Main Roads Western Australia

Report for Lake Raeside Material Sources

Preliminary Environmental Impact Assessment and Biological Survey

August 2007

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Executive Summary

Main Roads Western Australia (Main Roads) commissioned GHD Pty Ltd (GHD) to complete a Preliminary Environmental Impact Assessment (PEIA) and Biological Survey for the proposed Lake Raeside Material Source Locations adjacent to the Goldfields Highway (H49) 293.32 – 307.94 SLK and Nambi Road. The Project involves the clearing of native vegetation for the construction of material pit (borrow pit) sites.

A number of desktop assessments were undertaken to determine the potential environmental impacts of the proposed works. These included identification and reporting of:

» climate;

» topography, hydrology and soils;

» vegetation i.e. clearing and presence of Declared Rare Flora (DRF) or Priority Listed Flora (PLF), Threatened Ecological Communities (TECs) and the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (*EPBC Act*) listed species;

» weed management;

» significant fauna;

» indigenous heritage;

» non-indigenous heritage;

» land use; and

» construction phase impacts.

No issues identified during the development of this PEIA are considered to require referral to the Environmental Protection Authority or the Commonwealth under the *EPBC Act.*

A field survey of the area recorded no observations of any Declared Rare or Priority flora species within the project area. Based upon the currently available information, the proposed works are not at variance with the Department of Environment and Conservation's (DEC's) 10 Clearing Principles. It is considered the type and nominal area of clearing proposed for the project may be authorised under Main Roads Statewide Clearing Permit.

1. Introduction

Main Roads Western Australia (Main Roads) have commissioned GHD Pty Ltd (GHD) to complete a combined Preliminary Environmental Impact Assessment (PEIA) and Biological Survey for the proposed material source areas required for the Goldfields Highway (H49) 293.32 – 307.94 SLK Lake Raeside project.

Main Roads requires a biological survey for the proposed locations of seven material source areas. The purpose of the survey is to provide an appropriate examination and description of the receiving environment to ensure that all aspects of biological/ecological significance are identified and recorded.

This combined PEIA and Biological Survey seeks to determine and assess the potential environmental impacts of the proposed works within the project areas. Recommendations to Main Roads on the actions and requirements necessary for completion of this project within legislative guidelines are also provided.

The proposed material source areas are in the Northern Goldfields Region of Western Australia, in both the Shire of Leonora and the Shire of Menzies. The locations of the material source areas are shown in Figure 1.

1.1 Scope of Report

This PEIA and Biological Survey has been prepared to conform with the Main Roads project brief and:

- Identifies and reviews any existing relevant reports;
- Conducts an initial assessment to determine the key environmental aspects for the road proposal;
- Undertakes a site visit to conduct a survey of the relevant biological and physical aspects of the project; and
- Assesses the project against the Department of Environment and Conservation's (DEC's) 10 Clearing Principles (Schedule 5);
- Assesses all environmental aspects likely to interest the Department of Environment and Conservation (DEC) or likely to require referral of the project and advise whether the project should be referred to the Environmental Protection Authority (EPA);
- Assesses all matters of National Environmental Significance likely to require referral of the project and advise whether the project should be referred to the Commonwealth Department of the Environment and Water Resources (DEWR);
- Consults with the relevant government agencies as required;

- Determines (but does not apply for) clearances required under other legislative provisions, including (but not limited to) those required under the following Acts;
  - *Conservation and Land Management Act 1984;*
  - *Wildlife Conservation Act 1950;*
  - *Environmental Protection Act 1986;*
  - *Rights in Water and Irrigation Act 1914;*
  - *Heritage of Western Australia Act 1990;*
  - *Aboriginal Heritage Act 1972; and*
  - *Environmental Protection and Biodiversity Conservation 1999*
- Provides a concise report on the findings.

Based on the information provided by Main Roads and database/literature reviews the environmental and social aspects considered and discussed in this PEIA include:

- Climate;
- Geology;
- Landforms and soils;
- Hydrology;
- Vegetation and flora;
- Weed management;
- Fauna;
- Indigenous heritage;
- Non-indigenous heritage;
- Land use; and
- Construction phase impacts.

The Main Roads WA brief required a desktop investigation to assess a number of issues. Some of these issues are considered not to be relevant to this survey. Table 8 identifies these issues and provides reasons why they were not assessed.

2. Project Description and Justification

Main Roads requires basecourse material for road construction associated with the realignment of a 15 km section of the Goldfields Highway (HO49), at Lake Raeside, between Menzies and Leonora. Main Roads has found that previously identified material sources for the Lake Raeside project have had poor material testing results. Therefore, Main Roads has been exploring other source options within the vicinity of the project area. These newly investigated material sources require an assessment of the projects impacts, particularly an assessment of DEC's Ten Clearing Principles, in order to comply with Main Roads purpose permit (CPS 818/3).

A total of seven borrow pit locations are required for assessment. Pit 284 SLK and Pit 275 SLK are located on the western side of the Goldfields Highway approximately 27 km and 35 km south of Leonora, respectively. Pits 1 to 5 are located on the eastern side of Nambi Road, approximately 20 km to the north-east of Leonora. Not all pits will require clearing as some areas are devoid of vegetation. It is unclear at this stage of the project of exactly how much vegetation will require clearing for the proposed works.

3. Existing Environment

3.1 Climate

The Survey area is located within a region with hot dry summers and cold winters. The climate is persistently dry, with an average of 233 mm of rainfall each year. The rainfall within the region is highly variable and is subject to bimodal rainfall patterns – during the summer months thunderstorms and/or the remnants of tropical storms (ex-tropical cyclones) may dump large volumes of rainfall in short periods of time – and the region will also receive rainfall from the passage of cold fronts during winter. Wettest months in the Goldfields tend to be February/March and June/July.

The closest meteorological station is located in Leonora. The recorded climatic data is summarised as follows:

Mean Annual Maximum Temperature Range:	37.0 ^{0}C (January) & 18.4 $^{-0}$C (July)
Mean Annual Minimum Temperature Range:	21.7 ^{0}C (January) & 6.1 ^{0}C (July)
Mean Annual Rainfall:	233 mm
Mean Annual Rain days per year:	43.2

(*Bureau of Meteorology Climatic Averages of Australian Sites, 2006*)

3.2 Geology

The Survey area is situated within the Yilgarn Block, which forms the nucleus of the Western Australian Shield. It is comprised predominately of gneisses and granites, with interfolded belts of metamorphic sedimentary and igneous rocks. The area is gently undulating, generally not very dissected, and consists of extensive sand plains on remnants of a Tertiary surface, with occasional hills and ranges of metamorphic rocks. Archaean granites with mafic extrusive and intrusive rocks underlie the majority of the Survey area (Martinick, 1996).

3.3 Soil and Soil-Vegetation Relationships

The main soil-vegetation relationships present within the survey areas relate primarily to the topographical variation and influence of groundwater associated with the Lake Raeside system. Lower lying areas contain samphire and chenopod flats, grading up to Acacia low woodlands on dunes, to Low Woodlands of mulga away from the lower lying areas.

The disturbance in the area is primarily due to pastoral grazing activities, which has altered vegetation composition with palatable species being more heavily grazed. Grazing impacts are intensified around stock watering points.

3.4 Topography and Hydrology

The project areas are located within an area of gently undulating land surface ranging from approximately 380 – 420 m Australian Height Datum (AHD) (Commonwealth of Australia, 1983). The regional drainage system is disorganised, consisting of a chain of lakes including Lake Raeside. Lake Raeside is located approximately 13 – 22 km north of Pits 284 SLK and 275 SLK and approximately 20 km south of Pits 1 to 5. During intense storm events, drainage occurs as sheetflow, especially in areas with hard setting soils such as the southern approaches of Lake Raeside (Martinick, 1996).

There are a number of ephemeral creeklines to the east of Nambi Road within the vicinity of Pits 1 to 5, which flow southwards, towards Lake Raeside.

Lake Raeside forms part of a larger drainage system of lakes that are located in regionally extensive valley floors. This system includes Lakes Moore and Barlee, situated in the west and draining to the east and southeast. The drainage system is subject to extensive regional flooding during intense storm events, such as experienced during and after Cyclone Bobby in February 1995, and may reach the Nullarbor Plain, flowing down Ponton Creek to Lake Boonderoo (Martinick, 1996)

3.5 Acid Sulphate Soils

A desktop assessment of groundwater and topography in the project area indicates that there is very little risk of actual or potential Acid Sulphate Soils (ASS) occurring within the project area.

The main environmental indicator of ASS is a shallow groundwater and/or waterlogging of laterites and sands, which may have generated sulphuric conditions, which lead to acid sulphate soils. The project area is well known to be outside of the region in which potential or Actual Acid Sulphate Soils are known to occur.

ASS is not considered an issue in the survey areas.

3.6 Contaminated Sites

A search of DEC's Contaminated Sites Database was undertaken for the survey areas which indicated there were no contaminated sites registered under the *Contaminated Sites Act 2003*.

Given the remote location of the proposed works, it is considered unlikely that any contaminated sites occur in the vicinity of the survey area.

3.7 Land Use

Information obtained from online access to the Shire of Menzies and Shire of Leonora websites indicate that both towns are highly dependent on the mining industry. Leonora is described as the service centre for the mining, exploration and well-established pastoral industry.

The Goldfields Highway is the main access road between the towns of Kalgoorlie-Boulder and Leonora. Nambi Road is a minor road, which is the main access road from Leonora to Nambi Station.

Pastoral activities cover a large proportion of the land in the region, which is mostly reserved for sheep and goat grazing. Much of the Goldfields Highway is fenced for driver safety and livestock protection.

3.8 Heritage

3.8.1 Non Indigenous Australian Heritage

A search of the DEWR *EPBC Protected Matters Database* did not identify any registered heritage places on the Register of the National Estate.

A search of the Western Australian Heritage Council's Heritage Places Database also did not identify any heritage places located within the survey area.

3.8.2 Indigenous Australian Heritage

The Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System was accessed to identify Registered Indigenous Heritage sites within the project areas. There were no Indigenous heritage sites within or in close proximity to Pit 284 SLK or Pit 275 SLK. There are two Aboriginal Heritage sites within close proximity to Pits 1 to 5, Nambi Road. The details of the sites are summarised in Table 1.

Table 1 List of registered Sites within close proximity to the Project Sites

Site ID	Site Name	Site Type	Status
1177	Makata	Mythological	Permanent register
2869	Pig Well Bore 1	Skeletal material / Burial, Man-Made Structure	Interim register

(Source: Department of Indigenous Affairs, 2007).

3.8.3 Native Title

A search of the Native Title Tribunal, Western Australia Title Claim Map of Western Australia identified that no Native Title Determination has been granted over the proposed project areas.

Deep Woods Surveys (2004) consulted representatives from various Aboriginal Native Title Claim groups to identify and manage concerns associated with the proposed Lake Raeside roadworks and associated borrow pits. Numerous project related requests and recommendations were identified by Deep Woods Surveys (2004) during their consultations with the various native title groups. Main Roads should aim to comply where possible with these requests.

3.9 Environmentally Sensitive Areas

The DEC's online Native Vegetation Viewer was searched to determine the location of any Environmentally Sensitive Areas (ESAs) within the survey areas, as declared by a Notice under Section 51B of the *Environmental Protection Act 1986*.

