



CLIENTS | PEOPLE | PERFORMANCE

## **Main Roads Western Australia**

Report for North West Coastal Highway Strategic  
Material Pit SLK 666A and 666B

Preliminary Environmental Impact  
Assessment

April 2012



*This Report has been prepared by GHD Pty Ltd (GHD) for Main Roads Western Australia (MRWA) and may only be used and relied on by MRWA for the purpose agreed between GHD and MRWA as set out in Section 1.2 of this Report.*

*GHD otherwise disclaims responsibility to any person other than MRWA arising in connection with this Report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in the Report and are subject to the scope limitations set out in the Report.*

*The assessment is based on the Project footprint provided by MRWA, as listed in Section 1.1 and shown in Figure 1. Any changes to the project, outside the description provided above, are outside the scope of this assessment.*

*The opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the date of preparation of the Report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared.*

*The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD described in this Report (refer Section 2.2). GHD disclaims liability arising from any of the assumptions being incorrect.*

*The opinions, conclusions and any recommendations in this Report are based on information obtained from, and sampling undertaken at, or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.*

*Investigations undertaken in respect of this Report are constrained by the particular site conditions, in particular, a lack of access to all parts of the area studied. As a result, not all relevant site features and conditions may have been identified in this Report.*

*Site conditions may change after the date of this Report. GHD expressly disclaims responsibility arising from, or in connection with, any change to the site conditions; and the requirement to update this Report if the site conditions change.*

*Where GHD has relied upon external data, namely publicly available database, to identify species previously recorded in the area, the accuracy of this data lies with the provider, not with GHD.*

*This advice is considered valid until five years after the date of finalisation of the report whereupon the data contained within may no longer remain relevant.*



# Contents

|                                      |    |
|--------------------------------------|----|
| Executive Summary                    | i  |
| 1. Introduction                      | 1  |
| 1.1 Background                       | 1  |
| 1.2 Scope of Work                    | 1  |
| 2. Methodology                       | 2  |
| 2.1 Desktop Assessment               | 2  |
| 2.2 Field Assessment                 | 3  |
| 3. Environmental Aspects             | 5  |
| 4. Desktop Assessment                | 7  |
| 4.1 Project Area                     | 7  |
| 4.2 Previous Surveys                 | 7  |
| 4.3 Climate                          | 7  |
| 4.4 Land Use                         | 7  |
| 4.5 Geology and Soils                | 8  |
| 4.6 Contaminated Sites               | 8  |
| 4.7 Acid Sulphate Soils              | 8  |
| 4.8 Environmentally Sensitive Areas  | 9  |
| 4.9 Hydrology                        | 9  |
| 4.10 Noise and Vibration             | 10 |
| 4.11 Ambient Air Quality             | 10 |
| 4.12 Reserves and Conservation Areas | 10 |
| 4.13 Vegetation                      | 10 |
| 4.14 Flora                           | 12 |
| 4.15 Diseases or Pathogens           | 16 |
| 4.16 Fauna                           | 16 |
| 5. Field Assessment                  | 19 |
| 5.1 Survey Timing                    | 19 |
| 5.2 Nomenclature                     | 19 |
| 5.3 Taxonomic Identification         | 19 |
| 5.4 Hydrology                        | 19 |
| 5.5 Vegetation                       | 20 |



|     |  |    |
|-----|--|----|
| 5.6 | Threatened Ecological Communities              | 24 |
| 5.7 | Flora  | 24 |
| 5.8 | Fauna  | 35 |
| 6.  | Clearing of Native Vegetation                  | 40 |
| 6.1 | Assessment Against the Ten Clearing Principles | 40 |
| 7.  | Approvals Required                             | 41 |
| 7.1 | Approvals                                      | 41 |
| 8.  | References                                     | 42 |

## Table Index

|          |   |    |
|----------|---|----|
| Table 1  | Environmental Aspects   | 5  |
| Table 2  | Summary of Project Area Surveyed  | 7  |
| Table 3  | Beard Vegetation Associations within the Project Area   | 10 |
| Table 4  | Vegetation Extent and Status  | 12 |
| Table 5  | Results of Conservation Significant Flora Database Searches   | 14 |
| Table 6  | Conservation Significant Fauna Indicated from Database Searches to Occur within the Vicinity of the Project Area                                    | 17 |
| Table 7  | Vegetation Condition Scale (after Keighery, 1994)   | 20 |
| Table 8  | Project Area Vegetation Type  | 22 |
| Table 9  | Location of <i>Acacia startii</i>   | 26 |
| Table 10 | Department of Agriculture and Food Declared Plant Control Classes   | 34 |
| Table 11 | Environmental Weed Rating for Weed Species Recorded Within the Project Area   | 35 |
| Table 12 | Conservation Categories and Definitions for <i>Environmental Protection and Biodiversity Conservation Act</i> (1999) Listed Flora and Fauna Species | 52 |
| Table 13 | <i>Western Australia Wildlife Conservation Act</i> (1950) Conservation Codes  | 52 |
| Table 14 | Department of Environment and Conservation Priority Fauna Codes   | 53 |
| Table 15 | Department of Environment and Conservation Priority Flora Codes   | 53 |



|          |   |    |
|----------|---|----|
| Table 16 | Flora List for North West Coastal Highway Strategic Material Pit SLK 666A and B | 56 |
| Table 17 | Fauna List for North West Coastal Highway Strategic Material Pit SLK 666A and B | 62 |

