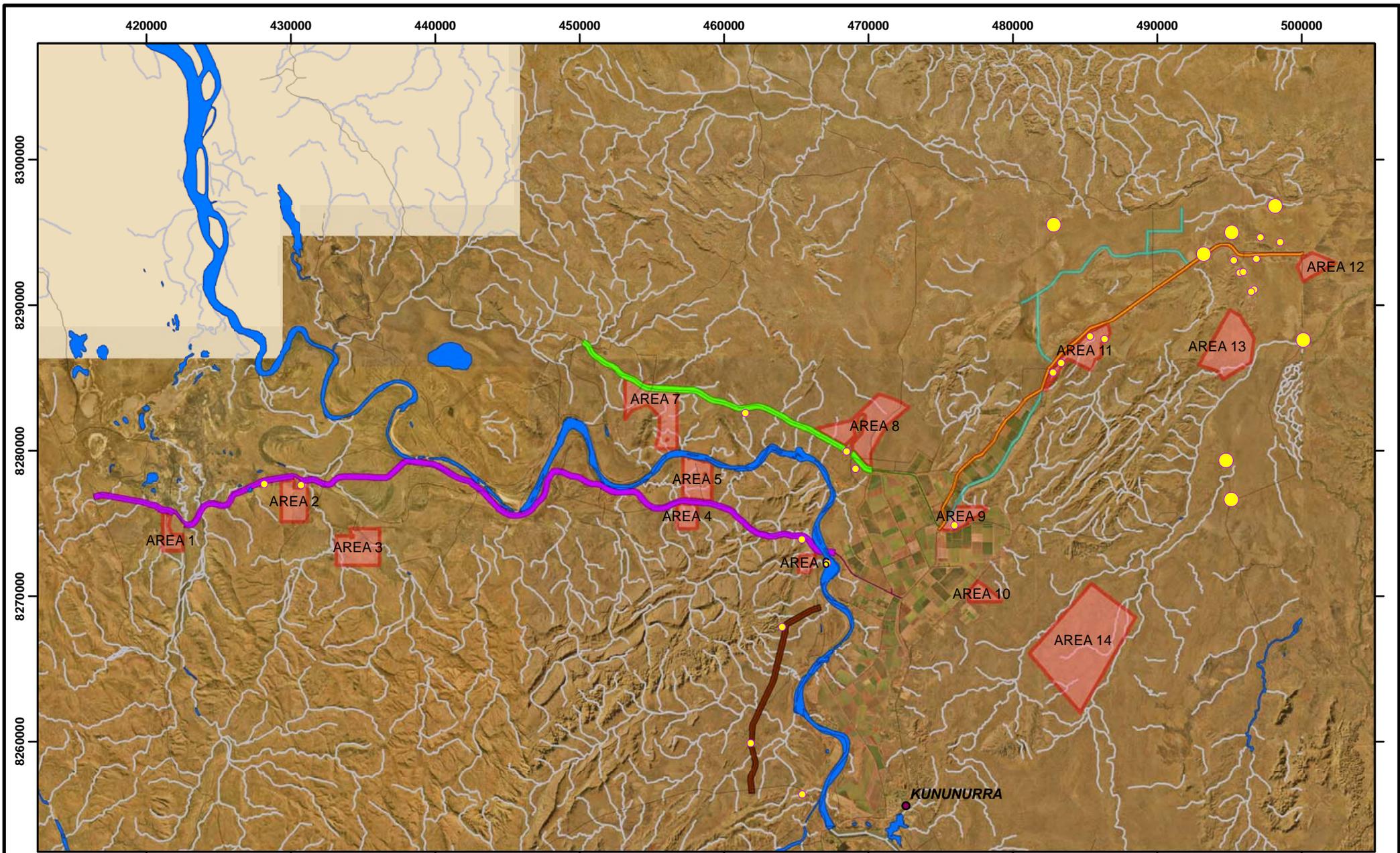
Notwithstanding, it is proposed that significant known populations of Priority Flora within the Proposal Area are avoided where practicable.

Priority Ecological Communities

One PEC has been identified in proximity to the areas in which disturbance may occur by the DEC database search (2009b). This PEC is located within the Point Springs Nature Reserve and is described by DEC (2008a) as a closed canopy rainforest on freshwater swamps and alluvial floodplain soils in the east Kimberley. Two occurrences are known to occur, one at Point Springs and the other at Long Swamp.

No geotechnical exploration activities will occur in the area of known PEC. The closest point of the proposed Loop Rd is 3 km to the south-east, and the nearest borrow pit is 4 km away from the PEC to the south-west.

Also this PEC is unlikely to occur within areas in which disturbance may occur as this vegetation comprises a closed canopy rainforest associated with freshwater swamps on alluvial flood plain soils, which do not occur the areas in which disturbance may occur. Similarly given the distance that Point Springs Nature Reserve is located away from the areas in which disturbance may occur, and the small scale nature of clearing activities, the clearing of native vegetation within the proposal area will not affect this PEC.

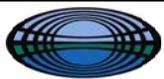


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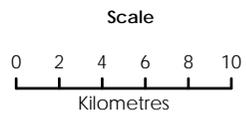
- Borrow pits
- Weaber Plain Road
- Loop Road (and M2 channel)
- Valentine Spring Road
- Parry Creek Road
- Carlton Plain Road (Section 1)
- Carlton Plain Road (Section 2)
- Watercourse lines

Figure 3 Surface water

Coordinate System: Transverse Mercator	Original scale: 1:350,000, at A4
Date: 18/05/2009	Source:
Prepared by: J. Doe	File: LAN09025_01\less\Figure 3 Surface water.mxd
Note that positional errors may occur in some areas.	



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6.2 CLEARING PRINCIPLE 2

Clearing Principle 2 states that native vegetation should not be cleared if it comprises habitat for fauna indigenous to Western Australia.

Fauna habitat

The categories containing the vegetation associations mapped as occurring within the Proposal Area are well represented throughout the Victoria Bonaparte region all with over 98% of their pre-European extent remaining.

In addition, given that the vegetation and soil types that occur within the remaining material extraction areas are well represented within the local area, it is unlikely that the proposed clearing will affect the amount of available habitat for indigenous fauna at a local or regional scale.

Wetlands are generally considered to be significant fauna habitat, and the proposed clearing will not affect fauna habitat within wetland areas, as no wetlands, wetland buffers, or riparian vegetation of rivers and creeks will be cleared.

Some vegetation that may be disturbed is likely to provide habitat for native species, but due to the small scale of the clearing and the common habitat types, the impacts are expected to be negligible.

Conservation significant fauna

The results of a DEC database search (2009c) indicated that 17 conservation significant fauna species have been recorded as occurring within the areas in which disturbance may occur and/or surrounding areas. The list of species is provided in Section 5.2.

Two conservation listed bat species, the Orange Leaf-nosed Bat and the Ghost Bat, inhabit caves, mine shafts and deep rock fissures. As proposed clearing areas occur along the periphery of the rocky outcrops and not within areas likely to contain caves or rock splits, clearing of native vegetation and soil extraction associated with the geotechnical surveys is not likely to affect key bat habitat.

The Northern Quoll occurs across much of northern Australia and in a wide range of habitats, with a preference for rocky areas. Due to the small areas of clearing, which are generally not in rocky areas, and the mobile characteristics of this species, the Northern Quoll is unlikely to be significantly affected by the proposed clearing.

Three land snail species are likely to be short-range endemics due to their limited mobility, and the limited range of locations in which they are found. *Cristilabrum isolatum* and *Cristilabrum spectaculum* are not likely to exist within the proposed clearing areas, as they have been recorded only in locations quite far from areas in which disturbance may occur. *Ordtrachia elegans* has been recorded at Point Springs; however, this area will not be disturbed by clearing activities.

The Burdekin Duck and the Water-Rat inhabit waterways and wetlands. As there will be no clearing in rivers, wetland areas or in areas of riparian vegetation these species are considered unlikely to be affected by clearing activities. The Painted Snipe and the Eastern Curlew are transitory visitors to beaches, estuaries and swamp, and are therefore also unlikely to be affected by clearing activities.

The Bush Stonecurlew, Partridge Pigeon and Flock Bronzewing are all ground-dwelling and ground-nesting birds, which generally inhabit open grassy woodland. Areas of habitat suitable for these species will be cleared; however, due to the small scale of the proposed clearing, neither species is likely to be significantly affected.

The Crested Shrike-tit and the Gouldian Finch inhabit woodlands, which are the main habitat type within the Proposal Area. Due to the mobility of these bird species and the small scale of proposed clearing, the loss of habitat is not likely to affect these species.

Two large predatory conservation-listed bird species (the Peregrine Falcon and the Red Goshawk) may potentially visit areas in which disturbance may occur. The Peregrine Falcon prefers areas with rocky ledges, cliffs, watercourses, open woodland, and margins with clear land and has a large range. The proposed clearing is unlikely to affect this species given its range and as there will be no clearing of rocky ledges, or watercourses, which this species prefers. Red Goshawks are highly mobile and can travel large distances between feeding areas; therefore the project is not likely to affect this species.