The search confirmed that there were no ESAs covering the vegetated land within the survey areas.

3.10 Reserves and Conservation Areas

A preliminary desktop investigation did not identify any reserves or conservation areas in close proximity to the survey areas.

4. Field Survey

4.1 Field Survey Methodology

The field survey seeks to verify results of the PEIA and provide an assessment of the existing environment in the Project areas and its relationship to adjoining areas.

GHD's qualified ecologists conducted the field flora survey in late April 2007.

4.1.1 Vegetation and Flora

The vegetation and flora in the survey area was mapped and described according to the process described below:

- Aerial photography was obtained, and used in the first instance to delineate vegetation types likely to be present in the survey area;
- An experienced qualified field botanist and experience environmental scientist undertook a flora and vegetation survey. The survey was conducted with regards to the *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* – EPA *Guidance Statement No. 51*, where possible. No information was collected from the use of quadrats;
- Vegetation was rated according to the vegetation condition scale commonly used in the Perth Metropolitan Region (Government of WA, 2000);
- The presence of potential Threatened Ecological Communities (TECs) in the area was assessed and mapped;
- The Department of Environment and Conservation's (DEC's) Declared Rare and Priority Flora database, and the *Environmental Protection and Biodiversity Conservation Act 1999 Protected Matters Search Tool* was searched to identify expected significant flora for the area;
- Suitable habitat for DRF and Priority Flora species was searched during the survey to determine the presence of previously unrecorded threatened flora.

4.1.2 Fauna

A reconnaissance survey was undertaken in conjunction with the botanical survey by a qualified ecologist, with regard to the *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia – Guidance Statement No. 56*, EPA, where possible.

An assessment of the likelihood of significant fauna, opportunistic records of fauna species, fauna habitat values, and fauna linkage corridors was undertaken.

Nomenclature

Nomenclature used in this report follows that used by the DEC's *FloraBase* and the WAM's *FaunaBase* program as these programs deemed to contain the most up-to-date species information for Western Australia.

4.2 Vegetation

4.2.1 Vegetation Description

Martinick (1996) indicate that the project area is located within the Barlee sub-region, which is the southern portion of the Austin Botanical District of the Eremaean Botanical Province. The dominant vegetation consists of low mulga woodlands on the plains, *Acacia* shrub on the hills, shrubland on extensive sandplains and halophytic shrublands on low-lying saline areas such as Lake Raeside. Martinick (1996) also indicate that the condition of the vegetation is generally good, with no extensive areas without vegetation and few signs of vegetation death.

There has been some previous clearing within four of the six proposed pit locations. Main Roads will require the clearing of native vegetation at the proposed pit locations where it hasn't been previously cleared.

4.2.2 Vegetation Extent Type and Status

A vegetation type is considered underrepresented if there is less than 30 percent of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation in States where clearing is still occurring (EPA, 2000)

- The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at a level of 30% of the pre-European/ pre-1750 extent of the vegetation type;
- A level of 10% of the original extent is regarded as being a level representing *Endangered*; and
- Clearing which would put the threat level into the class below should be avoided.

Such status can be delineated into five (5) classes, where:

- *Presumed Extinct*: Probably no longer present in the bioregion
- *Endangered**: <10% of pre-European extent remains
- *Vulnerable**: 10-30% of pre-European extent exists
- *Depleted**: >30% and up to 50% of pre-European extent exists
- *Least Concern*: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

* or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

Native vegetation types represented in the survey areas; their regional extent and reservation status are drawn from Shepherd, *et al*. (2002), and Shepherd pers. comm. (2005). These are shown in Table 2.

Beard (1978) indicates that the vegetation within the project areas comprises of low woodland of mulga (*Acacia aneura*), open low woodland of mulga, and shrublands with mulga scrub.

Table 2 Vegetation Type, Extent and Status

Vegetation Association Number	Association Description	Pre-European Extent (ha)	Current Extent (ha)	(%) Remaining	(%) Pre-European extent in IUCN Class I-IV Reserves	(%) in other reserves
18	Low Woodland; mulga (*Acacia aneura*)	12403248.48	12403248.48	100.0	0.4	0.4
28	Open low woodland; mulga	224294.358	224294.358	100.0	0.0	0.0
39	Shrublands; mulga scrub	1148411.403	1148411.403	100.0	0.0	0.0

Source: Beard (1978) Vegetation Associations, Calculations of Vegetation Extent (Shepherd, 2005)

The extent of the vegetation in the survey areas is considered to be Least Concern, with approximately 100% of the pre-European extents of each vegetation type remaining.

Results of Field Survey

Field investigations delineated four vegetation types within the survey areas (Table 4). This included a community described as cleared vegetation with some re-growth. Areas that have been historically cleared have been for the purpose of tracks, exploration and borrow pits. The vegetation over the survey areas comprises predominately of Low woodland: mulga.

The vegetation types within the survey areas have been mapped in Figures 3 – 8, Appendix A.

4.2.3 Vegetation Condition

Developed for Bush Forever, Vegetation Condition Rating is a scale that recognises a level of intactness of vegetation, which is defined by the following (Government of Western Australia, 2000):

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping; and
- The potential for natural or assisted regeneration.

The scale therefore consists of six (6) rating levels as outlined below in Table 3.

Table 3 Bush Forever (Government of WA, 2000) Vegetation Condition Rating Scale

Vegetation Condition Rating	Vegetation Condition	Description
1	*Pristine or Nearly So*	No obvious signs of disturbance
2	*Excellent*	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species
3	*Very Good*	Vegetation structure altered, obvious signs of disturbance
4	*Good*	Vegetation structure significantly altered by very obvious signs of multiple disturbance, retains basic vegetation structure or ability to regenerate it
5	*Degraded*	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management
6	*Completely Degraded*	The structure of the vegetation is no longer intact and the area is completely or almost without native species

The vegetation condition of the survey areas was rated during the field survey using the Bush Forever Scale (Table 3) and these conditions are mapped in Figures 9 – 13, Appendix A. A summary of these vegetation types and there condition rating is provided in Table 4.

Table 4 Vegetation Types and Condition Rating

Vegetation Type	General Description	Vegetation Condition (Government of WA, 2000)
Pit 275 SLK		
1	Low Woodland (mulga)	1 – 3 (generally)
2	Cleared Vegetation (includes regrowth in old pits)	5 – 6
Pit 284 SLK		
1	Open Mulga Shrubland	2
2	Cleared Vegetation (includes regrowth in old pits)	6
Pits 1 & 2		
1	Low Woodland (mulga)	1 – 2
2	Open Low Woodland (mulga)	1 – 2
Pit 3		
1	Low Woodland (mulga)	2 – 3 (generally)
2	Open Low Woodland (mulga)	1 – 3
3	Cleared Vegetation (includes regrowth in old pits)	5 – 6
Pit 4		
1	Low Woodland (mulga)	1 – 2
2	Open Low Woodland (mulga)	1 – 2
3	Cleared Vegetation (includes regrowth in old pits)	5 – 6
Pit 5		
1	Low Woodland (mulga)	1 – 2

A large proportion of the survey areas are considered to be Condition 2 (*Excellent*). Areas that have been previously cleared are considered to be Condition 5 - 6 (*Degraded - Completely Degraded*). These areas have been cleared for the purpose of roads/tracks; old borrow pits; fencing; and exploration. These areas contained little or no remaining native flora with some re-growth.

4.2.4 Threatened Ecological Communities

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered, and Vulnerable.

Some TECs are protected under the *EPBC Act*. Although TECs are not formally protected under the State *Wildlife Conservation Act 1950,* the loss of, or disturbance to, some TECs triggers the *EPBC Act*. The Environmental Protection Authority's (EPA's) position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

A search was undertaken of the DEC's TEC database and found no known occurrences of TECs recorded within the boundary of the survey area.

The search noted that there are no known occurrences of TECs within the vicinity of the survey area.

Possible TECs that do not meet survey criteria are added to the Department of Environment and Conservation's (DEC) Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. These are ecological communities that are adequately known; are rare but not threatened, or meet criteria for Near Threatened. PECs that have been recently removed from the threatened list are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

No Priority Ecological Communities are known from the within the vicinity of survey area.

No TECs or PECs were recorded from the field assessment.

4.3 Flora Survey

Results of Field Survey

Field investigations in April 2007 identified a total of 64 flora taxa from 23 families within the survey areas (62 native species and 2 weed species). The vegetation within the survey areas is described as having a low to moderate level of diversity and is considered to be relatively similar to the native vegetation occurring in the surrounding region. The lower level of plant diversity is primarily due to pastoral grazing activities, which has altered vegetation composition with palatable species being more heavily grazed. Only two weeds species were present over the survey areas, which were generally present in areas that had previously been disturbed.

The plant diversity of Pit 275 SLK and Pit 284 SLK is generally lower than Pits 1 to 5, with a proportion of the areas previously been cleared. Pit 284 SLK was the only survey area that contained both weed species identified over the entire survey area.

There are a number of tracks that dissect through the survey areas. Previously cleared areas for old borrow pits were found within Pits 3, 4, 275 SLK and 284 SLK.

Dominant families recorded within the Survey areas included:

- *Chenopodiaceae* 9 taxa
- *Myoporaceae* 9 taxa
- *Mimosaceae* 7 taxa
- *Poaceae* 6 taxa
- *Caesalpiniaceae* 4 taxa
- *Amaranthaceae* 3 taxa

Additionally, the dominant genera recorded were:

- *Eremophila* 9 taxa
- *Acacia* 7 taxa
- *Sclerolaena* 4 taxa
- *Senna* 4 taxa
- *Ptilotus* 4 taxa

Appendix C provides a full list of flora species recorded in the survey area.

4.3.1 Significant Flora Species

Significant impacts on species of flora that are listed as rare or endangered under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (*EPBC)* can trigger referral of development proposals to the Commonwealth Department of Environment and Water Resources (DEWR).

A description of Conservation Categories delineated under the *EPBC Act* is detailed in Appendix B. These are applicable to threatened flora and fauna species.

A search of the *EPBC Act* Protection Matters database did not identify any threatened flora species known to occur within the project areas.

In addition to the *EPBC Act,* significant flora in Western Australia is protected by the *Wildlife Conservation Act 1950*. This *Act*, which is administered by the DEC, protects Declared Rare Flora (DRF) species.

The DEC also maintains a list of Priority Flora species. Priority Flora are not currently protected under the *Wildlife Conservation Act 1950*. Priority Flora may be rare or threatened, but cannot be considered for declaration as rare flora until adequate surveys have been undertaken of known sites and the degree of threat to these populations clarified. Special consideration is often given to sites that contain Priority

Flora, despite not having formal legislatory protection. A description of the DEC's Conservation Codes that relate to flora species is provided in Appendix B.

A search of the DEC's Threatened Flora Database and Western Australian Herbarium (WAHERB) Records indicate that no DRF and 9 Priority Listed Flora species are known to exist within the vicinity of the project area (Appendix B).

The locations of Priority Flora known to occur within the vicinity of the survey area are mapped in Figure 2, Appendix A.

The field investigations did not identify the occurrence of any DRF, Priority Flora or regionally significant flora species.

4.3.2 Weeds and Introduced Species

Only 2 taxa within the survey area are weed species. Weed species were mainly dominant within cleared areas along tracks and old borrow pits.