## Figure Index

|          |  |    |
|----------|--|----|
| Figure 1 | Project Location                       | 45 |
| Figure 2 | Project Area Vegetation Type           | 46 |
| Figure 3 | Project Area Vegetation Condition      | 47 |
| Figure 4 | Project Area Environmental Constraints | 48 |

## Appendices

- A Conservation Categories
- B Project Area Flora List
- C Project Area Fauna List
- D Assessment Against the Ten Clearing Principles



## Executive Summary

Main Roads Western Australia (MRWA) proposes to widen the seal of the North West Coastal Highway (NWCH) between Carnarvon and Nanutarra to allow for increased traffic flow. To undertake these works considerable road building material needs to be sourced.

The proposed locations of the Material Pits will be at the following:

- NWCH SLK 666A; and
- NWCH SLK 666B.

MRWA proposes to clear one to two hectares of vegetation every two years, or when maintenance and project works are required. MRWA has advised that they will take a staged pit development approach, which means each one to two hectares will be revegetated at each stage, before opening up new areas of clearing.

MRWA commissioned GHD Pty Ltd (GHD) to complete a Preliminary Environmental Impact Assessment (PEIA) of the proposed material pit locations.

The results of the PEIA indicated that:

- No Aboriginal listed or European Heritage listed sites occur within the vicinity of the Project Area;
- The Project Area does not contain any known contaminated sites;
- The Project Area has low to extremely low probability of Acid Sulphate Soils;
- No Ramsar Listed Wetlands or Australian Nationally Significant Wetlands occur in the Project Area;
- According to *WetlandBase*, no wetlands occur within the vicinity of the Project Area;
- No defined watercourses are present within the Project Area. However, one defined watercourse was identified three kilometres south of the Project Area, the Lyndon River. GHD is aware that these water bodies will not be impacted by the proposed works;
- There are no residents in close proximity of the proposed works that will be impacted by construction noise or vibration;
- No Threatened Ecological Communities were present within the vicinity of the Project Area;
- The Project Area occurs within the buffer of a series of Priority Ecological Communities, which forms a part of the Carnarvon Basin Survey (CB) buffers of the Lake MacLeod Invertebrate Assemblages for CB 76; CB 77; CB 78 and CB 79;
- One Beard Vegetation Association is known within the vicinity of the Project Area, these are considered of *Least Concern*;
- A total of three vegetation types were delineated from the field survey including Sand Plain Rocky, Heathland and Cleared/Degraded;
- The majority of the Project Area was *Good* to *Degraded* vegetation condition. Historical disturbances associated with existing Material Pits and access tracks;
- A total of 89 flora taxa from 25 families were recorded within the Project Area;
- No Threatened (Declared Rare) Flora taxa were recorded within the Project Area;



- ▶ One Priority Flora species was recorded within the Project Area:
  - *Acacia startii* (Priority 3);
- ▶ Two weed species was recorded within the Project Area;
- ▶ No Threatened Fauna were recorded during the field surveys;
- ▶ No Priority Fauna species were recorded within the Project Area;
- ▶ No exotic fauna were recorded within the Project Area;
- ▶ An assessment of the clearing of vegetation required for the project indicated that the proposed works is considered to be “unlikely to be at variance” with the Principle (a) of the Ten Clearing Principles;
  - *Acacia startii* (Priority 3) was recorded in the Project Area at a number of locations. A total of 253 plants were recorded within the ‘Cleared/Degraded’ area of the Material Pit and 252 plants within the ‘Sandplain Rocky’ vegetation type;
  - Given that the population within the ‘Cleared/Degraded’ area of the Material Pit is equivalent to the population within the ‘Sandplain Rocky’ and it thrives from disturbances, GHD believes that the proposed project activities are likely to enhance the preferred habitat and increase germination of this species. *Acacia startii* has been identified as a disturbance response species; and
  - GHD considers that this species population will not be under threat from the proposed project activities, as this species is widespread within the local and regional area;
- ▶ An assessment of the clearing of vegetation required for the project indicated that the proposed works is considered to be “Not At Variance” with Principle (d) of the Ten Clearing Principles;
  - The buffer of four Priority Ecological Communities overlaps the Project Area. These PECs includes CB 76, CB 77, CB 78 and CB 79 of the Lake MacLeod Invertebrate Assemblages. GHD considers that no TECs or PECs will be impacted by this project.
- ▶ The project is considered not to be warrant referral to the Commonwealth Government, Government of Western Australia or Department of Environment and Conservation (DEC).

This report is subject to, and must be read in conjunction with, the limitations section of this report and assumptions and qualifications contained throughout the report.



# 1. Introduction

## 1.1 Background

The North West Coastal Highway (NWCH) is the main link between regional centres including Geraldton, Carnarvon, Karratha and Port Hedland. The highway also provides access to various tourist destinations, mining operations and pastoral communities. The NWCH also provides a travel route for triple road trains operating north of Carnarvon. It is anticipated that over the next coming years the demand for the movement of freight will increase with proposed industry expansions and new mining developments in the Northern Gascoyne and the Western Pilbara. The NWCH currently has a nominal seal width of 6.2 m. This is deemed to be unsafe for current and predicted traffic volumes.