Consequently, the proposed clearing is not at variance with clearing Principle 2?

6.3 CLEARING PRINCIPLE 3

Clearing principle 3 states that native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora (DRF).

DRF is defined under section 23F of the *Wildlife Conservation Act 1950* (WA) as follows:

- (1) *In this section rare flora means flora for the time being declared to be rare flora for the purposes of this section.*
- (2) *Where the Minister is of opinion that any class or description of protected flora is likely to become extinct or is rare or otherwise in need of special protection, he may, by notice published in the Government Gazette, declare that class or description of flora to be rare flora for the purposes of this section throughout the State.*

In April 2009, a DEC database search (including a search buffer) was conducted within the Proposal Area. The Department's *Declared Rare and Priority Flora List*, which is searched using 'place names' indicates that the DRF species *Eucalyptus ceracea* (Seppelt Range Gum) may occur within the search area. The Seppelt Range Gum is a tree growing 3–6 m high, with fibrous flaky bark, and orange flowers from June to November. The species prefers skeletal sandy soils, sandstone ridges and scree slopes (Florabase 2009). This species has been found only in the Kimberley, with a known distribution North-west of Wyndham and King George River.

As the areas in which disturbance may occur do not contain skeletal sandy soils, sandstone ridges or scree slopes, and as *Eucalyptus ceracea* has not previously been recorded near the areas in which disturbance may occur, it is unlikely to occur within the areas in which disturbance may occur. Therefore, the proposed geotechnical surveys are not considered to be at variance with clearing Principle 3.

6.4 CLEARING PRINCIPLE 4

Clearing principle 4 states that clearing of native vegetation should not be allowed if it comprises the whole or a part of, or is necessary for the maintenance of, a TEC.

TECs are defined under Schedule 5 of the EP Act as follows:

Threatened ecological community means an ecological community listed, designated or declared under a written law or a law of the Commonwealth as threatened, endangered or vulnerable.

According to the DEC database search no TECs occur within 10 km of the areas in which disturbance may occur (or indeed within the region).

Therefore the proposed clearing is not at variance with clearing Principle 4.

6.5 CLEARING PRINCIPLE 5

Clearing principles 5 states that vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

For the purposes of this desktop assessment, the vegetation types mapped by Beard (1979) have been used to determine the vegetation types that may occur within areas in which disturbance may occur and their distribution at a local scale. Details of vegetation types within geotechnical exploration areas can be found in section 5.1.1.

Seven vegetation types within the areas in which disturbance may occur fall within the category of *Eucalyptus* woodlands or *Eucalyptus* open woodlands. This vegetation category has 100% of its pre-European vegetation remaining in the Victoria Bonaparte subregion (ANRA 2009, data circa 1997).

Two vegetation types within the proposed exploration areas fall within the category of *Melaleuca* forests and woodlands, or other forests and woodlands, which also have 100% of their pre-European vegetation remaining in the Victoria Bonaparte subregion (ANRA 2009, data circa 1997).

Two vegetation types within the proposed exploration areas fall within the category of mangroves, tidal mudflat, samphire and bare areas, claypan, sand, rock, salt lakes, lagoons, and lakes, which have 98% of their pre-European vegetation remaining in the Victoria Bonaparte subregion (ANRA 2009, data circa 1997).

The condition of vegetation within the Victoria-Bonaparte subregion is generally good, as it has been largely spared from intensive land use; however, some pastoral areas have suffered degradation, including the Kununurra - Wyndham area where cattle grazing for beef production was historically and still is a major local industry (Kinhill 2000). Feral animals (pig, donkey, horse, water buffalo and cattle) are widespread and abundant in the Victoria Bonaparte region, fire regimes have changed substantially over the last century, and weeds are becoming more abundant and widespread, particularly in riparian areas and wetlands (DNREAS 2007).

The vegetation of the areas in which disturbance may occur is generally not in pristine condition due to historical cattle grazing and associated impacts. The vegetation of the areas in which disturbance may occur has not been significantly cleared, with all categories of vegetation represented at levels of 98% or more remaining of pre-European vegetation, so no vegetation types affected by clearing

activities are considered to be remnant native vegetation. Consequently the proposed clearing is not likely to be at variance with clearing Principle 5

6.6 CLEARING PRINCIPLE 6

Clearing Principle 6 provides that native vegetation should not be cleared where it is growing in, or in association with, an environment associated with a watercourse or wetland.

The main watercourse near the Proposal Area is the Ord River. MIAs 5, 6 and 7, and Parry Creek Road are near or adjacent to the Ord River. Parts of Parry Creek Road are as close as 20 m to the river.

Management actions should be implemented to ensure that riparian and riverine vegetation associated with the Ord River is not cleared. The width of riparian vegetation varies along the river bank, but as a precaution a buffer of 200 m between the river and any geotechnical exploration activities is proposed to protect the integrity of the river system and ensure that Clearing Principle 6 is adhered to. This will also provide protection from increased erosion or sedimentation in the vicinity of the river after rainfall.

The next largest watercourses near the areas in which disturbance may occur are Knox Creek, which lies within a few hundred metres from MIA 13, and Eight Mile Creek, located on the eastern boundary of MIA 14. To prevent the proposed clearing affecting vegetation growing within or in the vicinity of these watercourses it is proposed that a 200 m buffer also be applied to these creeks.

Clearing near smaller drainage lines within the proposed geotechnical exploration areas should also be avoided wherever practicable. For example, Broilga's Environment (2009) recommended that a small creek in the southern part of MIA 6 be excluded from geotechnical exploration.

MIAs 1 and 2, and part of MIA 3 are located within Parry Lagoon Nature reserve and the Ramsar listed Ord River Floodplain. Although vegetation types within these MIAs have been mapped as mainly woodland, there is greater potential for species associated with wetlands, mudflats, swamps and lagoons to exist here due to the proximity to these environments. It is proposed that a specific site assessment be carried out within these MIAs before geotechnical exploration commences to determine the lowest impact options for clearing within these areas.

Provided the above precautions and management actions are followed the proposed clearing is not likely to be significantly at variance with clearing Principle 6.

6.7 CLEARING PRINCIPLE 7

Clearing Principle 7 provides that native vegetation should not be cleared if the clearing is likely to cause appreciable land degradation.

As the clearing areas will not be located within or directly adjacent to wetland areas (with exceptions outlined above for clearing principle 6), risks of acid sulphate soils are considered to be low.

As the areas of clearing are small (5 m²) and the land in most areas is relatively flat, the likelihood of the excavation resulting in land degradation from erosion is considered low. Some short-term small scale erosion may occur, but this will not result in appreciable land degradation

Less than 0.5% of land within each MIA and road alignment will be cleared, and it is likely that clearing within borrow pits will be at a similarly low level. Overall due to the nature of the environment and the small scale and dispersed nature of clearing activities it is considered that the proposed clearing is not at variance with clearing Principle 7

6.8 CLEARING PRINCIPLE 8

Clearing Principle 8 states that native vegetation should not be cleared if it is likely to affect the environmental values of any adjacent or nearby conservation area.

Three Nature Reserves exist in the general vicinity of the Proposal: Point Spring Nature Reserve, Parry Lagoons Nature Reserve (which is also a Ramsar wetland) and Mirima National Park.

MIAs 1, 2, and part of 3, part of Parry Creek Rd, and two borrow pits are located within Parry Lagoons Nature Reserve, which is also a Ramsar wetland and an ESA. The western end of Parry Creek Road itself has been excised from the nature reserve and the Ramsar site, and exists as a road reserve, providing a single infrastructure corridor across the nature reserve. The width of the reserve has not specified, but the road reserve may incorporate some of MIA 1 and 2 as they are adjacent to this road.

Ord River and Parry Lagoons Nature Reserves Draft Management Plan (DEC 2008b) states a preference that basic raw materials for road construction be obtained from outside the planning area, or from areas that are already disturbed or which are of lower conservation value. The plan recognises, however, that the transportation of gravel and other industrial materials from areas outside the planning area could lead to the unwanted introduction of weeds and disease, as well as increasing construction costs. Raw materials may only be extracted from within the planning area in accordance with the State Gravel Supply Strategy and Conservation Commission of WA Policy Statement No. 3 on Basic Raw Materials, and is regulated under local government, departmental and mining acts.

Point Spring Nature Reserve is located several kilometres from any proposed geotechnical exploration activities, and Mirimar (Hidden Valley) National Park, is located over 10 km from the areas in which disturbance may occur. These conservation reserve areas will not be affected by the proposed clearing activities.

Some of the proposed geotechnical exploration areas occur within proposed conservation areas.