Declared Plants

Weeds that are, or may, become, a problem to agriculture or the environment can be formally classified as Declared Plants under the *Agriculture and Related Resources Protection Act, 1976*. The Department of Agriculture and the Agriculture Protection Board maintains a list of Declared Plants for Western Australia. If a plant is declared for the whole of the State or for particular Local Government Areas, all landholders are obliged to control that plant on their properties. Declarations specify a category, or categories, for each plant according to the control strategies or objectives which the Agriculture Protection Board believes are appropriate in a particular place.

Among the factors considered in categorising declared plants are:

- The impact of the plant on individuals, agricultural production and the
- Community in general,
- Whether it is already established in the area, and
- The feasibility and cost of possible control measures.

These Declared Plants are divided into 5 classes, which are detailed in Table 5.

Table 5 Department of Agriculture Declared Plant Classes (Standard Control Codes).

Priority Class	Description
P1	Prohibits movement of plants or their seeds within the State. This prohibits the movement of contaminated machinery and produce including livestock and fodder.
P2	Eradicate infestation to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.
P3	Control infestation in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set all plants.
P4	Prevent the spread of infestation from the property on or in livestock, fodder, grain, vehicles and/or machinery. Treat to destroy and prevent seed set on all plants.
P5	Infestations on public lands must be controlled

No Declared Plant species were observed within the survey area during the field investigations.

4.3.3 Plant Pathogens

The survey area is considered not to occur in an area susceptible to the development of the pathogen, *Phytophthora cinnamomi,* commonly known as Dieback (Dieback Consultative Council, 2001). Dieback is found throughout the southern extent of Western Australia in areas with susceptible plant species that receive rainfall in excess of 400 mm/year (Dieback Working Group, 2005).

No formal *Phytophthora cinnamomi* (dieback) assessment of the survey area has been undertaken, however; a visual inspection of vegetation for impacts of the pathogen was undertaken during the field investigations.

The vegetation within the survey area is not considered to be susceptible to the pathogen. Visual inspections indicated no patterns of plant death that could be attributed to the presence of Dieback.

4.4 Fauna

4.4.1 Significant fauna Species

The conservation status of fauna species is assessed under State and Commonwealth Acts: in particular the *Western Australian Wildlife Conservation Act 1950* and the *EPBC Act 1999*.

The significance levels for fauna used in the *EPBC Act* are those recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN). A description of Conservation Categories delineated under the *EPBC Act* is detailed in Appendix D. These are applicable to threatened flora and fauna species. The *WA Wildlife Conservation Act 1950* uses a set of Schedules but also classifies species using some of the IUCN categories. These categories and Schedules are described in Appendix D.

The *EPBC Act* also protects migratory species that are listed under the following International Agreements:

» Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;

» The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA); and

» The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Listed migratory species also include species identified in other international agreements approved by the Commonwealth Environment Minister.

The Act also protects marine species on Commonwealth lands and waters.

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the Western Australian *Wildlife Conservation Act 1950* but for which the Department feels there is a cause for concern. These species have no special legislatory protection, but their presence would normally be considered. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Levels of Priority are described in Appendix D.

The DEWR maintains a database of matters of national environmental significance that are protected under the *EPBC Act.* An *EPBC Act* Protected Matters Report was generated (from the website of the DEWR), for the matters of significance that may occur in, or may relate to, the survey area. A total of 5 bird species were identified as potentially occurring within the survey area. Appendix D contains the results of the search.

Martinick (1996) lists a number of species that may be found within the survey area, as well as a list of rare or endangered species that utilise the mulga habitats of the arid interior. Based on the CALM 2005 *Declared Threatened Fauna Occurrence in CALM Regions,* it is perceived that this list is current.

The declared threatened fauna, based on the report by Martinick (1996) are listed in Table 6.

Table 6 Declared Threatened Fauna (after Martinick, 1996)

Scientific Name	Common Name	DEC Status
Geopsittacus occidentalis	Night Parrot	Schedule 1
Dasycerus cristcauda	Mulgara	Schedule 1
Cacatua leadbeateri	Major Mitchell's Cockatoo	Schedule 4
Polytelis alexandrae	Princess Parrot	Priority 4

It should be noted that some species that appear in the *EPBC Act* Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the DEC searches of threatened fauna provide more accurate information for the general area, however some records of sightings or trappings can be dated and often misrepresent the current range of threatened species.

4.4.2 Results of Field Survey

A reconnaissance fauna survey (for vertebrate fauna only) was undertaken in conjunction with the flora survey.

The field investigations recorded a total of 30 fauna species over the survey area. Observed fauna included 22 bird species, 5 mammal species and 3 reptile species. The number of species determined during the survey was limited by the brief time spent in the field. The opportunistic nature of the survey also reduced the number species recorded. In addition, the survey did not include sampling for those species that are cryptic or nocturnal.

Error! Reference source not found. contains the complete list of fauna species observed.

No fauna species of conservation significance were observed during the survey.

Fauna Habitat Value

The habitat value of the survey sites was assessed during the field survey. In general, the habitat value is considered to be of a moderate value. Within the vicinity of the survey areas, there are some areas of vegetation that have been degraded by the grazing activities from pastoral operations, in addition to areas that have previously

been cleared. Vegetation types, however, are considered to be relatively unaltered, and good fauna habitat remains in most areas.

The survey areas also supports feral and domestic fauna species including the European Rabbit, Feral Goat, and Sheep, and are likely to support the Red Fox.

It is not considered that the construction and excavation of borrow pits for material sources for the Lake Raeside survey will significantly alter the fauna habitat of the region. It is considered that a disturbance will occur on a local scale, which is likely to impact on individual animals, rather than species.

The survey areas are wholly surrounded by native vegetation that have been subject to either major disturbances such as mining, clearing and / or livestock grazing at some time in the past. None of the areas surveyed contain vegetation or habitat zones that are not present within the surrounding areas.

Habitat Linkages

Fauna corridors and habitat linkage are important to allow animals to move between areas of resource availability. Such corridors are important for ground and aerial fauna, providing cover, resources, and linking areas suitable for rest and reproduction.

Habitat corridors are important in areas where extensive clearing has occurred to help overcome the effects of habitat fragmentation. These corridors assist in maintaining genetic diversity through connection of gene pools, enabling recolonisation of disturbed areas and the provision of habitat. Where contiguous bushland areas can not be maintained a connection can still be maintained through “stepping stones”, which are isolated patches of vegetation close enough together to allow certain species to move between them. Stepping stones are primarily of importance to very mobile species such as birds. Birds often require ‘flyways’, vegetated areas along a bush corridor, which they can use to move between habitat areas. These corridors can provide shelter from predators and rest sites.

The survey area is not considered to contain any significant breaks to habitat linkages, being completely surrounded by natural bushland.

5. Clearing of Native Vegetation

5.1 Assessment Against the Clearing Principles

Clearing is managed by the *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004. However, Main Roads Statewide project "Clearing Permit" (CPS 818/2) allows clearing in certain circumstances and the project not occurring in an Environmentally Sensitive Area (ESA).

Clearing applications are assessed against the Ten Clearing Principles outlined in Schedule 5 of the *Environmental Protection Amendment Act* (2003). These principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

Based on this desktop PEIA, the proposed survey has been assessed against the Ten Clearing Principles and is summarised in Table 7.