MRWA proposes to widen the seal of the NWCH to allow for increase traffic flow. To undertake these works, considerable road building material needs to be sourced.

The proposed location of the Material Pits will take place at the following:

- ▶ NWCH SLK 666A; and
- ▶ NWCH SLK 666B.

MRWA proposes to clear one to two hectares of vegetation every two years, or when maintenance and project works are required. To meet the environmental requirements MRWA commissioned GHD Pty Ltd (GHD) to complete a Preliminary Environmental Impact Assessment (PEIA) for each the proposed material pit locations.

## 1.2 Scope of Work

GHD has undertaken the following scope of works:

### **Preliminary Environmental Impact Assessment**

The preparation of the PEIA and subsequent report included the following:

- ▶ Desktop assessment of the Material Pit areas and surrounds;
- ▶ Field study of relevant biological aspects at each pit site;
- ▶ Assessment of the project against the *Environmental Protection Act 1986* Ten Clearing Principles; and
- ▶ Consultation with the regulatory stakeholders to determine requirements as required.





## 2. Methodology

### 2.1 Desktop Assessment

The desktop assessment was carried out prior to the field survey in order to determine the key environmental aspects that may impact the project. The following factors were examined:

- ▶ A review of the Environmentally Sensitive Areas;
- ▶ A review of the DEC's Threatened Ecological Communities database;
- ▶ A review of local and regional significance of plant communities;
- ▶ A review of the DEC's Threatened and Priority Flora databases;
- ▶ A review of the DEC's Threatened Fauna database;
- ▶ A review of the Departments of Sustainability, Environment, Water, Population and Communities (DSEWPaC) database for areas listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act); and
- ▶ A review and consideration of impacts on European and Aboriginal heritage within the Project Area including information from:
  - The Western Australian Heritage Commission;
  - The Australian Heritage Places Inventory;
  - Records held on Municipal databases;
  - National Native Title Tribunal (NNTT); and
  - The Department of Indigenous Affairs;
- ▶ A consideration of the impacts on:
  - Air quality;
  - Dust;
  - Fauna;
  - Surface waters/drainage;
  - Groundwater;
  - Wetlands and waterways;
  - Noise;
  - Visual amenity; and
  - Reserves and conservation areas.
- ▶ Providing information to assist in obtaining permits or approvals under legislative provisions, including those required under the following Acts and Regulations:
  - *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.*
  - *Rights in Water and Irrigation Act 1914.*
  - *Conservation and Land Management Act 1984.*
  - *Wildlife Conservation Act 1950.*
  - *Heritage of Western Australia Act 1990.*



## 2.2 Field Assessment

The Project Area was surveyed by traversing each section using a vehicle, and undertaking a survey of a series of walking transects within each Material Pit.

### Biological Surveys

Biological surveys were undertaken with reference to the Environmental Protection Authority (EPA) Guidance Statements No. 51 (EPA, 2004a) and No. 56 (EPA, 2004b). The surveys included:

- ▶ An examination whether the Project Area is within an Environmentally Sensitive Area (ESA) and the native vegetation in the area to be cleared is in a *Good* or better condition than the other vegetation within the vicinity;
- ▶ A review of the local and regional significance of the plant communities in terms of their intrinsic value, extent, rarity and condition;
- ▶ A description and location, including mapping, of plant communities within the Project Area. Dominant species in each vegetation type was noted, along with any conservation significant flora populations. These communities have been linked to already known, described communities where possible;
- ▶ A rating of condition of the vegetation communities or areas using a published rating scale (Keighery, 1994);
- ▶ A discussion of the presence, location, extent and impact of any plant pests or diseases. GHD notes that dieback is typically not considered to be relevant outside the south-west of Western Australia;
- ▶ An inventory of the vascular plant species in the surveyed area;
- ▶ Where field identification of plant taxa was not possible, specimens were collected in a systematic manner so that they could later be identified by comparison with the reference collection held at the Western Australian Herbarium (WAHERB) and by use of identification keys. Nomenclature of the species follows that of the online *FloraBase* program (<http://florabase.dec.wa.gov.au/>) as it is deemed to contain the most up to date information on flora nomenclature;
- ▶ A review of, and search for, native plant species considered to be rare or potentially endangered. Other species of interest, including those of limited distribution or outliers from their known range, should be discussed. Locations of Threatened (Declared Rare) and/or Priority Flora were mapped at a suitable scale;
- ▶ An inventory of dominant exotic plants and also including declared noxious plants and environmental weed species;
- ▶ The provision of advice on whether weeds are likely to spread to and result in environmental harm to adjacent areas of native vegetation that is in *Good* or better condition;
- ▶ A review of the fauna species considered to be rare or in need of special protection;
- ▶ An inventory of the vertebrate fauna species in the surveyed area. This was undertaken as a Level 1 targeted search and opportunistic recording of species. Identification of fauna taxa was undertaken using handbooks, with current nomenclature following that of *NatureMap*. Where taxa could not be confidently identified, specialist zoologists were consulted;
- ▶ A review of the presence and abundance of pest, declared or feral animals;



- Identify any habitats of significance; and
- An assessment of the value of the roadside in providing habitat and facilitating movement between conservation areas.