MIAs 11 and 13 are located in the designated buffer of the M2 development area, which will be set aside for conservation purposes on the M2 proposal is implemented, and the proposed Pincombe Conservation Area, which includes Cave Springs. Several borrow pits are also located within the M2 buffer. The environmental values within the M2 buffer area consist of vegetation associated with the black cracking clay soils of the Ivanhoe Land System which consists predominantly of grassland and sparse woodland. The environmental values of the Pincombe Range Conservation Area comprise areas of rock and aeolian sand deposits, which form unique cave and rock split habitats used by conservation significant bat species.

Clearing and soil disturbance within MIAs 11 and 13 will occur at the fringes of the proposed conservation area, and not within the cave and rock split habitats located within the Ranges. However, specific site assessment of clearing is proposed in MIA 13 to determine whether the values of the proposed Pincombe conservation area would be at risk from clearing in this area and to propose management measures to ensure any impacts are not significant. As there have been more surveys

carried out for MIA 11, and as this area is predominantly in the M2 buffer area, the characteristics of which are better known, no further investigation is likely to be required for MIA 11.

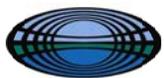
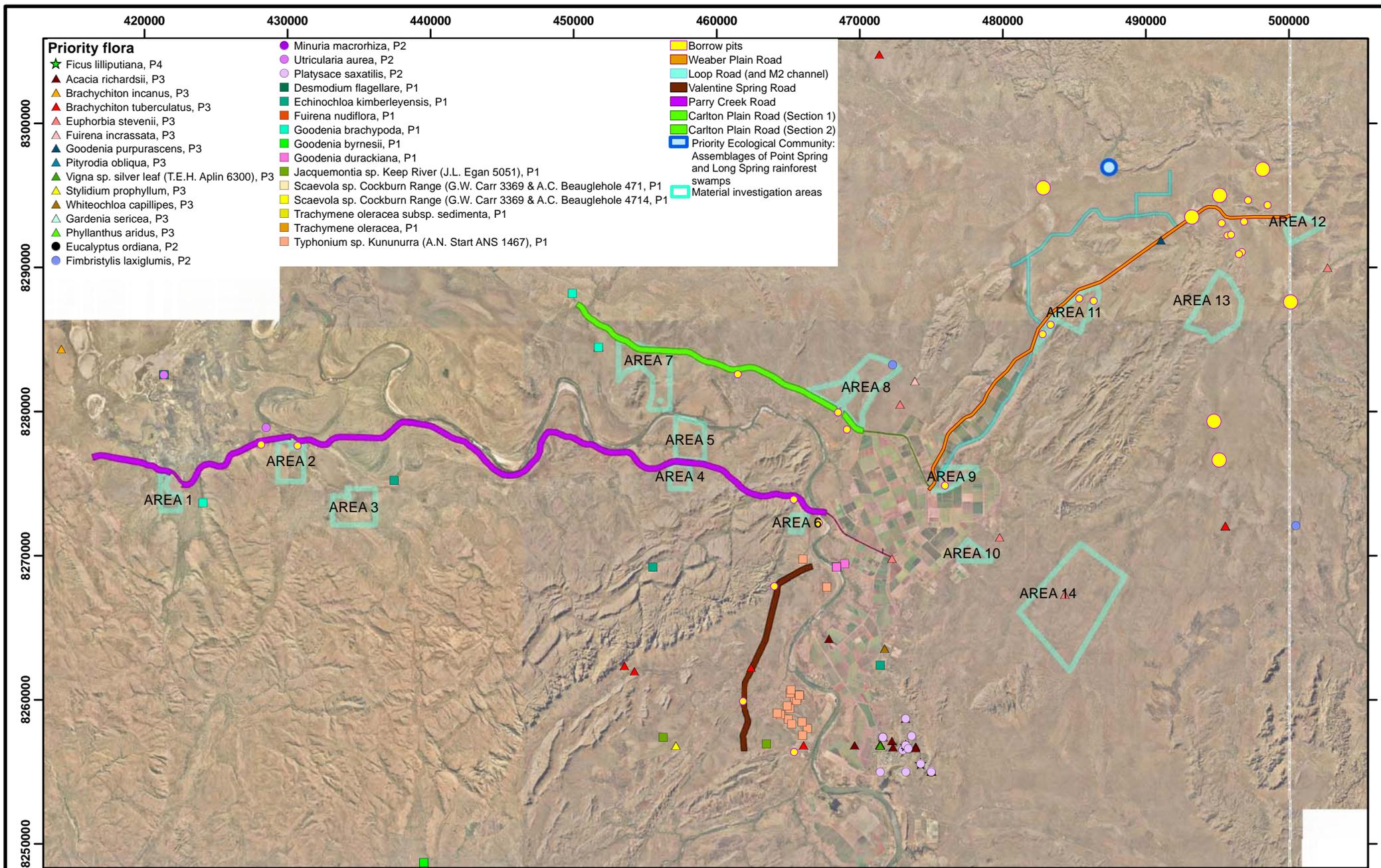
MIAs 4 and 6 and a borrow pit are located adjacent to proposed Livistona Conservation Area, and part of Parry Creek Rd runs through this area.

Due to the small scale and localised nature of the proposed clearing within MIAs adjacent to or on the periphery of existing or proposed conservation areas is unlikely to adversely affect on the environmental values of these areas.

The proposed clearing will not affect the environmental values of the nature reserves, National Park , the M2 development buffer or the proposed Pincombe Range Conservation Area and Livistona Conservation area, and consequently it is considered that the proposed clearing is not at variance with clearing Principle 8, with the possible exception of:

- MIAs 1, 2, 3, the western end of Parry Creek road and the two borrow pits located within Parry Lagoon Nature Reserve and the Ramsar wetland
- MIA 13, located in the M2 buffer and the proposed Pincombe conservation area
- the length of Parry Creek Rd running through the proposed Livistona conservation area.

Clearing in the areas outlined above may be at variance to clearing Principle 8, but would not be at significant variance to this clearing principle. The impact of clearing on the environmental values of these proposed and existing conservation areas should be assessed in more detail before clearing activities commence.



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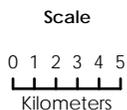


Figure 4 Flora and priority ecological communities

Coordinate system: GDA 1994 MGA zone 52

Date: 15/05/2009

Prepared by: DMS

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Original scale: 1:350,000 at A4

Source: Aerial Photography: Whelans 2007, Vegetation Association, Department of

Agriculture 2005, PEC and PF, DEC

Note that occasional errors may occur in some areas

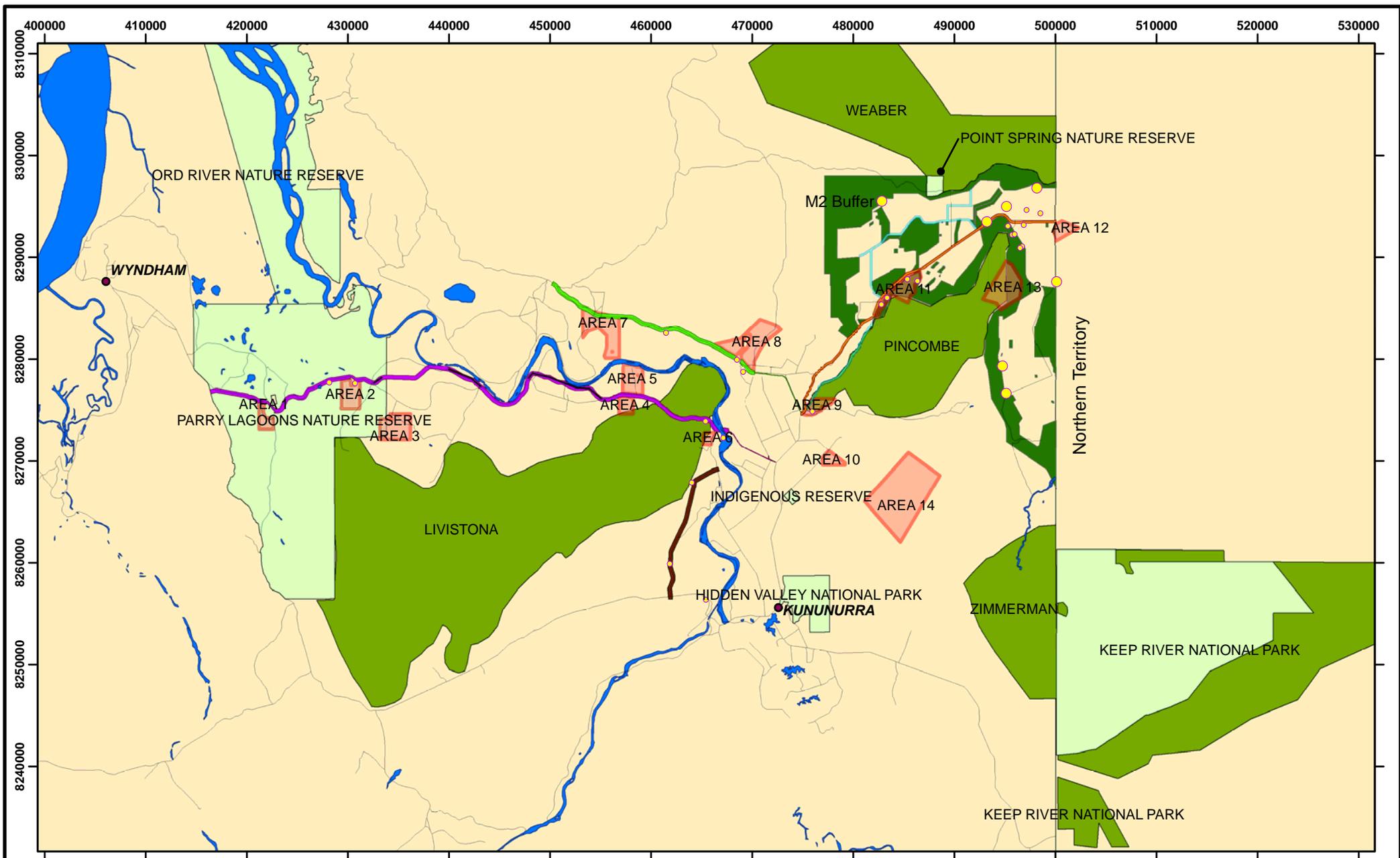
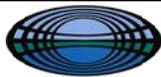