Table 7 Assessment Against the Ten Clearing Principles

Principle	Criteria	Assessment	Outcome
a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	a1) Native vegetation should not be cleared if it is representative of an area of outstanding biodiversity in the Bioregion.	The remnant native vegetation remaining within each of the survey areas is not considered to contain a high level of biological diversity.	Not at variance with clearing principle.
	a2) Native vegetation should not be cleared if it has higher diversity of indigenous aquatic or terrestrial plant or fauna species than native vegetation of that ecological community in good or better condition in the Bioregion.	The remnant native vegetation remaining within each of the survey areas is not considered to contain a higher diversity of indigenous plant and fauna species than native vegetation of that ecological community in good or better condition in the Bioregion.	Not at variance with clearing principle.
	a3) Native vegetation should not be cleared if it has higher diversity of indigenous aquatic or terrestrial plant or fauna species than the remaining vegetation of that ecological community in the local area.	The remnant native vegetation remaining within each of the surveys areas is not considered to contain a higher diversity of indigenous plant or fauna species than the remaining vegetation of that community in the local area.	Not at variance with clearing principle.
	a4) Native vegetation should not be cleared if it has higher ecosystem diversity than other native vegetation of that local area.	The remnant native vegetation remaining within each of the surveys areas is not considered to contain a higher ecosystem diversity than other native vegetation of that local area.	Not at variance with clearing principle.
	a5) Native vegetation should not be cleared if it has higher genetic diversity than the remaining native vegetation of that ecological community.	The remnant native vegetation remaining within each of the surveys areas is not considered to contain a higher genetic diversity than the remaining native vegetation of that ecological community.	Not at variance with clearing principle.
b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	b1) Native vegetation should not be cleared if it is or is likely to be habitat for fauna that is declared Specially Protected under the *Wildlife Conservation Act*.	No fauna species declared Specially Protected under the *Wildlife Conservation Act* were recorded from the survey areas. It is considered that none of the survey areas contain vegetation or habitat zones that are not present within the surrounding areas.	Not at variance with clearing principle.
	b2) Native vegetation should not be cleared if it is or is likely to be habitat for Priority Listed Fauna.	No Priority Listed Fauna were recorded from the survey areas. It is considered that none of the survey areas contain vegetation or habitat zones that are not present within the surrounding areas.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	b3) Native vegetation should not be cleared if it is or is likely to be habitat for fauna that is otherwise significant.	No significant fauna species were recorded from the survey areas. It is considered that none of the survey areas contain vegetation or habitat zones that are not present within the surrounding areas.	Not at variance with clearing principle.
	b4) Native vegetation should not be cleared if it provides significant habitat for fauna species in the local area.	The habitat value of the survey sites was considered to be of a moderate value. Within the vicinity of the survey areas, there are some areas of vegetation that have been degraded by the grazing activities from pastoral operations, in addition to areas that have previously been cleared. Vegetation types, however, are considered to be relatively unaltered, and good fauna habitat remains in most areas. However, the habitat types within the survey areas are all well represented within the wider bioregion.	Not at variance with clearing principle.
	b5) Native vegetation should not be cleared if it maintains ecological functions and processes that protect significant habitat for fauna.	Clearing of native vegetation will not alter ecological functions and processes that protect significant habitat for fauna. No significant fauna species were recorded from the survey area.	Not at variance with clearing principle.
	b6) Native vegetation should not be cleared if it forms, or is part of, an ecological linkage that is necessary for the maintenance of fauna.	The survey area is not considered to contain any significant breaks to habitat linkages, being completely surrounded by natural bushland.	Not at variance with clearing principle.
	b7) Native vegetation should not be cleared if it provides significant habitat for fauna communities (assemblages) and meta-populations.	It is considered that the vegetation within the survey areas does not provide significant habitat for fauna communities (assemblages) and meta-populations. The habitat types within the survey areas are well represented within the surrounding areas.	Not at variance with clearing principle.
c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	c1) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of populations of Declared Rare Flora under the *Wildlife Conservation Act 1950*.	No Declared Rare Flora species were recorded from the survey areas.	Not at variance with clearing principle.
	c2) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of other significant flora.	No flora of conservation significance were recorded from the survey areas.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	c3) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of significant habitat for priority flora species published by the Department of Environment and Conservation.	No Priority Flora species were recorded from the survey areas.	Not at variance with clearing principle.
d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	d1) Native vegetation should not be cleared if threatened ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* are present.	The native vegetation within each of the survey areas does not comprise the whole or part of a threatened ecological community.	Not at variance with clearing principle.
	d2) Native vegetation should not be cleared if it is necessary for the maintenance of Threatened Ecological Communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.	The native vegetation within the survey areas is not necessary for the maintenance of any threatened ecological communities.	Not at variance with clearing principle.
	d3) Native vegetation should not be cleared if other significant ecological communities are present.	The native vegetation within each of the survey areas does not comprise the whole or part of other significant ecological communities.	Not at variance with clearing principle.
	d4) Native vegetation should not be cleared if it is necessary for the maintenance of other significant ecological communities.	The native vegetation within the survey areas is not necessary for the maintenance of other significant ecological communities.	Not at variance with clearing principle.
	d5) Native vegetation should not be cleared if it is necessary for the continued *in situ* existence of significant examples of priority threatened ecological communities published by the Department of Environment and Conservation.	The native vegetation within the survey areas is not necessary for the continues *in situ* existence of significant examples of priority threatened ecological communities published by DEC.	Not at variance with clearing principle.
e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	e1) Native vegetation should not be cleared if the remaining native vegetation represents less than 30%, or the clearing would reduce the representation of remaining native vegetation to less than 30% in the Bioregion (or subregion where applicable).	Native vegetation in the survey area is considered to be not reduced (i.e. at 100%) in extent from pre-European extents.	Not at variance with clearing principle.
	e2) Native vegetation should not be cleared if an ecological community represents less than 30% of its original extent or clearing would reduce the representation of any ecological community to less than 30% of its original extent in the Bioregion (or subregion where applicable).	Native vegetation in the survey area is considered to be not reduced (i.e. at 100%) in extent from pre-European extents.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	e3) Native vegetation should not be cleared if clearing would reduce an ecological community to less than 1% of the Bioregion (or subregion where applicable)	Native vegetation in the survey area is considered to be not reduced (i.e. at 100%) in extent from pre-European extents.	Not at variance with clearing principle.
	e4) Native vegetation should not be cleared if the remaining native vegetation represents less than 30% or the clearing would reduce the representation of remaining native vegetation to less than 30% in the Local Area.	Native vegetation in the survey area is considered to be not reduced (i.e. at 100%) in extent from pre-European extents.	Not at variance with clearing principle.
	e5) Native vegetation should not be cleared if an ecological community represents less than 30% of its original extent or clearing reduce the representation of any ecological community to less than 30% of its original extent in the Local Area.	Native vegetation in the survey area is considered to be not reduced (i.e. at 100%) in extent from pre-European extents.	Not at variance with clearing principle.
	e6) Native vegetation should not be cleared if clearing would reduce any ecological community to less than 1% of the Local Area.	Native vegetation in the survey area is considered to be not reduced (i.e. at 100%) in extent from pre-European extents.	Not at variance with clearing principle.
f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	f1) Native vegetation should not be cleared if it is growing in a watercourse or wetland that has been identified as having significant environmental values.	There are no watercourses or wetlands within the survey areas. There are minor, non-perennial drainage lines that run through some of the survey areas.	Not at variance with clearing principle.
	f2) Native vegetation should not be cleared if it provides a buffer area for watercourses and wetlands identified in criteria (f1) and (f2).	The remnant native vegetation within the survey areas does not provide a buffer area for watercourses or wetlands.	Not at variance with clearing principle.
	f3) Native vegetation should not be cleared if water tables are likely to change and adversely affect ecological communities that are wetland or groundwater dependent.	The clearing of remnant native vegetation within the survey areas is considered not likely to change and adversely affect ecological communities that are wetland or groundwater dependent.	Not at variance with clearing principle.
	f4) Native vegetation should not be cleared if it is growing in other watercourses or wetlands.	The native vegetation in the survey area is not associated with a watercourse or wetland.	Not at variance with clearing principle.
g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	g1) Native vegetation should not be cleared if wind or water erosion of soil is likely to be increased (on or off site).	The clearing of native vegetation is not considered to increase wind or water erosion. Appropriate pit design and rehabilitation practices will reduce any potential alteration to erosion	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	g2) Native vegetation on land with soils with high or low pH should not be cleared.	The soil in the survey area is not considered to contain high or low pH.	Not at variance with clearing principle.
	g3) Native vegetation should not be cleared if water logging is likely to be increased (on or off site).	Some pooling of water following ephemeral rainfall may occur in pit basins, however, the clearing of native vegetation will not cause water logging to increase.	Not at variance with clearing principle.
	g4) Native vegetation should not be cleared if land salinisation is likely to be increased (on or off site).	The clearing of native vegetation is not considered to alter the salinity regime present on or off site.	Not at variance with clearing principle.
h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	h1) Native vegetation should not be cleared if it contributes significantly to the environmental values of a conservation area.	No conservation areas are known to occur adjacent or within the vicinity of the survey area.	Not at variance with clearing principle.
	h2) Native vegetation should not be cleared if that vegetation provides a buffer to a conservation area.	No conservation areas are known to occur adjacent or within the vicinity of the survey area.	Not at variance with clearing principle.
	h3) Native vegetation should not be cleared if the land contributes to an ecological linkage to a conservation area.	No conservation areas are known to occur adjacent or within the vicinity of the survey area. The survey area occurs in an area of contiguous vegetation, and as such will form part of a continuous ecological linkage with regional vegetation. Clearing of native vegetation will not alter any ecological linkages in the region	Not at variance with clearing principle.
	h4) Native vegetation should not be cleared if it provides habitats not well represented on conservation land.	Native vegetation in the survey area does not provide habitat not well represented on conservation land.	Not at variance with clearing principle.
i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	i1) Native vegetation should not be cleared if clearing the vegetation will reduce the quality of surface or underground water in proclaimed, gazetted or declared areas or catchments.	The survey area is not within a managed surface or groundwater catchment area.	Not at variance with clearing principle.
	i2) Native vegetation should not be cleared if sedimentation, erosion, turbidity or eutrophication of water bodies on or off site is likely to be caused or increased.	The survey areas are considered to be remote from known watercourse or wetlands and the clearing of native vegetation will not alter sedimentation, erosion, turbidity or eutrophication of water bodies on or off site.	Not at variance with clearing principle.

Principle	Criteria	Assessment	Outcome
	i3) Native vegetation should not be cleared if water tables are likely to change significantly altering salinity or pH.	The survey areas are considered to be remote from known watercourse or wetlands and the clearing of native vegetation will not alter salinity or pH of water bodies on or off site.	Not at variance with clearing principle.
	i4) Native vegetation should not be cleared if the clearing is likely to alter the water regimes of groundwater-dependent ecosystems (GDEs) on or off site, causing degradation to the biological communities associated with these systems.	No impacts are considered likely to any GDEs on or off site, as there are no known GDEs in within or adjacent to the survey area.	Not at variance with clearing principle.
j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	j1) Native vegetation should not be cleared if it is likely to lead to an incremental increase in peak flood height.	It is unlikely that clearing of vegetation required for the project will lead to an incremental increase in peak flood height.	Not at variance with clearing principle.
	j2) Native vegetation should not be cleared if it is likely to lead to an incremental increase in duration of flood peak.	It is unlikely that clearing of vegetation required for the project will lead to an incremental increase in duration of flood peak.	Not at variance with clearing principle.

The project has been assessed to be not at variance with the clearing principles. On the basis of this PEIA and assessment against the Ten Clearing Principles, it is considered the type and nominal area of clearing proposed for the project may be authorised under Main Roads Statewide Clearing Permit.

6. Construction Phase Impacts and Management

Table 8 lists all of the environmental aspects assessed in Section 3 and describes and evaluates their potential impact relevant to the proposed project. The table also describes and evaluates the social aspects of the project.

Where the impact of an assessed aspect is not considered relevant, a statement will be included in the table to that effect. Alternatively, where an impact or environmental aspect has been deemed significant for the proposed project during the construction phase, recommendations will be included where applicable.

The environmental aspects necessary for further consideration are listed in Section 5.1.

6.1 Key Environmental Aspects

Key environmental and social aspects that have been considered to the proposed works are:

- vegetation – clearing;
- fauna;
- surface waters and drainage;
- borrow pit rehabilitation;
- erosion;
- dust emissions;
- public safety and risk; and
- Construction phase impacts – weed and topsoil management, fire management, fuel and chemical storage, local community consultation, complaints management and rubbish disposal.

6.2 Assessment of Aspects and Impacts

Table 8 lists all of the environmental aspects assessed and evaluates their potential impact relevant to the proposed project. This section includes recommendations where applicable.

Table 8 Assessments of Environmental and Social Aspects and Impacts

Aspect	Evaluation of Potential Impact	Recommendations
Vegetation	Following assessment against the "10 Clearing Principles" (Table 7) it is considered that clearing of native vegetation for the proposed project may proceed under CPS 818/3 (Part 1 – Type of Clearing Authorised).	The limits of clearing should be clearly marked on-site prior to works commencing and all project activities contained within them. Minimisation of clearing, where possible, is considered best practice.
Flora	No Declared Rare or Priority Listed Flora species were identified within the project areas during the field assessment.	Not considered to be an issue.
Fauna	The habitat value of the remaining bushland is considered to be moderate.	A Construction Environmental Management Plan (CEMP) should be developed in line with Main Road policies. Clearing should be clearly marked and adhered to by site personnel. No native vegetation outside of the clearing limit will be impacted. Main Roads should ensure that contractors are aware of potential fauna in the project area. It is recommended that fauna management strategies be incorporated into the Main Roads WA contract documentation to prevent impacts on fauna during the construction works. It is recommended that clearing be kept to a minimum in order to reduce the impact of habitat destruction on resident fauna, including retainment of felled trees for habitat.
Weeds	Only two weed species were found within the survey areas. These species were mostly present in disturbed areas (tracks, and other previously cleared areas). No Declared Plant species were observed within the survey area during the field investigations. Weed introduction and spread will be an issue that will require management during the clearing and construction phase. It is necessary to reduce the risk of weed introductions and spread from disturbed areas to less disturbed areas adjacent to the survey areas via vehicles, machinery and soil movement.	It is recommended that Main Roads WA incorporate weed management strategies within the Main Roads WA contract documentation to minimise the introduction and spread of weed species and declared plants during construction.