### **Heritage Survey**

GHD has completed a desktop heritage assessment as part of this project. MRWA has advised that Aboriginal Heritage Surveys have completed at all Material Pits. The survey findings are available upon request from MRWA Gascoyne region.

### **Noise Survey and Modelling**

This project occurs within a remote area. No residential areas occur within the vicinity of the Project Area. As such, GHD considers that construction activity does not require a noise survey or noise modelling works.

### **Wetland Field Assessment**

The wetland field assessment included a description of existing surface drainage patterns with respect to topography, and to flora and fauna communities; and an inventory and brief description of wetlands and their conservation value.

### **Contaminated Sites Assessment**

GHD has completed a desktop contaminated sites assessment as part of this project.

### **Air Quality Monitoring**

This project occurs within a remote area. No residential areas occur within the vicinity of the Project Area. As such, GHD considers that construction activity does not require air quality modelling works.

### **Dust**

This project occurs within a remote area. No residential areas occur within the vicinity of the Project Area. As such, GHD considers that construction activity does not require dust management from a residential perspective. Dust management is considered likely to be required for dust suppression on the gravel roads to ensure safe conditions of for road users during construction works.

### **Acid Sulphate Soil Assessment**

GHD has completed a desktop Acid Sulphate Soils assessment as part of this project.

#### **2.2.1 Field Report**

The field report:

- Provides a summary the results of environmental investigations and clearances obtained; and
- Also examines the results of the biological surveys undertaken to allow any proposed clearing of native vegetation to be assessed against the Ten Clearing Principles.



### 3. Environmental Aspects

Environmental aspects considered for the Project Area are outlined in Table 1.

**Table 1 Environmental Aspects**

| Environmental Aspects   | Yes | No | Comments  |
|---|-----|----|---|
| <b>Biophysical</b>  |     |    |   |
| Vegetation - Clearing   | ✓   |    | Vegetation clearing has been assessed using the Ten Clearing Principles. MRWA has advised that they will take a staged pit development approach, which means one to two hectares will be revegetated at each stage before open up new areas for clearing. |
| Vegetation - threatened species and communities   | ✓   |    | Threatened species and communities have been assessed within Section 4.13.3.  |
| Vegetation-Weeds  | ✓   |    | Weeds occurring within the area have assessed in Section 4.14.2.  |
| Vegetation-dieback and other diseases or pathogens  | ✓   |    | Dieback and other disease or pathogens were not considered for this project. Section 4.15, assesses the likelihood of these occurring.  |
| Fauna   | ✓   |    | Fauna occurring within the area were assessed in section 4.16. The fauna identified during the field survey and habitats that they are likely to occur in were assessed <i>Against the Ten Clearing Principles</i> .                                      |
| Surface Waters/Drainage<br>(watercourses, erosion, stormwater, disposal, water quality, salinity) | ✓   |    | Surface water and drainage were assessed in section 4.9.2.  |
| Wetlands  | ✓   |    | Wetlands were assessed within section 4.9.1. No wetlands occur within the immediate or within the vicinity of the Project Area.   |
| Groundwater   | ✓   |    | A number of registered groundwater bores were identified in the immediate vicinity or within the Project Area.  |
| Public Drinking Water Supply  | ✓   |    | No Public Drinking water supply occurs within the vicinity of the Project Area.   |
| Reserve and Conservation Areas  | ✓   |    | No conservation areas will be impacted by the proposal.   |
| Acid Sulphate Soil  | ✓   |    | Acid Sulphates soils were assessed within Section 4.7.  |



| Environmental Aspects                          | Yes | No | Comments   |
|--|-----|----|--|
| Air Quality                                    |     | ✓  | Air quality was assessed within section.   |
| Noise and Vibration                            |     | ✓  | Noise and vibration for the proposed there are no receptors that occur within proximity of the Project Area. |
| Contaminated Sites                             | ✓   |    | Contaminated sites were assessed in Section 4.6. No contaminated sites occurred within the Project Area.     |
| Social Surroundings                            |     | ✓  | Social surroundings are not considered to be impacted by the proposed works.                                 |
| European Heritage                              | ✓   |    | European Heritage was assessed in Section 4.4.2. No listed sites occur within the Project Area.              |
| Aboriginal Heritage                            | ✓   |    | Aboriginal Heritage was assessed in Section 4.4.1. No listed sites occur within the Project Area.            |
| Assessment Against the Ten Clearing Principles | ✓   |    | An assessment Against the Ten Clearing Principles is shown in Section 6 and Appendix D.                      |



## 4. Desktop Assessment

### 4.1 Project Area

The Project Area is located in the Shire of Carnarvon, Western Australia. Two material pits were examined as a part of this project. Overall location is shown in Figure 1. Table 2 provides a summary of the approximate area surveyed during the field work.

**Table 2 Summary of Project Area Surveyed**

| Material Pit Name      | Approximate Size |
|------------------------|------------------|
| NWCH Material Pit 666A | 60 ha            |
| NWCH Material Pit 666B | 63 ha            |

### 4.2 Previous Surveys

No known biological surveys have been previously completed within the Project Area.