Figure 5 Existing and proposed conservation areas

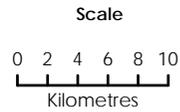
Legend

- Borrow pits
- Weaber Plain Road
- Loop Road (and M2 channel)
- Valentine Spring Road
- Parry Creek Road
- Carlton Plain Road (S 1)
- Carlton Plain Road (S 2)
- Material area
- Existing conservation areas
- Proposed conservation areas
- M2 buffer

Coordinate System: Transverse Mercator	Original scale: 1:500,000 at A4
Date: 21/05/2009	Source:
Prepared By: Diles	Note that positional errors may occur in some areas
File: I:\AN02025_01\Less\Figure 5 Proposed ORAs and buffer zones.mxd	



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6.9 CLEARING PRINCIPLE 9

Clearing Principle 9 provides that native vegetation should not be cleared if it is likely to cause deterioration in the quality of surface or underground water.

As outlined in Section 5.3 a number of watercourses, tributaries and drainage lines traverse areas in which disturbance may occur. Clearing for geotechnical surveys will involve the removal of small areas of vegetation and soil at numerous locations throughout the areas in which disturbance may occur. Potential exists for water quality change in the form of increased sediment load associated with clearing carried away from disturbed land in the wet season to enter the surface water system.

Consequently, it is proposed that no clearing or soil disturbance activities occur inside 200 m of major watercourses, and that clearing of riparian vegetation associated with minor drainage lines is avoided as far as practicable. Spoil management measures should be developed and implemented to reduce the likelihood of silty run-off affecting watercourses.

In consideration of the small area of clearing proposed, clearing is unlikely to have a significant effect on the quality of groundwater in the area. Provided that management proposals and protocols are followed (as outlined above), the proposed clearing is unlikely to be at significant variance with clearing Principle 9.

6.10 CLEARING PRINCIPLE 10

Clearing Principle 10 states that clearing of native vegetation should not occur where it is likely to cause, or exacerbate, the incidence or intensity of flooding.

The Kimberley region is characterised by intense rainfall events in the wet season, resulting in sheet flow and flooding in low lying areas. This is a natural part of the system. Due to the small scale of clearing over a large area, changes to run-off characteristics are expected to be negligible, provided that the existing drainage patterns are not altered significantly by access tracks or other clearing activities.

The scale and nature of the proposed clearing is such that it will not significantly affect landform and therefore is unlikely to cause or exacerbate the incidence or intensity of flooding. The proposed clearing is therefore not at variance with clearing Principle 10.

7. PROPOSALS FOR ENVIRONMENTAL MANAGEMENT

7.1 MITIGATION AND MANAGEMENT

The following actions should be undertaken:

1. Establish a 200 m buffer area between areas proposed to be cleared or disturbed and significant watercourses and major drainage lines.
2. Avoid clearing in drainage lines, ephemeral watercourses or minor creeks, or their associated areas of riparian vegetation as far as practicable.
3. Develop soil and erosion management measures to prevent the occurrence of silty run-off entering the surface water system.
4. Avoid significant known populations of Priority flora where practicable.
5. Apply weed management measures, as outlined within Condition 13(c) and (d) of the Permit during and after the clearing of Proposal Area.
6. Avoid disturbance of trees with signs of nests that potentially belong to conservation listed birds where practicable.

7.1.1 Rehabilitation and revegetation

In accordance with Section 13 of the Permit, areas cleared for geotechnical investigations are to be revegetated and rehabilitated as soon as possible once the permit holder no longer requires the area for a project activity. Where the permit holder intends to use that cleared area for another project activity within 12 months, the area need not be revegetated or rehabilitated.

The results of the geotechnical surveys will determine which portions of the areas in which disturbance may occur are required for another project activity (i.e. extraction of materials) within 12 months. These areas need not be revegetated or rehabilitated prior to materials extraction; however, the remaining portions of the proposal area must be revegetated and rehabilitated as soon as possible following the completion of the geotechnical surveys.

As the area proposed to be cleared is not less than 0.5 ha, the proposed clearing is not exempt from revegetation and rehabilitation requirements stipulated under Section 13 of the Permit.

Revegetation and rehabilitation of areas not required for future materials extractions must be undertaken in accordance with a Revegetation Plan that the permit holder must provide to the CEO prior to commencement of the proposed geotechnical surveys. The Revegetation Plan must be developed having regard to the permit holder's *Environmental Guideline: Revegetation Planning and Techniques*.

7.1.2 Weed control

With respect to weed control, conditions 13(c) and (d) of the Permit state:

- (c) When undertaking any clearing, revegetation and rehabilitation, or other activity pursuant to this Permit the permit holder must take the following steps to minimise the risk of introduction and spread of weeds;
 - i. Clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be clearing
 - ii. Ensure that no weed-affected road building materials, mulch, fill or other material is brought into the area to be cleared
 - iii. Restrict the movement of machines and other vehicles to the limits of the areas to be cleared.
- (d) At least once in each 12 month period for the term of this Permit, the permit holder must remove or kill any weeds growing within areas cleared, revegetated and rehabilitated, or the subject of an offset implemented by the permit holder under this Permit where those weeds are likely, having regard to the advice of an environmental specialist, to spread to and result in environmental harm to adjacent areas of native vegetation that are in good or better condition.

The actions outlined within conditions 13(c) and (d) are required to be implemented during and after clearing within areas in which disturbance may occur.

7.2 FURTHER SURVEYS

Appropriate flora and fauna survey information should be assessed for MIAs 1, 2 and part of 3, the western end of Parry Creek Road and the two borrow pits located nearby. These areas are located within an Environmentally Sensitive Area (ESA), based on the Environmental Protection (Environmentally Sensitive Areas) Notice 2005. ESAs are protected under the Environmental Protection (Clearing of Native Vegetation) Regulation 2004 because of their environmental values. Projects within ESAs require flora and fauna surveys, and quantified evidence of the extent of impacts. Exemptions offered for clearing under Regulation 5 of the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply within an ESA (DEC 2009d).

In addition clearance should be in accordance with the requirements of the *Aboriginal Heritage Act 1972* (WA) is obtained for proposed geotechnical exploration areas that were not inspected as part of the Ord Final Agreement process.

CONCLUSIONS

1. The proposed clearing activities are not anticipated to require referral to the EPA under the EP Act, subject to the recommendations made in this report and the points outlined below.
2. The proposed clearing activities are considered unlikely to have a significant impact to matters of national environmental significance and therefore are not anticipated to require referral to DEWHA under the EPBC Act.
3. The PEIA involved the assessment against the 10 clearing principles of clearing approximately 49 ha of native vegetation for geotechnical investigation across 14 MIAs, five road alignments and 30 borrow pits.
4. The desktop assessment indicated that the relevant environmental factors to consider in relation to clearing activities are vegetation and flora, fauna, surface water, reserve and conservation areas, and Aboriginal heritage. The assessment of impact to these factors was the focus of the PEIA.
5. In addition to addressing the 10 clearing principles, the relatively small areas proposed to be cleared, the low-impact nature of the proposed clearing and the historical disturbance of the areas in which disturbance may occur by previous and current cattle grazing and weed infestation reduced the potential for clearing to be at variance with clearing principles.
6. Assessment of clearing against the 10 clearing principles found the proposed clearing is only unlikely to be at variance with eight clearing principles and may not be at significant variance with two principles (6 and 8) if appropriate management measures are implemented.
7. The potential to be at variance but not at significant variance with clearing principles 6 and 8 was due to:
 - the location of proposed clearing areas within existing and potential conservation areas
 - the proximity of proposed clearing areas to wetlands, rivers, creeks and drainage lines.
8. Clearing is unlikely to be at variance with clearing principles 1, 2, 7 and 9, provided appropriate management protocols are implemented.
9. Clearing is unlikely to be at variance with clearing principles 3, 4, 5 and 10.
10. Clearing that is unlikely to be at variance with the clearing principles should be the focus of initial works, with adherence to appropriate management protocols.
11. Areas where there is potential to be at variance (but not at significant variance) with principles 6 and 8 should be subject to more detailed assessment or investigation to determine management measures which ensure that variance from clearing principles is not significant.
12. The EPASU advised LandCorp in May 2009 that the proposed geotechnical surveys are subject to the conditions of Statement No. 585, but are not constrained by them. That is, the EPASU does not consider the proposed geotechnical surveys to be 'ground disturbance'. Based on this advice, MRWA would be authorised under Statement No. 585 to undertake geotechnical surveys within the M2 development area, although the EPASU also advised LandCorp in May 2009 that it does

not support the conduct of geotechnical surveys and material extraction within the M2 buffer area. Nonetheless, it may be possible to establish reserves within the buffer where material extraction could occur and further discussion with the EPASU is recommended to clarify this position.