Aspect	Evaluation of Potential Impact	Recommendations
Surface waters/ drainage and erosion	A number of the proposed borrow pits are in close proximity to drainage lines. As these drainage lines are not within the survey area it is not likely that there will be a significant impact on any watercourses. However, the project works is likely to alter sheet flow in the area.	It recommended that Main Roads design the proposed works at the project areas so that they do not significantly alter existing drainage patterns. This will lessen the impact on *Acacia aneura* (Mulga). It is recommended that no laydown areas be placed within 50m of any drainage lines in the Project areas in order to reduce the risk of pollution from potential fuel, oil or sewerage spills. It is recommended that Main Roads address water quality and soil and erosion management in the project CEMP.
Construction phase impacts – fire management, fuel and chemical storage, and waste disposal.	During the construction phase of the proposed works, a number of common activities may cause environmental/social impacts.	It is recommended that Main Roads develop and implement a CEMP to address all environmental and social impact issues throughout the development of the project. These measures shall then be implemented during pre-construction and road construction activities.
Public safety and risk	The construction phase of the project may create some public safety and risk issues with vehicles and machinery exiting and entering the project areas along the Goldfields Hwy.	Public safety and risk will be managed in accordance with standard Main Roads WA specifications.
Dust	Dust may be a potential issue during the construction phase, especially in summer when construction sites can generate wind-borne dust. Excessive dust may impact on adjacent areas of native vegetation.	Apply standard dust management measures during construction.
Aboriginal Heritage	The results of the on-line search of Department of Indigenous Affairs (DIA) sites database show that there are two Aboriginal heritage sites in close proximity of the project areas Pits 1 to 5. It is not likely that the proposed works will impact these heritage sites.	It is recommended that Main Roads WA adhere to the conditions placed under the *Aboriginal Heritage Act (1972)* for any potential heritage sites that may be discovered during excavation or construction works. Standard Aboriginal heritage management clauses should be included in the construction Environmental Management Plan and site induction.
Acid Sulphate Soils	Acid sulphate Soils are not considered to be a major issue within the survey area.	An Acid Sulphate Soils Assessment is considered not to be required in the survey area.
Groundwater	If excavations are required below the water table dewatering may impact on groundwater quality. Consequently this potential impact will require management actions to prevent any disturbance to the groundwater quality or levels.	Main Roads should be aware that if dewatering is required, the water be directed into infiltration basins to allow the water to be naturally filtered before returning to the groundwater.
Noise and Vibration	Noise and vibration are not considered to be an issue based on the lack of sensitive receptors within the project boundaries or surrounding area.	Not considered to be an issue.

Aspect	Evaluation of Potential Impact	Recommendations
Visual Amenity	The proposed works and clearing of vegetation will not impact upon the visual amenity given their isolated locations.	Not considered to be an issue.
Vegetation – Dieback	The available climatic and hydrological data suggests that the survey areas are not vulnerable to dieback.	Not considered to be an issue.
Heritage (non-indigenous)	A search of the EPBC Act Protected Matters Search Tool (2005) and Heritage Council of Western Australia online database indicated there are no World Heritage Properties or European heritage sites of significance present in the project areas.	Not considered to be an issue.
Contaminated Sites	No sites identified. The potential to encounter a contaminated site during the proposed project is considered a low risk. There are no known previous land use activities on or adjacent to the survey area that had the potential to create contamination.	Not considered to be an issue.
Reserves and conservation areas	There were no Nature Reserves identified in close proximity to the survey area.	Not considered to be an issue.
Wetlands	There are no significant wetlands present in the survey area.	Not considered to be an issue.
Salinity	Given the nature and scale of the proposed project, this aspect is not considered relevant.	Not considered to be an issue.

7. Consultation

As specified by Main Roads, no community consultation was undertaken. However, GHD contacted the following DEC representatives:

Wayne Astill – Environmental Section of the Department of Environment and Conservation (Kalgoorlie Regional Office)

The DEC has no objection to this proposal, based on the mapping provided.

- It is expected that clearing will be in accordance with Main Roads clearing permits.
- The Nambi Road pits are in close proximity Crown Reserves 6504, 9681 & 12396 which are vested for waterways. Care should be taken in these areas to minimise the impact on fringing vegetation in this area. Similarly activities that could cause erosion in this area should be minimised, and steps taken to prevent erosion where stream crossings are necessary.

Julie Patten – Biodiversity Section of the Department of Environment and Conservation (Kalgoorlie Regional Office)

The biodiversity section of the DEC provided the following advice:

- DEC expects that a desktop flora survey and a targeted field flora survey of the pit areas is completed and submitted to Wendy Thompson at the DEC Kalgoorlie office prior to machines commencing work; and
- DEC would like to see some details in relation to rehabilitation of the pits both progressive if the pits are going to be left open for some time and final rehabilitation plans.

8. Environmental Approvals

Table 9 indicates that it is unlikely that approvals from government agencies are required.

Table 9 Approvals from Government Agencies

Relevant Agency	Agency required
Commonwealth Department of the Environment and Water	No
Environmental Protection Authority	No
Department of Environment and Conservation	No
Department of Indigenous Affairs	No
Australian Heritage Council	No
Heritage Council of Western Australia	No
Department of Agriculture and Food Western Australia	No

9. Conclusions and Recommendations

A field biological assessment for the proposed Lake Raeside Material Sources pits along the Goldfields Hwy and Nambi Road was conducted in April 2007 and the results of the assessment concluded that:

- No vegetation types surveyed across the area are considered to be under-represented.
- No Threatened Ecological Communities were recorded within the survey areas.
- Vegetation condition was considered to range from *Pristine or nearly so* to *Completely Degraded* in areas of native vegetation. Areas considered as *Degraded – Completely Degraded* have previously been cleared with some re-growth. The majority of the survey areas was considered to be in *Pristine – Excellent* condition with little to no weed or introduced species. Vegetation was generally impacted by pastoral grazing operations and existing borrow pits.
- The survey areas have a relatively low level of plant diversity, due to grazing impacts and poor rainfall season.
- No evidence of plant diseases was observed during the survey. Based on patterns of health of susceptible plants there was no indication of the occurrence of dieback (*Phytophthora cinnamomi*) within the survey areas.
- No Declared Rare or Priority Flora species were recorded within the survey areas.
- No Threatened Fauna species were recorded from the survey area.
- The survey contains vegetation that is in excellent condition, and which would provide good value as fauna habitat. However, the extent of clearing required for this project is minor. Impacts on the remaining vegetation and on fauna species at the borrow and basecourse pits can be managed through appropriate mitigation measures including site rehabilitation.
- No wetlands or watercourses were located within the Survey area.

As a result this project is considered to be not at variance with the Ten Clearing Principles. Works may be undertaken under the Main Roads Purpose Permit CPS 818/3.

9.1 Recommendations

GHD has the following recommendations with respect to the proposed material source areas along the Goldfields Hwy (H49) 293.32 – 307.94 SLK and Nambi Road:

Recommendation 1

The limits of clearing should be clearly marked on-site prior to works commencing and all project activities contained within them. No native vegetation outside of the clearing limit will be impacted.

Recommendation 2

Main Roads should ensure that contractors are aware of potential fauna in the project area. It is recommended that fauna management strategies be incorporated into the Main Roads WA contract documentation to prevent impacts on fauna during the construction works.

Recommendation 3

It is recommended that clearing be kept to a minimum in order to reduce the impact of habitat destruction on resident fauna, including retainment of felled trees for habitat.

Recommendation 4

It is recommended that Main Roads WA incorporate weed management strategies within the Main Roads WA contract documentation to minimise the introduction and spread of weed species and declared plants during construction.

Recommendation 5

It recommended that Main Roads design the proposed works at the project areas so that they do not significantly alter existing drainage patterns. This will lessen the impact on *Acacia aneura* (Mulga).

Recommendation 6

It is recommended that no laydown areas be placed within 50m of any drainage lines in the Project areas in order to reduce the risk of pollution from potential fuel, oil or sewerage spills.

Recommendation 7

It is recommended that Main Roads address water quality and soil and erosion management in the project CEMP.

Recommendation 8

It is recommended that Main Roads incorporate standard dust control measures into the Main Roads WA contract documentation for the construction works.

Recommendation 9

It is recommended that Main Roads develop and implement a CEMP to address all environmental and social impact issues throughout the development of the project. These measures shall then be implemented during pre-construction and road construction activities.

Recommendation 10

Public safety and risk will be managed in accordance with standard Main Roads WA specifications.

Recommendation 11

It is recommended that Main Roads WA adhere to the conditions placed under the *Aboriginal Heritage Act (1972)* for any potential heritage sites that may be discovered during excavation or construction works. Standard Aboriginal heritage management clauses should be included in the construction Environmental Management Plan and site induction.

Recommendation 12

Main Roads should be aware that if dewatering is required, the water be directed into infiltration basins to allow the water to be naturally filtered before returning to the groundwater.

Recommendation 13

A Construction Environmental Management Plan (CEMP) should be developed in line with Main Roads Western Australia policies.

10. References

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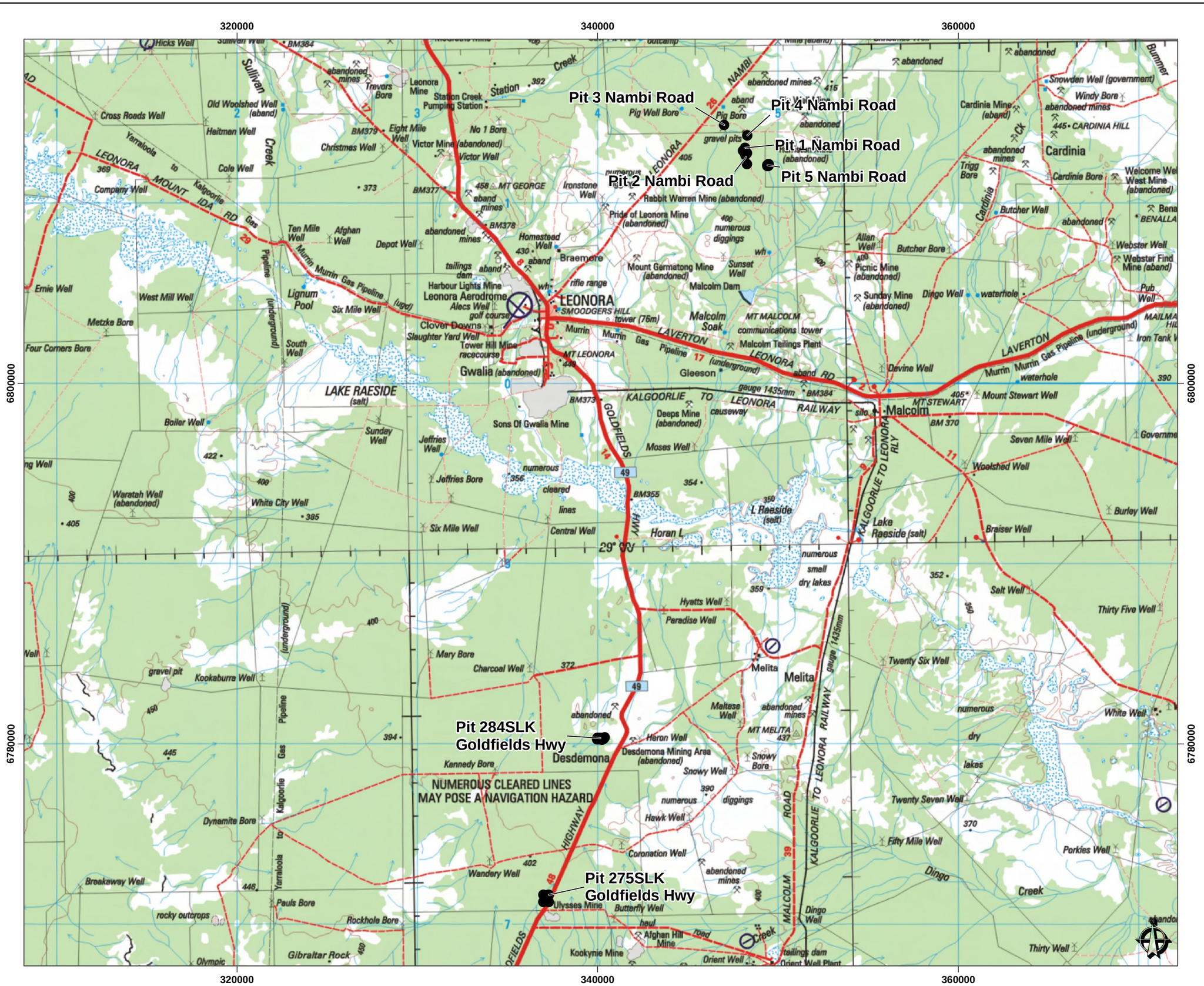
Appendix A