### 4.3 Climate

The Shire of Carnarvon has an arid, semi-arid to sub-tropical climate. The average yearly rainfall is 300 mm, with the highest amount of rainfall occurring from January to March. Occasionally tropical cyclones influence the region causing heavy rain, high temperatures and strong winds but apart from these erratic conditions the summer is generally dry (Mau and Kendrick, 2002).

The closest Bureau of Meteorology (BoM) weather station to the project site with continuous reliable data is Learmonth. A summary of the climatic data (BoM, 2012) for this weather station is summarised below:

- ▶ The mean average rainfall is approximately 262.0 mm with the majority of rainfall occurring during the summer months;
- ▶ Mean Daily Temperature: 25.4 °C in July to 41.3 °C in January; and
- ▶ Mean Minimum: 25.1°C in February to 11.3°C in July.

#### 4.3.1 2011 Climate

In the three months prior to the survey (August to October) 12 mm rainfall was recorded at Learmonth (Station number 5007). This is comparative to the long-term average of 16.5 mm for this period.

### 4.4 Land Use

The majority of the Shire of Carnarvon is occupied by pastoral lease land used for extensive grazing of native pastures. The region is also occupied by Aboriginal reserves, mining leases, national parks, nature reserves and DEC managed estates.



#### **4.4.1 Indigenous Heritage**

The Aboriginal Site Register is held under Section 38 of Western Australia's *Aboriginal Heritage Act 1972*. It protects places and objects customarily used by, or traditional to, the original inhabitants of Australia.

Where an activity disturbs an Aboriginal site or object an application for permission to disturb will need to be submitted under Section 18 of the *Aboriginal Heritage Act 1972*. Where a site of previously unknown Aboriginal heritage is to be disturbed it is advised that a detailed anthropological and archaeological heritage survey is undertaken to find if there are any sites or objects of significance in that area, as it is an offence to disturb all Aboriginal Heritage sites, even those not contained on the Aboriginal Heritage Site Register. In the event that Aboriginal archaeological or ethnographic sites are discovered during construction, there will be a need to meet the requirements of the *Aboriginal Heritage Act (1972)*.

A search of the Project Area was undertaken on Department of Indigenous Affairs, Aboriginal Inquiry System. The search indicates that no known registered Listed Aboriginal Sites occur in the Project Area.

#### **4.4.2 European Heritage**

Database searches were undertaken to determine whether or not the Project would impact on World Heritage Sites, National Heritage Sites or Commonwealth Heritage Sites.

No non-indigenous heritage sites will be impacted by the proposal.

### **4.5 Geology and Soils**

The Project Area occurs within the Carnarvon Interim Biogeographic Regionalisation of Australia (IBRA) region and Cape Range sub-region. The Cape Range IBRA sub-region forms the northern part of the Carnarvon Basin and is described as rugged tertiary limestone ranges and extensive areas of red aeolian dune field, Quaternary coastal beach dunes and mud flats. The bioregion lies within a complex geological setting that includes a Proterozoic (545 to 2500 million years ago) terrain and Mesozoic (65-251 million years ago) marine sedimentary rocks of the Carnarvon Basin (Kendrick and Mau, 2002).

### **4.6 Contaminated Sites**

A search was conducted on the DEC database for Contaminated Sites and their records indicate that there are no contaminated sites existing within the vicinity of the Project Area.

### **4.7 Acid Sulphate Soils**

The DEC (2009) describes Acid Sulphate Soils (ASS) as naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulphide). In an undisturbed state below the water table these soils are benign and not acidic. However, if the soils are drained, excavated or exposed by lowering of the water table the sulphides will react with oxygen to form sulphuric acid.

Inappropriate disturbance of these soils can generate large amounts of sulphuric acid and leaching of contaminants naturally occurring in soils. Flushing of acidic leachate to ground water and surface waters can cause off site impacts including:

- Ecological damage to aquatic and riparian ecosystems;
- Effects on estuarine fisheries and aquaculture Projects;



- ▶ Contamination of groundwater with arsenic, aluminium and other metals;
- ▶ Reduction in agricultural productivity through metal contamination of soils; (predominantly aluminium); and
- ▶ Damage to infrastructure through the corrosion of concrete and steel pipes, bridges and other sub-surface assets.

The online CSIRO Australian Soil Resource Information System (ASRIS) program indicated the majority of the Project Area occurs in an area that has low to extremely low probability of ASS occurring, but with a very low confidence level of the accuracy of this statement due to a lack of surveys in the area.

The Shared Land Information Portal (SLIP) (Government of Western Australia, 2011) indicates that these areas contain a “low risk” of the presence of ASS.

#### **4.8 Environmentally Sensitive Areas**

Environmentally Sensitive Areas (ESAs) are subject to definition under Section 51B of the *Environmental Protection Act 1986* and may include areas, such as those requiring special management attention to protect important scenic values, fish wildlife resources, historical and cultural values, and other natural systems or processes.

The DEC’s online Native Vegetation Map Viewer did not indicate the presence of any ESAs within the vicinity of the Project Area.

#### **4.9 Hydrology**

The majority of waterways and wetland areas present within the vicinity of the Project Area are ephemeral and generally flow or fill during seasonal rainfall events.

##### **4.9.1 Wetlands**

A search undertaken on the Western Australian Wetlands Database (*WetlandBase*) and the EPBC Act Protected Matters Search tool indicated no wetlands within the vicinity of the Project Area.