13. In contrast to the EPASU position regarding the M2 buffer area, the Ord Final Agreement states that extraction of raw materials may occur in the buffer (e.g. refer to Division 4B Clause 31(7) in the Ord Final Agreement)⁴.

⁴ Note that, while the Ord Final Agreement was released after Statement No. 585, it does not take precedence over the Statement. The proposed geotechnical investigations must meet the requirements of both documents.

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**Appendix 1
Brolga's Environment
vegetation report**

Priority Flora Survey for

Main Roads

Material Investigation Areas 11, 6 and 8

for infrastructure development associated with the

Ord River Expansion.

DRAFT

Prepared by Basil Byrne

Brolgas Environment

for Strategen

May 2009

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INTRODUCTION

Main Roads Western Australia (Main Roads) requires Priority Flora surveys to be conducted within twelve of fourteen Material Investigation Areas (MIA's), located within the boundaries of the Ord River Stage 2 expansion, in the Kununurra/East Kimberley district of WA. Material Investigation Area 11 is the highest priority for survey, with MIA6 and 8 second highest. These three areas are discussed in this report.

Material Investigation Area 11 (Figure 1) comprises a diverse range of landforms and vegetation communities, including escarpments, rocky hills, grasslands, open woodlands, woodlands, closed woodlands, creeks – both running and dry, and marsh areas. Some patches of woodland had been recently burned and were not surveyed for ground flora.

Much of the eastern boundary of the MIA coincides with a local road, which heads across the Western Australia/Northern Territory border towards Keep River. The south-west corner of the MIA is accessed along a well-used track heading towards Cave Springs, a popular area of significance.

Material Investigation Area 6 (Figure 2) is predominantly flat, open woodland. The southern section contains several running creeks and dry, sandy creekbeds. Extensive burning has recently occurred within the site, particularly the northern section, leaving only small mosaic patches for survey of ground flora.

Running east-west through the centre of MIA6 is the access track to Black Rock Pool, a popular tourist and locals swimming hole during the dry season (Figure 4 - Appendix A).

Material Investigation Area 8 (Figure 3) is a relatively large area, divided in the southern section by a rocky outcrop which is excluded from the area of interest. The Northern half of the MIA is currently underwater and was not surveyed due to its inaccessibility. The western leg of MIA8 consists of predominantly flat, open woodlands and shrublands on red and yellow sands, with only subtle changes in the landscape. The eastern leg is heavily grazed in areas but contains more diversity of landform than the western leg and includes marsh areas, woodlands and grasslands.

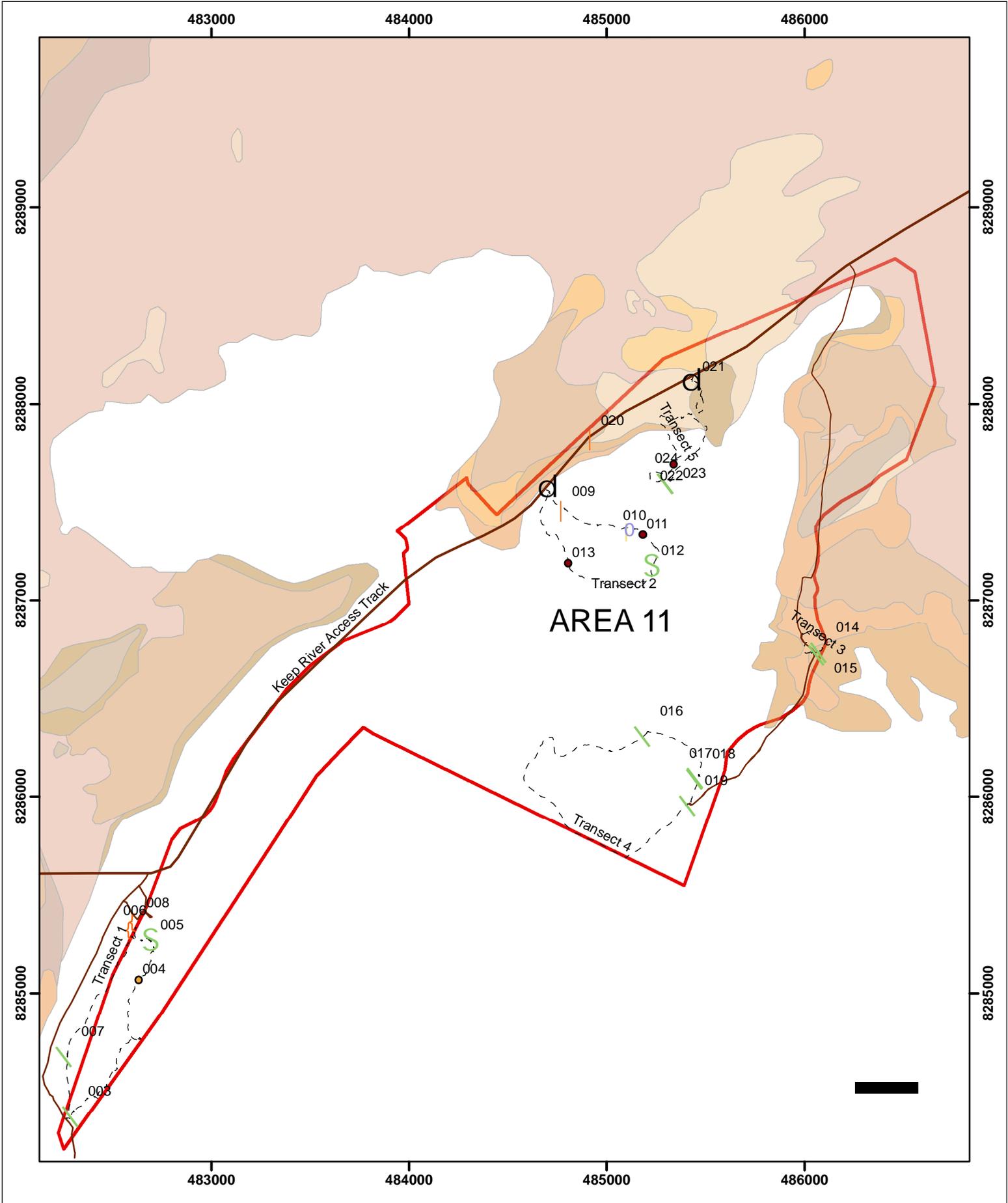
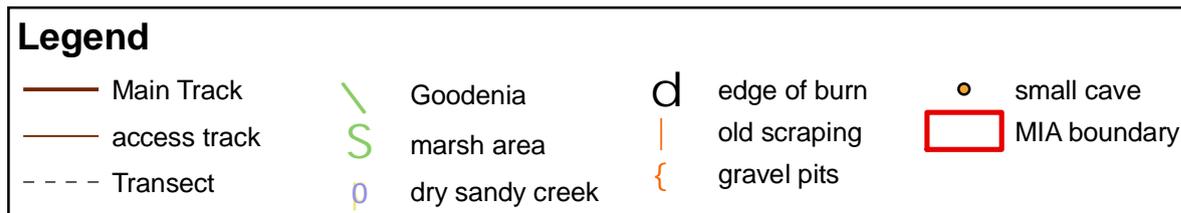
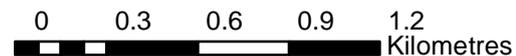