Figures

Figure 1	Locality
Figure 2	Environmental Constraints
Figures 3 – 8	Vegetation Type
Figures 9 – 14	Vegetation Condition



LEGEND

- Pit Boundary Coordinates (Provided by MRWA)

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS

SCALE

2 0 2 4 6km

1:200,000 at A3

LOCALITY MAP

Goldfields Region

CREATED BY	CHECKED	APPROVED
MD		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51
HEIGHT DATUM: **METADATA RECORDED:**

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mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 1
Material Source Locations

LEGEND

- ● Pit Boundary Coordinates (Provided by MRWA)

Declared Rare & Priority Species

- (R) Declared Rare Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS

SCALE

2.5 0 2.5 5 7.5km

1:250,000 at A3

LOCALITY MAP

LEONORA
MALCOLM

Goldfields Region

CREATED BY	CHECKED	APPROVED
MD/NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

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mainroads WESTERN AUSTRALIA
GHD CLIENTS | PEOPLE | PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 2
Environmental Constraints

336750
337000
337250
337500
6771750
6771500
6771250

337000mE
6771640mN

337300mE
6771640mN

337000mE
6771240mN

337300mE
6771240mN

GOLDFIELDS HWY

LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Type

- Low Woodland (Mulga)
- Open Low Woodland (Mulga)
- Open Mulga Shrubland
- Cleared Vegetation (Includes regrowth in old pits)

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - OCT 2003 MELITA MOSAIC
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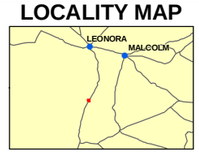
SCALE

25 0 25 50 75m

1:2,500 at A3

LOCALITY MAP



Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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mainroads WESTERN AUSTRALIA

GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 3 - Pit 275SLK Goldfields Hwy Vegetation Type

LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Type

- Low Woodland (Mulga)
- Open Low Woodland (Mulga)
- Open Mulga Shrubland
- Cleared Vegetation (Includes regrowth in old pits)

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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SCALE

25 0 25 50 75m

1:2,500 at A3

LOCALITY MAP

Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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REVISION	DRAWING NO
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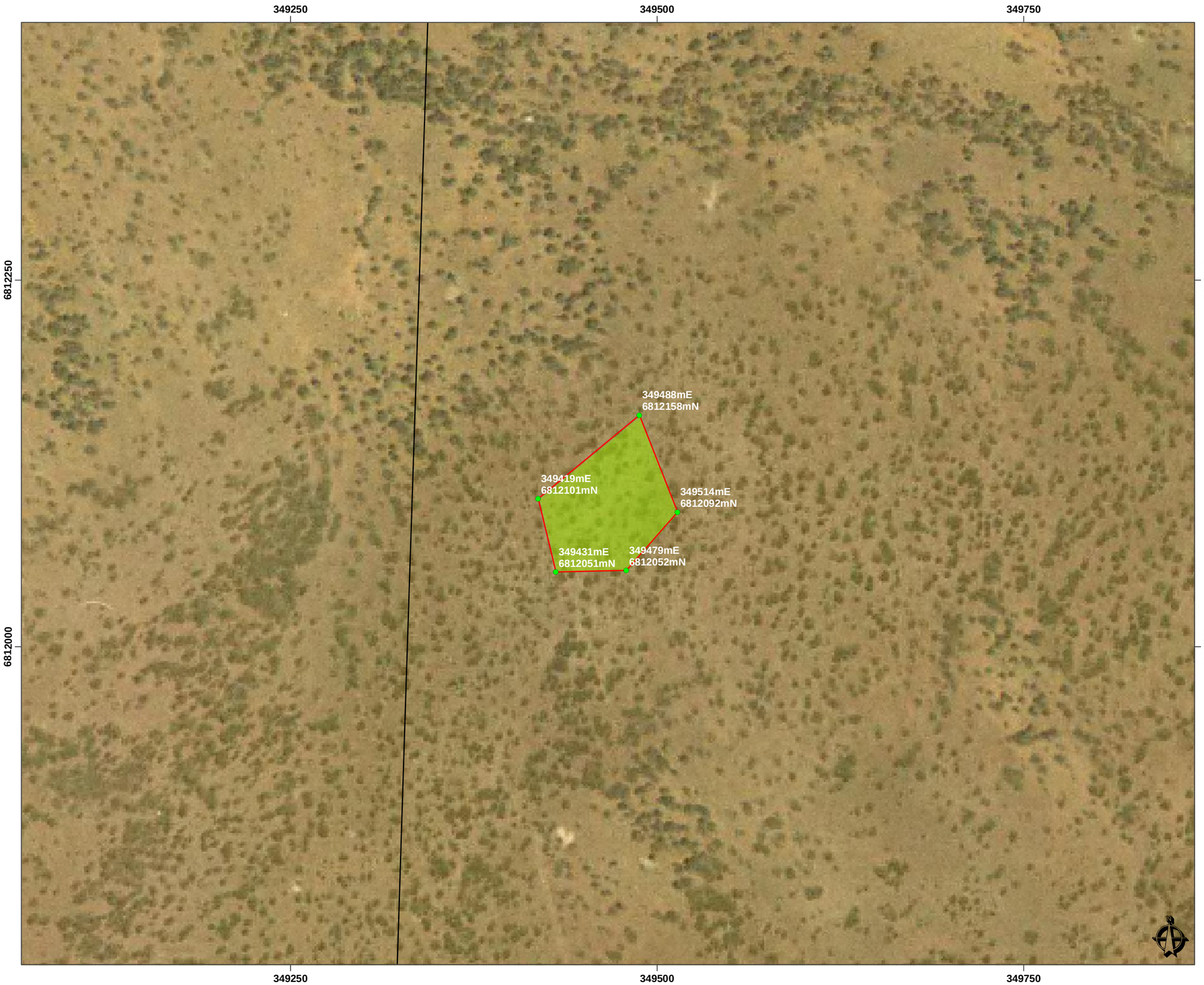
mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 4 - Pit 284SLK Goldfields Hwy Vegetation Type



LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Type

- Low Woodland (Mulga)
- Open Low Woodland (Mulga)
- Open Mulga Shrubland
- Cleared Vegetation (Includes regrowth in old pits)

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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SCALE

25 0 25 50 75m

1:2,500 at A3

LOCALITY MAP

Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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REVISION	DRAWING NO
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mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 5 - Pit 5 Nambi Road Vegetation Type

348000
348400
348800
6814000
6813600
348303mE
6813755mN

LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Type

- Low Woodland (Mulga)
- Open Low Woodland (Mulga)
- Open Mulga Shrubland
- Cleared Vegetation (Includes regrowth in old pits)

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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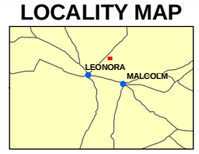
SCALE

40 0 40 80 120m

1:4,000 at A3

LOCALITY MAP



Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

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HEIGHT DATUM: **METADATA RECORDED:**

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REVISION	DRAWING NO
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mainroads WESTERN AUSTRALIA

GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 6 - Pit 4 Nambi Road Vegetation Type

346400
346800
347200
347600
6814800
6814400
6814000

347012mE
6814329mN

LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Type

- Low Woodland (Mulga)
- Open Low Woodland (Mulga)
- Open Mulga Shrubland
- Cleared Vegetation (Includes regrowth in old pits)

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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SCALE

40 0 40 80 120m

1:4,000 at A3

LOCALITY MAP

Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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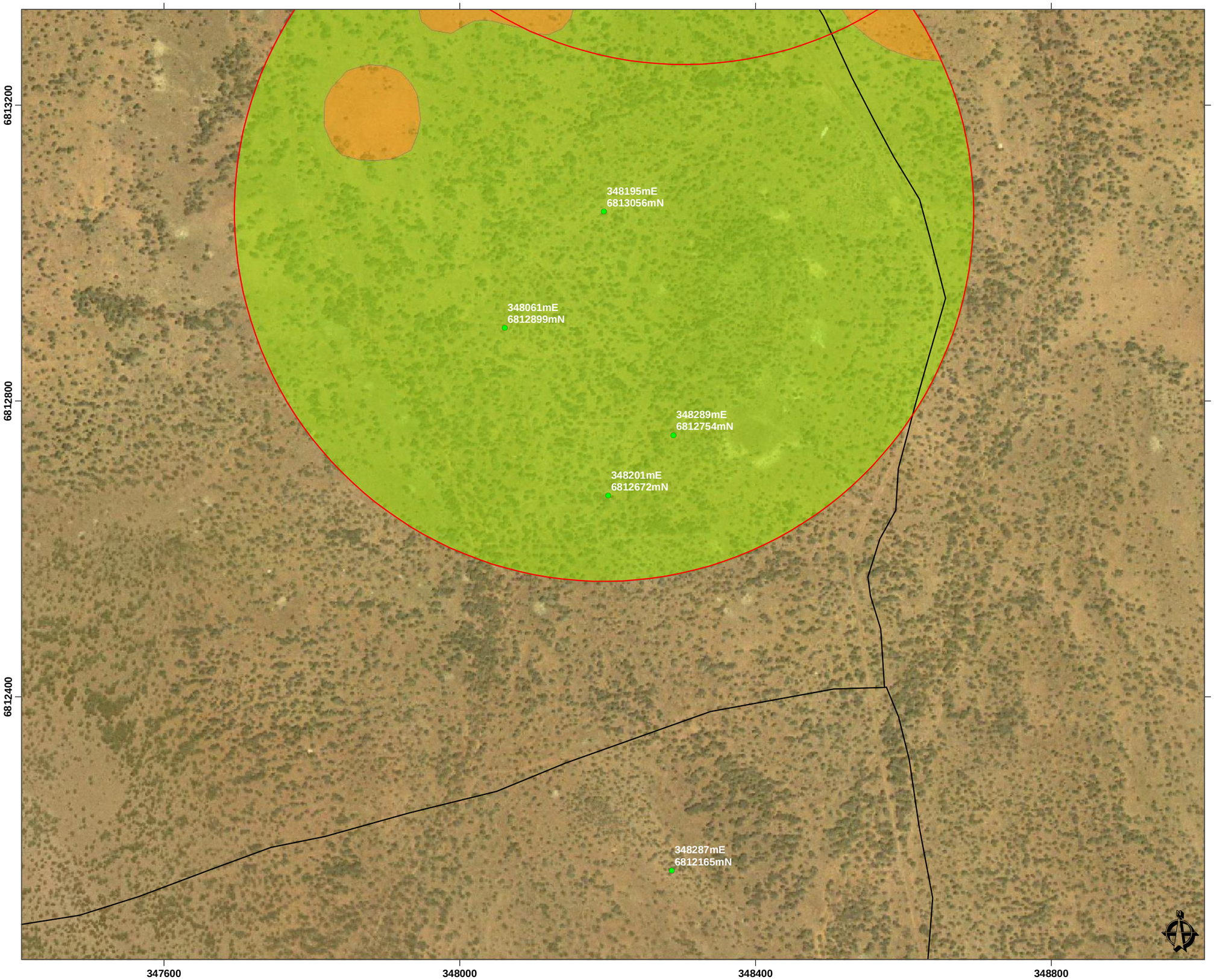
mainroads WESTERN AUSTRALIA

GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 7 - Pit 3 Nambi Road Vegetation Type



LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Type

- Low Woodland (Mulga)
- Open Low Woodland (Mulga)
- Open Mulga Shrubland
- Cleared Vegetation (Includes regrowth in old pits)

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - JAN 2003 LEONORA MOSAIC
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SCALE

50 0 50 100 150m

1:5,000 at A3

LOCALITY MAP

Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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mainroads WESTERN AUSTRALIA

GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 8 - Pits 1 & 2 Nambi Road Vegetation Type

336750 337000 337250 337500

6771750 6771500 6771250

337000mE
6771640mN

337300mE
6771640mN

337000mE
6771240mN

337300mE
6771240mN

1-2
5
1-2
6
5
6
3
5
4
6
4

GOLDFIELDS HWY

LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Condition
1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - OCT 2003 MELITA MOSAIC
REPRODUCED BY PERMISSION OF LANDGATE,
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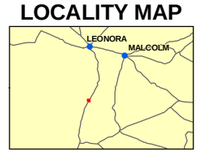
SCALE
25 0 25 50 75m
1:2,500 at A3

LOCALITY MAP



Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51
HEIGHT DATUM: **METADATA RECORDED:**

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mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 9 - Pit 275SLK Goldfields Hwy Vegetation Condition

LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Condition

1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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REPRODUCED BY PERMISSION OF LANDGATE,
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SCALE

25 0 25 50 75m

1:2,500 at A3

LOCALITY MAP

Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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REVISION	DRAWING NO
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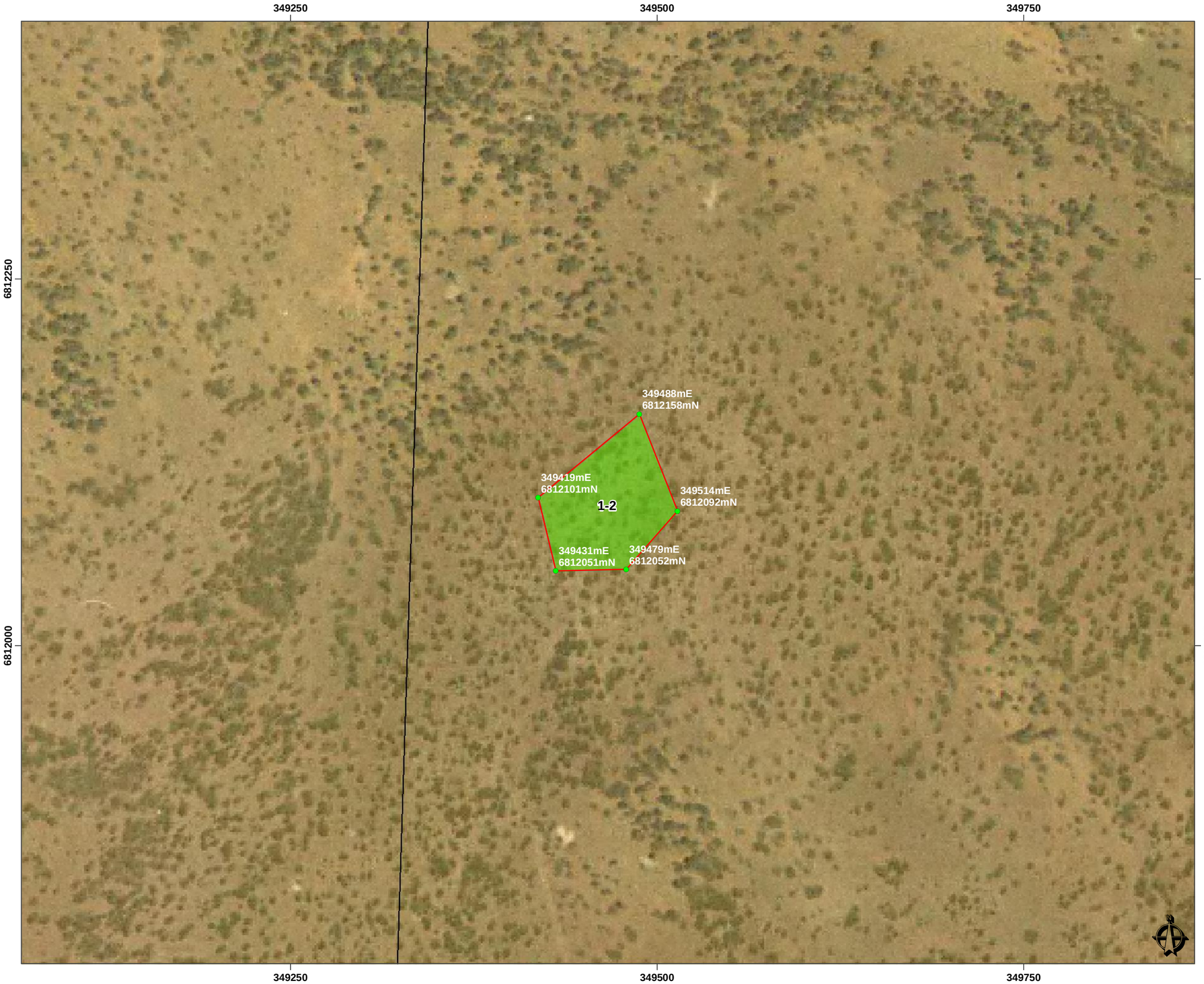
mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 10 - Pit 284SLK Goldfields Hwy Vegetation Condition



LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Condition

1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - JAN 2003 LEONORA MOSAIC
REPRODUCED BY PERMISSION OF LANDGATE,
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SCALE

25 0 25 50 75m

1:2,500 at A3

LOCALITY MAP

Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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REVISION	DRAWING NO
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mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 11 - Pit 5 Nambi Road Vegetation Condition

346400 346800 347200 347600

6814800 6814400 6814000

1-2

347012mE
6814329mN

5

6

6

3

6

6

2-3

LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Condition

1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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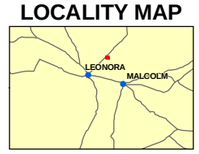
SCALE

40 0 40 80 120m

1:4,000 at A3

LOCALITY MAP



Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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REVISION	DRAWING NO
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mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 13 - Pit 3 Nambi Road Vegetation Condition

348000 348400 348800

6814000

6813600

6
5
6
1-2
348303mE
6813755mN
1-2
1-2

LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Condition

1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
AERIAL PHOTOGRAPHY SOURCED FROM LANDGATE - JAN 2003 LEONORA MOSAIC
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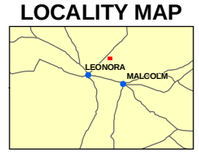
SCALE

40 0 40 80 120m

1:4,000 at A3

LOCALITY MAP



Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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REVISION	DRAWING NO
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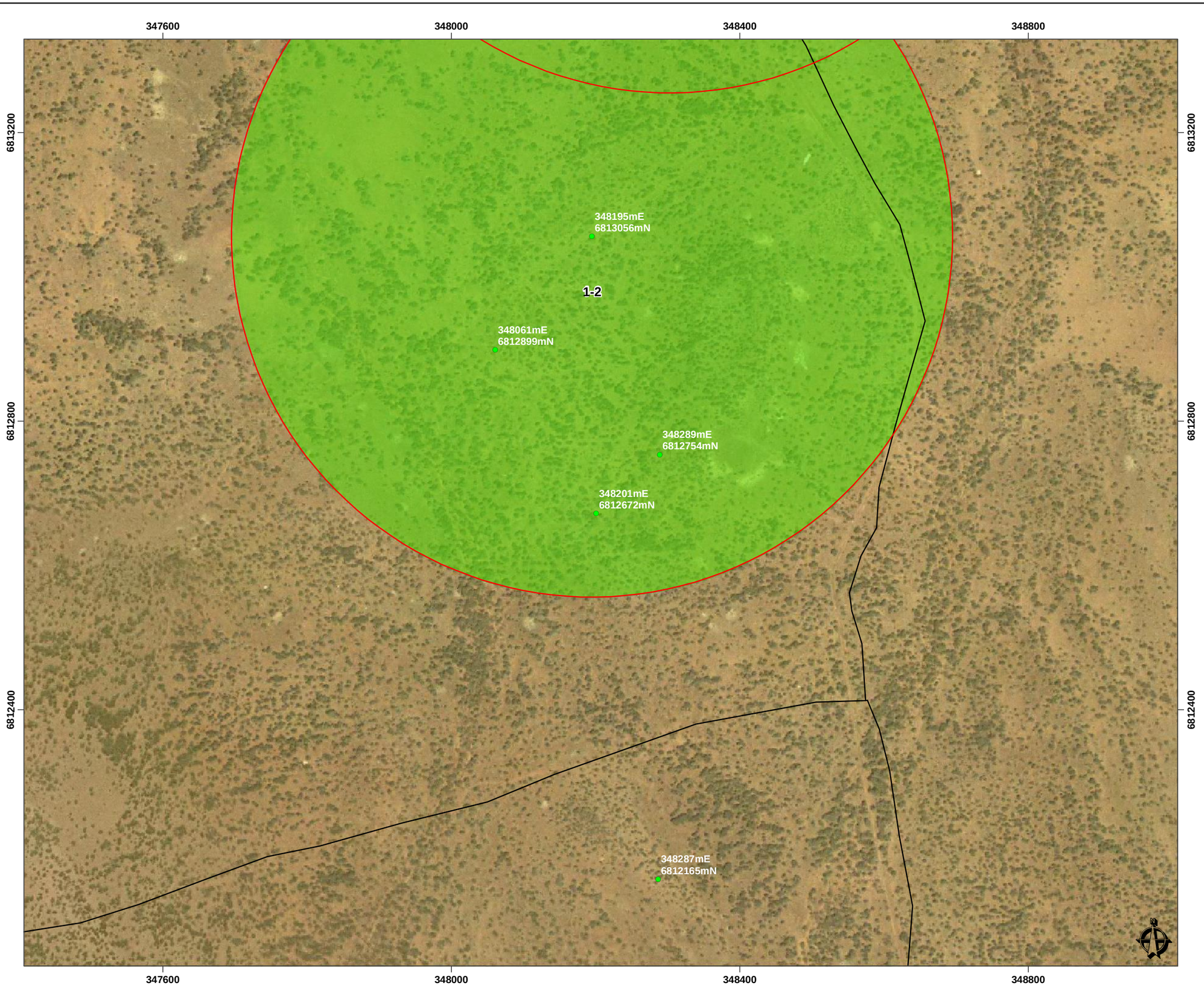
mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 12 - Pit 4 Nambi Road Vegetation Condition



LEGEND

- Pit Boundary Coordinates (Provided by MRWA)
- Material Pit Survey Area

Vegetation Condition

1. Pristine or nearly so
2. Excellent
3. Very Good
4. Good
5. Degraded
6. Completely degraded

MAP UNITS PROJECTED IN MGA ZONE 51
NOTE THAT POSITIONAL ERRORS CAN BE > 5M IN SOME AREAS
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SCALE

50 0 50 100 150m

1:5,000 at A3

LOCALITY MAP

Goldfields Region

CREATED BY	CHECKED	APPROVED
NT		

HORIZONTAL DATUM: GDA94 **PROJECTION:** MGA ZONE 51

HEIGHT DATUM: **METADATA RECORDED:**

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REVISION	DRAWING NO
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mainroads WESTERN AUSTRALIA GHD CLIENTS|PEOPLE|PERFORMANCE

LAKE RAESIDE MATERIAL SOURCES PEIA AND BIOLOGICAL SURVEY

Figure 14 - Pits 1 & 2 Nambi Road Vegetation Condition

Appendix B

Declared Rare and Priority Flora

DRF and Priority Flora Conservation Categories

Results of Significant Flora Species Database searches

Table 10 Conservation Categories and Definitions for *EPBC Act* Listed Flora and Fauna Species.