##### **4.9.2 Watercourses**

No defined watercourses are present within the vicinity of the Project Area, with the nearest defined watercourse (the Lyndon River) occurring three kilometres south of the Project Area. This watercourse will not be impacted by the proposed works.

##### **4.9.3 Public Drinking Water Catchments**

A search of the Department of Water (DoW) Geographic Data Atlas indicates that the Project Area is not within, or located in proximity to, any Gazetted Public Drinking Water Source Areas (PDWSAs) (Department of Water, 2011). No PDWSAs were identified within the vicinity of the Project Area.

##### **4.9.4 Groundwater**

The Project Area occurs within the Carnarvon Artesian Basin (CAB). The CAB is a significant geographical area containing sources of confined or artesian groundwater. No naturally occurring groundwater-dependent ecosystems are known to occur in the CAB geographical area.





Any abstraction of groundwater from the Carnarvon Artesian Basin (the Birdrong Aquifer) requires a 5C Licence from the DoW. The construction or alteration of any new or existing bores requires a 26D Licence from the DoW.

Department of Water bore search indicates that there are no known registered groundwater bores within the vicinity of the Project Area.

#### **4.10 Noise and Vibration**

There are no residents in close proximity of the proposed works that will be impacted by noise or vibration associated with the proposed works.

#### **4.11 Ambient Air Quality**

Soils in the Project Area may create a minor potential degradation to ambient air quality during the proposed clearing of vegetation in Material Pits. Given the isolation of the area, the lack of sensitive receptors, and proposed vegetation clearing of up to two hectares every two years, it is considered that dust generated will not cause a significant environmental constraint.

#### **4.12 Reserves and Conservation Areas**

A search was undertaken on the DEC database and found no reserves, conservation areas or other DEC managed estates located within the vicinity of the Project Area.

#### **4.13 Vegetation**

The Project Area is situated in the Cape Range Sub-region of the Carnarvon Interim Biogeographic Regionalisation of Australia (IBRA) bioregion with one Vegetation Associations occurring in the vicinity of the Project Area as shown below.

- Low woodland; *Acacia victoriae* & snakewood.

##### **4.13.1 Vegetation Associations**

The following Beard Vegetation Association exists within the vicinity of the Project Area.

**Table 3 Beard Vegetation Associations within the Project Area**

| <b>Vegetation Association</b> | <b>Description</b>                                | <b>Location</b>                                     |
|-------------------------------|---|---|
| 264                           | Low woodland; <i>Acacia victoriae</i> & snakewood | Immediate vicinity and including both Material Pits |

##### **4.13.2 Vegetation Extent and Status**

A vegetation type is considered to be underrepresented if there is less than 30% of its original extent remaining. From a biodiversity perspective, and taking no account of any other land degradation issues, there are several key criteria applied to vegetation where clearing is still occurring (EPA Position Statement No. 2, December 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 extent of the vegetation type. Vegetation communities where less than 30% of the original vegetation extent remain are referred to as “*Vulnerable*”; and
- ▶ A level of 10% of the original vegetation extent is regarded as being a level representing an “*Endangered*” vegetation community.

Such vegetation community status can be delineated into five classes, where:

- ▶ *Presumed extinct*: Probably no longer present in the bioregion;
- ▶ *Endangered\**: <10% of pre-European extent remains;
- ▶ *Vulnerable\**: 10 to 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 extent and reservation status are drawn from the CAR Reserve Analysis 2009 (Government of Western Australia 2010). Extents at the State, IBRA, IBRA sub-region and the Local Government Area (LGA) (Shire of Carnarvon) level are shown in Table 4. The Vegetation Associations 264 is considered to be *Least Concern*.



**Table 4 Vegetation Extent and Status**

| <b>Vegetation Association</b> | <b>Pre-European Extent (Ha)</b> | <b>Current Extent (Ha)</b> | <b>% Remaining</b> | <b>Status</b>        |
|-------------------------------|---------------------------------|----------------------------|--------------------|----------------------|
| 264                           | State:<br>581,127.75            | State:<br>581,127.75       | State:<br>100%     | <i>Least Concern</i> |
|                               | IBRA:<br>503681.76              | IBRA:<br>503681.76         | IBRA:<br>100%      | <i>Least Concern</i> |
|                               | Sub-IBRA:<br>475948.78          | Sub-IBRA:<br>475948.78     | Sub-IBRA:<br>100%  | <i>Least Concern</i> |
|                               | LGA:<br>218235.68               | LGA:<br>218235.68          | LGA:<br>100%       | <i>Least Concern</i> |

#### **4.13.3 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 *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Although TECs are not formally protected under the *State Wildlife Conservation Act 1950* (WC Act), the loss of, or disturbance to, some TECs trigger the EPBC Act. The EPA's position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to the Department of Environment and Conservation's Priority Ecological Community (PEC) Lists under 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 are placed in Priority 5.

A search of the DEC's Threatened Ecological Communities (TEC) database was undertaken for the Project Area which indicated that no TECs occur within the vicinity of the Project Area. However, a Priority 4 PEC community buffer extends over the Project Area:

- ▶ Lake MacLeod Invertebrate Assemblages. This PEC incorporates the communities called CB 76, CB 77, CB 78 and CB 79 as indicated by the *NatureMap* search.