Figure 1 - Material Investigation Area 11



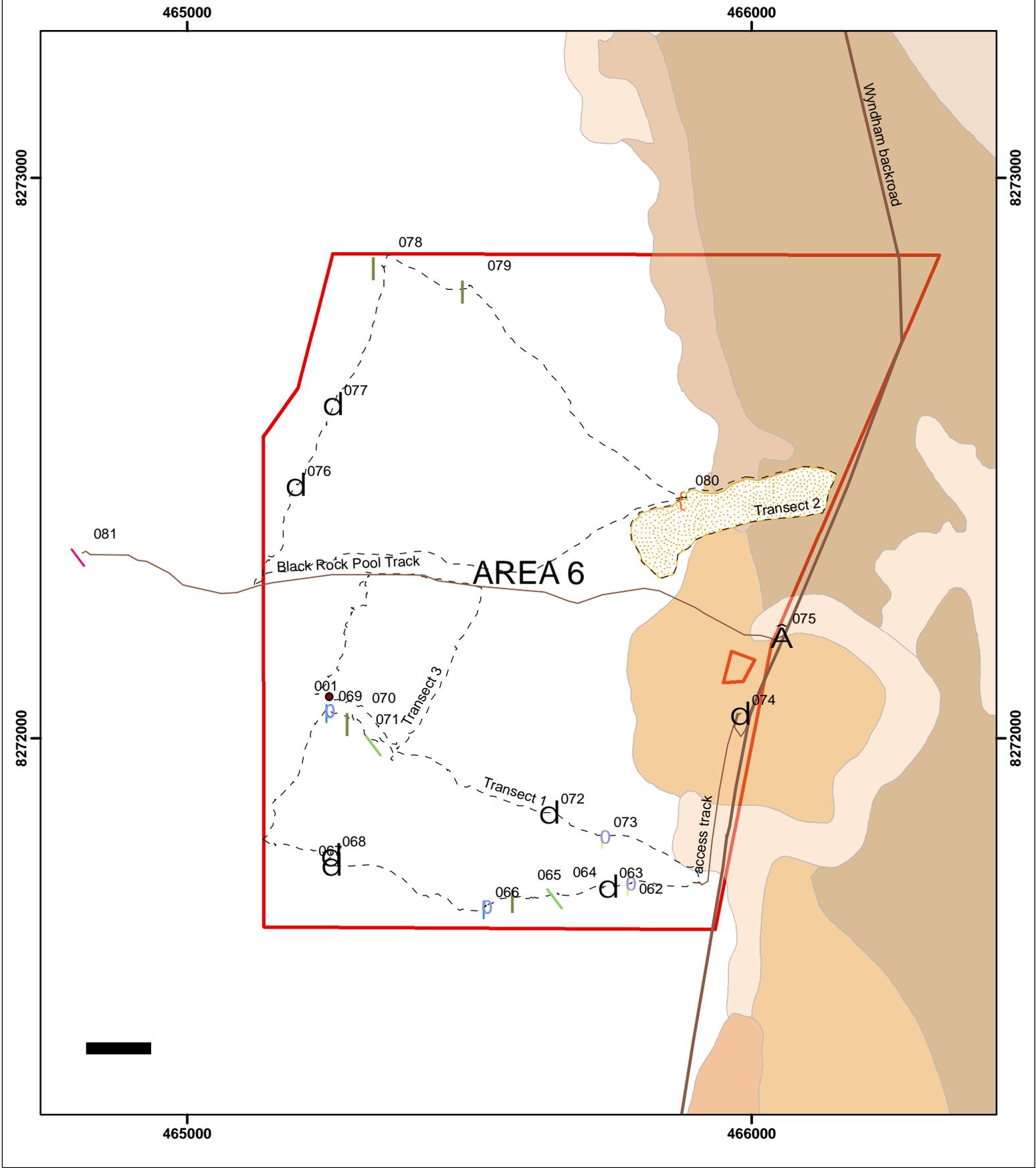
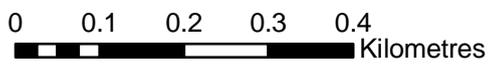


Figure 2 - Material Investigation Area 6



Legend					
	Main Track		Brachychiton tuberculatus		MIA boundary
	access track		Goodenia		gravel pits
	Transect		dry sandy creek		gravel pits
			flowing creek		Black Rock turnoff
			edge of burn		Black Rock Pool
			gravel pits		

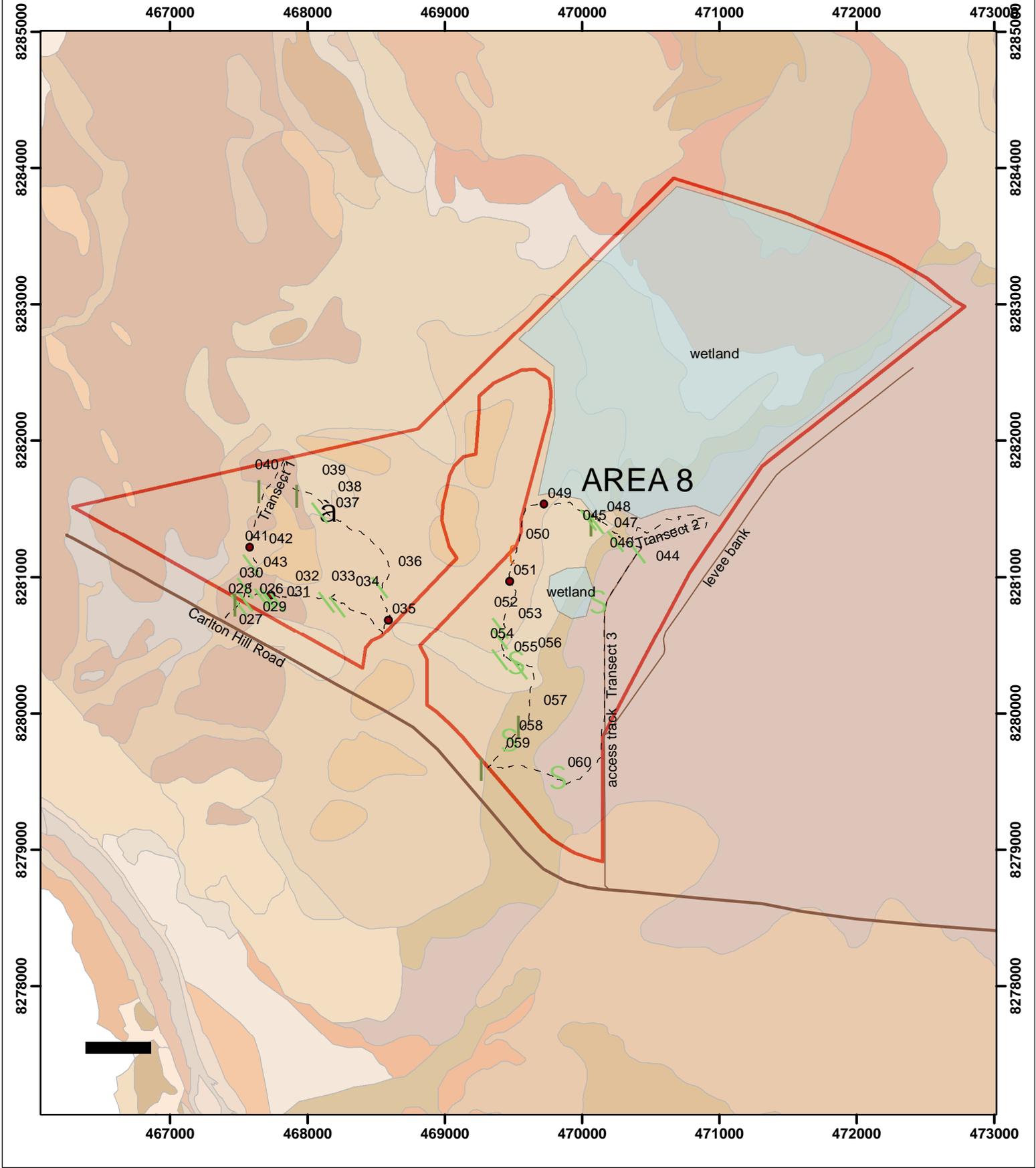
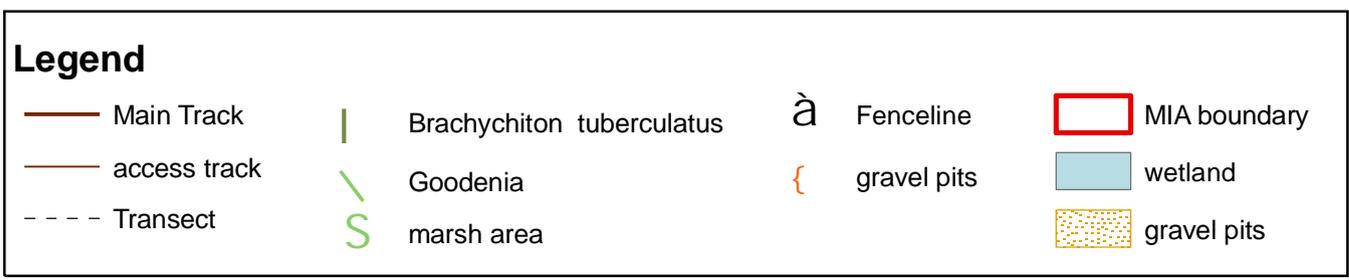
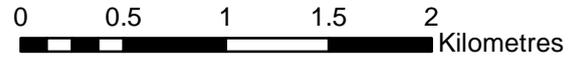


Figure 3 - Material Investigation Area 8



METHODOLOGY

An initial orientation to seven of the twelve sites to be surveyed was conducted over two days on the 27th and 28th of April. Areas that had been burned recently and access to each site was noted, as was an estimate of time expected to complete each site. A partial floral survey of MIA6 was also conducted during the orientation (referred to as Transect 3).