Conservation Category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

Table 11 Conservation Codes and Descriptions for DEC Declared Rare and Priority Flora Species.

Conservation Code	Description
R: Declared Rare Flora – Extant Taxa	Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
P1: Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2: Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally<5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P3: Priority Three – Poorly Known Taxa	Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.

Table 12 Department of Environment and Conservation DRF and Priority Flora Search Results, Lake Raeside area, Leonora.

Species	Conservation Code
Baeckea sp. Melita Stn.	Priority 3
Calytrix praecipua	Priority 3
Eremophila annosocaule	Priority 1
Eremophila mirabilis	Priority 2
Grevillea subterlineata	Priority 3
Hemigenia exilis	Priority 4
Hybanthus floribundus subsp. *chloroxanthus*	Priority 3
Micromyrtus serrulata	Priority 3
Ptilotus tetrandrus	Priority 1
Sauropus ramosissimus	Priority 3
Triglochin protuberans	Priority 3

Appendix C

List of Recorded Flora Species

List of Recorded Flora Species, Survey areas

Table 13 List of Recorded Flora Species, Lake Raeside Material Source Survey Areas

Family	Genus	Species	Common Name	Status
Adiantaceae	*Cheilanthes*	*lasiophylla*	Woolly Cloak Fern	
Adiantaceae	*Cheilanthes*	*seiberi*	Mulga Fern	
Amaranthaceae	*Ptilotus*	*calostachyus*	Weeping Mulla-Mulla	
Amaranthaceae	*Ptilotus*	*divaricata*	Climbing Mulla-Mulla	
Amaranthaceae	*Ptilotus*	*exaltatus*	Tall Mulla Mulla	
Amaranthaceae	*Ptilotus*	*obovatus*	Cotton Bush	
Asclepiadaceae	*Marsdenia*	*australis*	Cogla	
Caesalpiniaceae	*Senna*	*artemisioides* subsp. *filifolia*		
Caesalpiniaceae	*Senna*	*artemisioides subsp. x stuartii*	Dense Cassia	
Caesalpiniaceae	*Senna*	*glaucifolia*		
Caesalpiniaceae	*Senna*	*manicula*		
Casuarinaceae	*Casuarina*	*pauper*	Black Oak	
Chenopodiaceae	*Atriplex*	*vesicaria*	Bladder Saltbush	
Chenopodiaceae	*Enchylaena*	*tomentosa*	Barrier Saltbush	
Chenopodiaceae	*Maireana*	*georgei*	Satiny Bluebush	
Chenopodiaceae	*Maireana*	*triptera*	Threewinged Bluebush	
Chenopodiaceae	*Rhagodia*	*eremaea*		
Chenopodiaceae	*Salsola*	*sp.*		
Chenopodiaceae	*Sclerolaena*	*?patenticuspis*	Spear-fruit Saltbush	
Chenopodiaceae	*Sclerolaena*	*cuneata*	Yellow Bindii	
Chenopodiaceae	*Sclerolaena*	*diacantha*	Grey Copperburr	
Chenopodiaceae	*Sclerolaena*	*obliquicuspis*	Limestone Bindii	
Cucurbitaceae	*Citrullus*	*lanatus*	Pie Melon	*
Goodeniaceae	*Scaevola*	*spinescens*	Currant Bush	
Lamiaceae	*Salvia*	*verbenaca*	Wild Sage	
Loranthaceae	*Lysiana*	*casuarinae*	Mistletoe	
Malvaceae	*Lawrencia*	*squamata*		
Malvaceae	*Sida*	*calyxhymenia*	Tall Sida	
Mimosaceae	*Acacia*	*aneura var. intermedia*	Mulga	

Family	Genus	Species	Common Name	Status
Mimosaceae	*Acacia*	*aneura var. major*	Mulga	
Mimosaceae	*Acacia*	*craspedocarpa*	Hop Mulga	
Mimosaceae	*Acacia*	*quadrimarginea*		
Mimosaceae	*Acacia*	*ramulosa var. linophylla*	Horse Mulga	
Mimosaceae	*Acacia*	*ramulosa var. ramulosa*	Horse Mulga	
Mimosaceae	*Acacia*	*tetragonophylla*	Kurara	
Myoporaceae	*Eremophila*	*?ionantha*		
Myoporaceae	*Eremophila*	*forrestii*	Wilcox Bush	
Myoporaceae	*Eremophila*	*latrobei*	Warted Fuchsia Bush	
Myoporaceae	*Eremophila*	*longifolia*	Berrigan	
Myoporaceae	*Eremophila*	*metallicorum*		
Myoporaceae	*Eremophila*	*oldfieldii var. angustifolia*	Pixie Bush	
Myoporaceae	*Eremophila*	*platycalyx*	Granite Poverty Bush	
Myoporaceae	*Eremophila*	*scoparia*	Broom Bush	
Myoporaceae	*Eremophila*	*serrulata*	Serrate-leaved Eremophila	
Myrtaceae	*Thryptomene*	*?urceolaris (not flowering)*	Hook-leaf Thryptomene	
Papilionaceae	*Indigofera*	*georgei*	Bovine Indigofera	
Phormiaceae	*Dianella*	*revoluta*	Blueberry Lily	
Poaceae	*Aristida*	*sp. (not flowering)*		
Poaceae	*Austrostipa*	*sp. (not flowering)*		
Poaceae	*Cenchrus*	*ciliaris*	Buffel Grass	*
Poaceae	*Chloris*	*truncata*	Windmill Grass	
Poaceae	*Eragrostis*	*dielsii*	Mallee Lovegrass	
Poaceae	*Eragrostis*	*setifolia*	Neverfail Grass	
Proteaceae	*Grevillea*	*nematophylla*		
Proteaceae	*Hakea*	*preissii*	Needle Tree	
Proteaceae	*Hakea*	*recurva*		
Rutaceae	*Phebalium*	*canaliculatum*		
Santalaceae	*Exocarpos*	*aphyllus*	Leafless Ballart	
Santalaceae	*Santalum*	*acuminatum*	Quandong	
Santalaceae	*Santalum*	*spicatum*	Sandalwood	
Sapindaceae	*Dodonaea*	*lobulata*	Bead Hopbush	
Sapindaceae	*Dodonaea*	*rigida*	Thread Leaf Hopbush	

Family	Genus	Species	Common Name	Status
Solanaceae	*Solanum*	*lasiophyllum*	Flannel Bush	
Sterculiaceae	*Brachychiton*	*gregorii*	Desert Kurrajong	

Where * = weed species

Appendix D

Significant Fauna Species

Significant Fauna Species Conservation Categories

Results of Significant Fauna Species Database searches

Table 14 Conservation Categories and Definitions for *EPBC Act* Listed Flora and Fauna Species.

Conservation Category	Definition
Extinct	Taxa not definitely located in the wild during the past 50 years
Extinct in the Wild	Taxa known to survive only in captivity
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium-term
Near Threatened	Taxa that risk becoming Vulnerable in the wild
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classified as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern	Taxa that are not considered Threatened

Table 15 Significant Fauna occurring, or likely to occur within the vicinity of the project area, from *EPBC Act* Protected Matters search

Genus/Species	Common Name	EPBC Act Status
Acanthiza iredalei iredalei	Slender-billed Thornbill (western)	Vulnerable
Merops ornatus	Rainbow Bee-eater	Migratory
Ardea ibis	Cattle Egret	Migratory
Ardea alba	Great Egret, White Egret	Migratory
Apus pacificus	Fork-tailed Swift	Migratory

Table 16 *Western Australian Wildlife Conservation Act 1950* Conservation Codes

Conservation Code	Description
Schedule 1	"…fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"…fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"…birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
Schedule 4	"…fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"

Table 17 DEC Priority Fauna Codes.

Conservation Code	Description
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc.
Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Appendix E

List of Observed Fauna Species

Fauna Species Observed within the Survey Area

Table 18 List of Observed Fauna Species, Lake Raeside Material Sources Survey Area

Family	Genus	Species	Common Name	Status
Birds				
Accipitridae	*Aquila*	*audax*	Wedge-tailed Eagle	
Accipitridae	*Haliastur*	*sphenurus*	Whistling Kite	
Artamidae	*Artamus*	*personatus*	Masked Woodswallow	
Campephagidae	*Coracina*	*novaehollandiae*	Black-faced Cuckoo-shrike	
Casuaridae	*Dromaius*	*novaehollandiae*	Emu	
Columbidae	*Phaps*	*chalcoptera*	Common Bronzewing	
Corvidae	*Corvus*	*coronoides*	Australian Raven	
Corvidae	*Corvus*	*orru*	Torresian Crow	
Cracticidae	*Cracticus*	*nigrogularis*	Pied Butcherbird	
Cracticidae	*Cracticus*	*tibicen*	Australian Magpie	
Cracticidae	*Cracticus*	*torquatus*	Grey Butcherbird	
Dicruridae	*Grallina*	*cyanoleuca*	Magpie-lark	
Dicruridae	*Rhipidura*	*leucophrys*	Willie Wagtail	
Hirundinidae	*Hirundo*	*neoxena*	Welcome Swallow	
Maluridae	*Malurus*	*leucopterus*	White-winged Fairy-wren	
Meliphagidae	*Lichenostomus*	*virescens*	Singing Honeyeater	
Meliphagidae	*Manorina*	*flavigula*	Yellow Throated Miner	
Passeridae	*Taeniopygia*	*guttata*	Zebra Finch	
Petroicidae	*Melanodryas*	*cucullata*	Hooded Robin	
Pomatostomidae	*Pomatostomus*	sp. (heard, not sighted)	Babbler species	
Psittacidae	*Cacatua*	*roseicapilla*	Galah	
Mammals				
Bovidae	*Capra*	*hirtus*	Goats	*
Bovidae	*Ovis*	*aries*	Sheep	+
Leporidae	*Oryctolagus*	*cuniculus*	European Rabbit	*
Macropodidae	*Macropus*	*fuliginosus*	Western Grey Kangaroo	
Macropodidae	*Macropus*	*rufus*	Western Red Kangaroo	
Reptiles				
Agamidae	*Ctenophorus*	*salinarum*	Dragon Lizard	

Family	Genus	Species	Common Name	Status
Gekkonidae	*Underwoodisaurus*	*milii*		
Varanidae	*Varanus*	*gouldii*	Bungarra	

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