GHD considers that no TECs or PECs will be impacted by this project.

#### **4.14 Flora**

##### **4.14.1 Significant Flora**

Flora species considered to be under threat are listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and/or the *Wildlife Conservation Act 1950* (WC Act). Any



activities that are deemed to have a significant impact on species that are recognised by these can trigger referral to the Environmental Protection Authority (EPA) and/or the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

A description of conservation categories delineated under the EPBC Act is detailed in Appendix A, Table 12. These are applicable to threatened flora and fauna species.

A search of the EPBC Act Protected Matters Search Tool identified no Commonwealth protected flora species within the boundaries of the Project Area.

In addition to the EPBC Act, significant flora in Western Australia is protected by the WC Act. This Act is administered by the DEC and protects Threatened Flora (Declared Rare) species. The DEC also maintains a list of Priority Flora species. Conservation Codes for flora species are assigned by the DEC to define the level of conservation significance (Appendix A, Table 15). Priority Flora taxa are not protected under the WC Act. 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 have been clarified. Special consideration is often given to sites that contain Priority Flora, despite them not having formal legislator protection.

A search was undertaken through the DEC Threatened (Declared Rare) Flora Database, the DEC Declared Rare and Priority List and the Western Australian Herbarium (WAHERB). No Threatened species were indicated to occur within the Project Area. However, 11 Priority Flora were indicated to occur, or potentially occur within the vicinity of the Project Area. These are shown in Table 5.



**Table 5 Results of Conservation Significant Flora Database Searches**

| <b>Taxon</b>                                   | <b>Conservation Code</b> | <b>Description</b>  | <b>Flowering Period</b>         | <b>Preferred Habitat</b>  | <b>Likelihood of Occurrence in Project Area</b>                    |
|--|--------------------------|---|---------------------------------|---|--|
| <i>Abutilon</i> sp. Quobba<br>(H. Demarz 3858) | Priority 2               | Erect shrub, 0.5 to 1.5 m high. Flowers: Yellow to orange.                                | July to September.              | Sand.   | Extremely unlikely - Known 140 km south-west of the Project Area.  |
| <i>Acacia startii</i>                          | Priority 3               | Dense, rounded, much-branched shrub, 1 to 2 m high, to 3 m wide. Flower: Green to yellow. | July to August.                 | Calcareous loam with limestone pebbles. Stony hills and watercourses. | Very Likely - Known within immediate vicinity of the Project Area. |
| <i>Crinum flaccidum</i>                        | Priority 2               | Bulbaceous, perennial, herb, to 1 m high. Flower: White/cream/yellow.                     | October to December or January. | Loam, clay, sandstone, swamps and creeks.                             | Possible - Known 15 km south of the Project Area.                  |
| <i>Euphorbia inappendiculata</i>               | Priority 3               | Spreading, procumbent herb, to 0.4 m high. Flower: Pink.                                  | August.                         | Clay soils. Among Broken rocky screes.                                | Extremely Unlikely - Known 160 km east of the Project Area.        |
| <i>Gymnanthera cunninghamii</i>                | Priority 3               | Erect shrub, 1 to 2 m high. Flower: Cream to yellow to green.                             | January to December.            | Sandy soils.  | Possible - Known 40 km south of the Project Area.                  |
| <i>Myriocephalus nudus</i>                     | Priority 1               | Annual, herb, to 0.2 m high. Flower: Yellow.  | January or April to November.   | Moist areas, along rivers and creeks, granite outcrops                | Unlikely - Known 80 km north-east of the Project Area.             |
| <i>Owenia acidula</i>                          | Priority 3               | Tree, 3 to 8 m high. Flowers: White to brown/cream.                                       | August.                         | Clay.   | Possible - Known 45 km south-west of the Project Area.             |



| <b>Taxon</b>   | <b>Conservation Code</b> | <b>Description</b>                                    | <b>Flowering Period</b> | <b>Preferred Habitat</b>                      | <b>Likelihood of Occurrence in Project Area</b>                   |
|--|--------------------------|---|-------------------------|---|---|
| <i>Rhodanthe ascendens</i>                                     | Priority 1               | Ascending annual, herb to 0.1 m high. Flower: Yellow. | August.                 | Clay and Roadside Verge.                      | Unlikely - Known 70 km south-east of the Project Area.            |
| <i>Rhodanthe frenchii</i>                                      | Priority 2               | Upright annual, herb, to 0.35 m high. Flower: Yellow. | August to October.      | Stony hills, rocky river bands and outcrops.  | Extremely unlikely - Known 112 km south-east of the Project Area. |
| <i>Rumex crystallinus</i>                                      | Priority 2               | Annual, herb, 0.06 to 0.4 m high.                     | -                       | On moist soils and mud on edges of clay pans. | Unlikely - Known 55 km east of the Project Area.                  |
| <i>Tephrosia</i> <b>sp. Kennedy</b><br>Range (J.S. Beard 4392) | Priority 1               | Shrub to 1.5 m tall. Flowers: Magenta and green.      | -                       | Sand dunes, sand over sandstone.              | Extremely Unlikely - Known 120 km south-east of the Project Area. |



#### 4.14.2 Invasive Flora Species

The EPBC Act Protected Matters Search (DSEWPaC, 2012) indicates that there is potentially one invasive flora species that may occur in the vicinity of the Project Area:

- ▶ \**Cenchrus ciliaris* Buffel-Grass.