Survey of MIA11 was conducted over two days on the 29th and 30th April, 2009. MIA6 was surveyed on the 7th May and MIA8 on the 5th and 6th of May, 2009. For each MIA, every discernable landform type was walked through, using a Garmin GPS to tracklog the route, with waypoints taken at areas of interest. These routes are referred to as transects in the discussion. Co-ordinates for the MIA boundaries were supplied for this survey by the environmental consulting firm, Strategen,

Descriptions and images of the Priority Flora were sourced from "Flora of the Kimberley Region" (Wheeler *et. al* 1992), samples when available were scanned at DEC Kununurra Herbarium and Florabase (florabase.calm.wa.gov.au) was accessed for supplementary descriptions and images. Not all of the Priority Flora had descriptions and very few images were available. Where a description was absent, I looked for any plants that appeared to belong to the same Genus or Family. Not all of the priority flora are necessarily flowering or fruiting at present and may have been missed due to lack of distinguishing characteristics. For example *Typhonium* sp. Kununurra at this time of year is reputedly reduced to an underground corm and thus not visible for survey.

Plants with little or no information available were

- *Desmodium flagellare* (Desmodium have distinctive seedpods and this characteristic was searched for among any pea species observed),
- *Goodenia strangfordii* (Photographs of all *Goodenia* sp observed flowering on site were taken for future identification),
- *Jacquemontia* sp. Keep River (Convolvulaceae have distinctive flowers and only two species were seen flowering on site. DEC Kununurra have a *Jacquemontia* sp un-named, from the Keep River region, which maybe the target species),
- *Stylidium propophyllum* (Stylidiums are short-lived ephemeral species and are unlikely to be observed. Any flowers observed with the *Stylidium* characteristics were photographed),
- *Vigna* sp. Silver Leaf (no *Vigna* species with dark green leaves and an inner light green stripe as characterised by this species were observed, although pea species were photographed).

More complete descriptions were requested from the WA Herbarium, although were unavailable for the MIA11 survey. Photographs have been taken of most flowering flora within the MIA and once descriptions become available a review will be undertaken to ensure any flowering Priority Flora were not missed. (*Information has since been sourced from the WA Herbarium although the supplied information was of a very general nature and provides little information for identifying these rare flora. Samples will need to be collected and sent with photographs to the Herbarium for identification.*)

The Priority Flora were visually searched for along each route. The most common species within each section were identified to genus or species level using descriptions available in Kimberley Flora or sourced from various plant guides (Brock, 2001 and Petheram and Kok, 2003). No samples were taken, only photographs, and a more in-depth survey would be required to validate these species. Eucalypts and Acacias were not identified to species except to exclude the possibility of *Eucalyptus ordiana* and *Acacia richardsii* being present. Grasses and sedges were

also not identified, excepting to exclude *Whiteochloa capillipes* and *Fuirena nudiflora* amongst the flowering grasses/sedges.

The Ten Clearing Principles, as outlined in Schedule 5 of the Environmental Protection Act 1986, were considered while surveying MIA11, 8 and 6.

RESULTS

Material Investigation Area 11

Transect 1: Open, relatively low diversity woodlands with 80% grass cover; more diverse and closer canopied woodlands; rocky hill slopes with 5% *Triodia* sp. cover; a ridgeline (130 metre altitude); a dry creek line that would provide wet-season runoff from the associated hills; a small permanent spring with associated flora; and a quarry. The area of the spring and associated wetland was relatively small (perhaps 200 m²). The spring does not flow for a great distance, with a dry creek-bed continuing into the area currently being quarried.

Three single plants of a Goodenia sp. were found at in transect 1 at waypoint 3. This species does not match any description in "Flora of the Kimberley Region" but also does not match the priority flora descriptions, as it is thin stemmed with sparse leaves.

A single plant found in the vicinity of waypoint 6 resembles the common Goodenia sepalosa but exhibits similar characteristics to the closely related priority listed Goodenia brachypoda.

Two species were found at waypoint 7. A single example fine-stemmed species, differing from that at waypoint 3 did not match a priority flora description, however the second species may belong to either Goodenia sepalosa or Goodenia brachypoda.

Transect 2: Open woodlands; a rocky hill slope with evidence of previously being scraped; numerous sandy, dry creek beds; a marshy soak; grasslands; rocky embankments; swamp areas (recently dried).

Several examples of a single thin-stemmed Goodenia species were found within the woodlands behind the first hill.

Transect 3: Open woodland and rocky hills.

Two thin-stemmed Goodenia species were scattered throughout the woodland area but in no great density. Unlikely to be priority flora. A thirds species superficially resembling the priority flora but having a 3-branched style rather than one, excludes this species from the listed priority flora.

A single Stylidium species was found near the end of the transect but does not match the available description of S. propophyllum.

Transect 4: Open woodlands and a rocky outcrop.

A single purple (waypoint 14) and single white (waypoint 15) Goodenia were found on an open cracking black clay area but the leaves of both plants do not match the description of Goodenia purpurascens and are unlikely to be the listed priority flora.

Two Goodenia species were present scattered through the woodlands regularly but in no great density. Neither of these species appeared to match the listed priority flora.

Transect 5: Open woodland; rocky hills (110 metre altitude); and a valley with a dry creek bed.

A purple/yellow Goodenia was found to be locally abundant in the woodland area and is likely to be Goodenia bicolor.

Waypoints 16 to 19 mark several Goodenia species, although only one to a few examples were found for each species. Waypoint 16 is a species with a 3-branched style and is not part of the listed priority flora. The two species at waypoint 17, a thin-stemmed and more succulent leafy-stemmed species do not match descriptions of the listed priority flora. The species at waypoint 18 maybe Goodenia sepalosa or Goodenia brachypoda. The species at waypoint 19 did not match descriptions of the listed priority flora.

Transect 6: Woodland; rocky outcrop and closed woodlands.

Several examples of the same Goodenia species were found in the open woodlands but did not match the priority flora description. A single plant was found at waypoint 23 and waypoint 24 which perhaps match the priority flora species.

Material Investigation Area 6

Transect 1: Open woodland with understory burnt out on both sides of sandy creek; sandy creekbed; open woodland with understory present (included several weed species); small flowing creek with associated flora; Open woodlands with dense grass coverage and few herb species present.

One Goodenia specimen was located under dense grass, on red sand at waypoint 64. No other individuals were observed in the area.

Two small Brachychiton tuberculatus individuals (to 1.7 m) were observed at waypoint 65 and two were in the vicinity of the flowing creek (waypoint 70)

Single examples of a fine-stemmed and one large-leafed Goodenia (perhaps a priority flora) were located at waypoint 71. The fine-stemmed species was observed sparsely through the grassy woodlands.

Transect 2: Open woodland on red sand with an understory patchily burnt throughout the transect; sandy creek, heavily eroded in parts; highly disturbed area with evidence of gravel pits.

A burnt patch of Brachychiton tuberculatus was located at waypoint 78. There were perhaps 20 saplings to 70 cm and one adult tree to 6 m. Six other plants were within visual range, all under 2 m. A single tree to 4 m was observed at waypoint 79 with two individuals of 1.5 m within a ten metre radius.

No Goodenia species were observed along this transect.

Transect 3: Open woodland on red sand; flowing creek with associated flora.

No priority species were observed along this transect.

Material Investigation Area 8

Transect 1: Grasslands and open woodland on yellow sand, with lots of eucalypt saplings; more diverse woodlands as red soils became obvious; *Acacia* dominated woodland on yellow sand;

Two Goodenia plants were found at waypoint 25. Superficially they looked different but may belong to the same species. Potentially they match the priority flora.

Several specimens of Brachychiton tuberculatus were observed within sight of waypoint 26. Several larger individuals occurred outside the MIA boundary towards the road. Waypoint 26 was the first location they were observed along the transect and all individuals (approximately 15) were below 1.7 m tall.

Two individuals of Goodenia species were present at waypoint 27. A small patch of Goodenia were located on red sandy soil on and near waypoint 28. A single plant was observed at waypoint 30. Any of these specimens may represent the priority flora.

Waypoint 31 represented a thin-stemmed Goodenia and did not match the listed priority flora.

Waypoint 32 most likely represents Goodenia odonnellii.

Several thin-stemmed Goodenia species were observed at waypoints 33, 34, 36 – 38.

A patch of 7 individuals of Brachychiton tuberculatus were observed (to 1.7m) at waypoint 39. Three B. tuberculatus individuals over 4 m were located near waypoint 40, with several smaller individuals in the vicinity under 2 m.

The more succulent leaved Goodenia species were observed between waypoint 42 and 43. Very few individuals were observed.

Transect 2: Highly disturbed paddocks due to grazing and clearing; swamp region extremely muddy underfoot.

A high abundance of a single Goodenia species occurs throughout the heavily disturbed fields on the South-eastern edge of MIA8. (Photographed at waypoint 44). Does not match any descriptions in "Flora of the Kimberley Region". No other Goodenia species were found during this transect.

Transect 3: Grazed shrubland (to 5 m) with the occasional tree to 8 m on grey soils; more diverse open woodland; woodland on red soils with patches of dense weeds; rocky shrubland, dried soak with associated flora; evidence of gravel pits south-west of the MIA boundary running parallel to the access road into Carlton Hill Station.

Waypoint 45 marks a single Goodenia sp. on red soils, dispersed thinly throughout the vicinity. It may well be one of the priority species.

Waypoint 46 is the first indication of Brachychiton tuberculatus in this south-eastern section. Five small individuals (to 1 m) were observed within a visual radius of the waypoint. Several thin-stemmed Goodenia's were present near waypoint 46 as were two different leafy Goodenia's. Several individuals of the more lobed flower form were present. The difference between the flower shapes may be due to individuals rather than species differentiation.

A noticeably smaller flower was present on the Goodenia at waypoint 48. It doesn't exactly fit any of the descriptions although has characteristics of the priority flora.

Waypoint 52 had a single *Goodenia* individual that fits with the *Goodenia sepalosa* grouping of plants as did waypoint 53. May well be a priority species.

One small individual of *Brachychiton tuberculatus* was observed on grey soil at waypoint 57 and a tree to 7 m, with seedpods was located at waypoint 59. No other individuals were present.

DISCUSSION

Material Investigation Area 11

Although MIA11 contained a variety of landforms, the common species present were similar throughout the area. There was relatively low diversity within the woodlands and rocky slopes, with the highest diversity occurring near soaks and creeks.

All transects were through open woodlands or woodlands and over any hills or rocky outcrops. *Goodenia* species were found in all the woodland areas but no hill slopes. There was evidence of grazing in the majority of woodland areas.

None of the target Priority Flora were observed with the possible exception of the *Goodenia* species. Several different *Goodenia* species were observed, photographed and GPS co-ordinates taken, although specimens will have to be collected for verification with the WA Herbarium. Where *Goodenia* did occur, it was usually only a few plants in an area, although several species were observed occurring in the same habitat. The common, widespread *Goodenia sepalosa* is a variable species with two varieties recorded for the Kimberley region. *G. brachypoda* and *G. durackiana* are closely related to *G. sepalosa*, with *G. brachypoda* previously considered a variety of *G. sepalosa*.

In terms of the Ten Clearing Principles, principle 3 (*it includes, or is necessary for the continued existence of rare flora*) and principle 6 (*it is growing in, or in association with, an environment associated with a water course or wetland*) need to be considered. The presence of the *Goodenia* species may require that some of the areas are excluded from excavation, although if the same priority species are found in the surrounding landscape outside the MIA boundary, the threat to the species would be much reduced. Until confirmation that the species we have observed are the priority flora, it appears at this stage un-necessary to investigate the outlying areas. In regard to principle 6, the small spring (Figure 1, waypoint 05), is a diverse wetland area and likely acts as an important water source for fauna in this seasonally arid landscape. Some areas of the woodlands would be wetlands during the wet-season as is evidenced by the *Melaleuca*, *Drosera* and other swamp associated species present, although these areas are widespread throughout the landscape.

Material Investigation Area 6

The majority of the northern half of MIA6 had undergone mosaic burning so little understory vegetation was able to be assessed, although there were several *Brachychiton tuberculatus* individuals present. The eastern border of MIA6, located near the corner of Black Rock Pool access track and the main track contained a largely disturbed area due to the presence of gravel pits and was depauperate in floral species. The area to the south of the Black Rock Pool access track was a more diverse landscape than the north, containing a running creek and examples of *B. tuberculatus* and *Goodenia* species.

None of MIA 6 could be described as highly diverse, and is surrounded by similar, undisturbed areas outside the borders, so is unlikely to be necessary for the continued existence of priority flora. The running stream, however, did have associated flora and is likely to be an important water source in this arid environment. Exclusion of the creek and a suitable buffer should be considered.

Approximately one kilometre south of Material Investigation Area 6, on the eastern side of the road appears to be disused gravel pits, extending approximately 500 metres along the road frontage.

Material Investigation Area 8

Transect 1 on the western leg of MIA 8 occurred through relatively flat country across yellow and red sands and contained several specimens of *Brachychiton tuberculatus* and perhaps potential *Goodenia* priority species. The eastern leg is a more diverse landscape than the western leg but is highly disturbed country with many weed species present, grazing damage and old gravel pits. The northern end of MIA6 is currently heavily inundated with water. This inundation is a seasonal occurrence, although anecdotal evidence suggests that the construction of a levee bank to the east of the site has extended the duration of water retainment (Clare Taylor), Broilgas Environment, pers. comm).

Although *Brachychiton tuberculatus* was present at the site, they were also observed outside the MIA so the area is unlikely to be necessary for the continued existence of the rare flora (Clearing Principle number 3).

CONCLUSION

Material Investigation Area 11 contains a high diversity of landforms although relatively low vegetation diversity. There is the potential for priority listed *Goodenia* species to be present although all other priority flora appear to be absent. It should be noted that not all species are flowering or fruiting at present, which reduces the opportunity for reliable identification, and more ephemeral species may not currently be visible.

It must be noted that on the "request for rare flora information" supplied to Strategen, condition 7 states that the list is not a comprehensive listing of rare flora of the area in question. Considering the diversity of *Goodenia* species found within Area 11, I would highly recommend a more intensive examination of the species present, including a collection of samples to send to the WA Herbarium for verification.

The southern section of Material Investigation Area 6 contains a running creek which should be considered for exclusion from the MIA. The northern section is disturbed, containing existing gravel pits and is unlikely to be an area necessary for the continued existence of rare flora.

Material Investigation Area 8 contains several *Brachychiton tuberculatus* individuals, with the greatest abundance and most intact habitat occurring in the South-west leg of the MIA. This area also exhibited the greatest diversity in *Goodenia* species, with the rest of the site being of a degraded and disturbed nature. MIA8 is unlikely to be an area necessary for the continued existence of rare flora.

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APPENDIX A

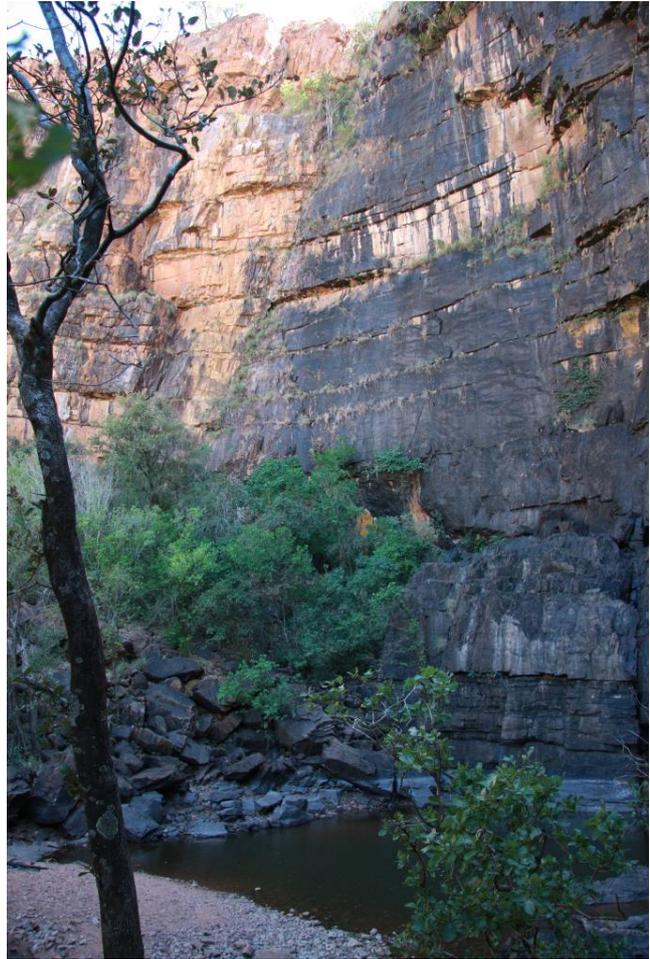


Figure 4 – Black Rock Pool, a popular tourist and local swimming hole, accessed through the centre of MIA6.