#### 4.15 Diseases or Pathogens

*Phytophthora cinnamomi* ("Dieback") disease is generally restricted to areas of the south of the State, south of the 26<sup>th</sup> parallel of latitude, in areas receiving annual rainfall of greater than 400 mm.

The Project Area is not considered to be susceptible to the development of the *Phytophthora cinnamomi* pathogen.

#### 4.16 Fauna

##### 4.16.1 Existing Fauna Records

A search on *NatureMap* was undertaken for the Project Area. The *NatureMap* records show that 36 birds, six mammals and two reptiles have been officially recorded in the vicinity of the Project Area. A list of these species is provided in Table 17.

##### 4.16.2 Significant Fauna

The conservation of fauna species and their significance status is currently assessed under both Commonwealth EPBC Act and State WC Act.

##### Commonwealth

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 and the circumstances under which a project will trigger referral to the DSEWPaC are described in EPBC Act Fauna Conservation Categories.

The WC Act uses a set of schedules, but also classifies species using some of the IUCN categories. These Schedules are described in Appendix A, Table 13.

The EPBC Act 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 People's Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- ▶ 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);
- ▶ The Agreement between the Republic of Korea and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (ROKAMBA); and



- All Migratory Listed birds in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance under the Commonwealth EPBC Act.

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

The DSEWPac maintains a database of matters of national environmental significance that are protected under the EPBC Act. An EPBC Act Protected Matters Report was generated for the matters of significance that may occur in, or relate to, the study area (DSEWPac, 2012).

## State

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 WC Act but for which the Government feels there is a cause for concern. These species have no special legislative 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 A Table 14.

A search of the DEC's Threatened Fauna database for any rare and priority species that may occur in the general area has previously been undertaken. These records are from the DEC and the DSEWPac databases and the Western Australian Museum (WAM). The protected fauna species were identified as potentially occurring within the Project Area are listed in Table 6.

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 a general 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.

**Table 6 Conservation Significant Fauna Indicated from Database Searches to Occur within the Vicinity of the Project Area**

| Genus             | Species            | Common Name              | EPBC Act Status | WC Act Status | Cited |
|-------------------|--------------------|--------------------------|-----------------|---------------|-------|
| <i>Apus</i>       | <i>pacificus</i>   | Fork-tailed Swift        | Mi; Ma          | S3            | EPBC  |
| <i>Ardea</i>      | <i>alba</i>        | Great Egret              | Mi; Ma          | S3            | EPBC  |
| <i>Ardea</i>      | <i>ibis</i>        | Cattle Egret             | Mi; Ma          | S3            | EPBC  |
| <i>Charadrius</i> | <i>veredus</i>     | Oriental Plover          | Mi; Ma          | S3            | EPBC  |
| <i>Haliaeetus</i> | <i>leucogaster</i> | White-bellied Sea-Eagle  | Mi; Ma          | S3            | EPBC  |
| <i>Hirundo</i>    | <i>rustica</i>     | Barn Swallow             | Mi; Ma          | S3            | EPBC  |
| <i>Merops</i>     | <i>ornatus</i>     | <b>Rainbow</b> Bee-eater | Mi; Ma          | S3            | EPBC  |
| <i>Dasycercus</i> | <i>cristicauda</i> | Mulgara                  | V               | S1            | EPBC  |
| <i>Dasyurus</i>   | <i>hallucatus</i>  | Northern Quoll           | E               | S1            | EPBC  |

Where: E = Endangered; V=Vulnerable; Mi = Migratory Listed; Ma = Marine Listed; S1 = Schedule 1; S3 = Schedule 3





#### **4.16.3 Exotic Fauna**

The result of the *NatureMap* search indicates that no introduced fauna taxa have been officially reported within the vicinity of the Project Area.

The EPBC Act Protected Matters searches indicate the presence of a total of four exotic (feral) fauna

- ▶ *\*Capra hircus* (Feral Goats);
- ▶ *\*Felis catus* (Feral Cat);
- ▶ *\*Oryctolagus cuniculus* (European Rabbit); and
- ▶ *\*Vulpes vulpes* (Red Fox).



## 5. Field Assessment

Field surveys were undertaken by a qualified, experienced field botanist/zoologist with over 15 years experience, Joshua Foster, with assistance from an environmental scientist, Steven Petts.

### 5.1 Survey Timing

The field surveys were undertaken during November 2011. The survey was completed over a timeframe of one day undertaken as part of a broader survey of MRWA Material Pits in the Shire of Carnarvon, Shire of Exmouth and Shire of Ashburton.

#### 5.1.1 Influence of Climate

The rainfall received by the Project Area prior to the survey is considered to have assisted in the longevity of the 2011 flowering period. In the three months prior to the survey (August to October) 12 mm rainfall was recorded at Learmonth (Station number 5007). This is comparative to the long-term average of 16.5 mm for this period.

### 5.2 Nomenclature

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

### 5.3 Taxonomic Identification

#### 5.3.1 Flora

A list of vascular flora species recorded within the Project Area was generated. Where field identification of flora species was uncertain, a sample was collected for comparison with taxonomic literature, online databases and the Western Australian Herbarium (WAHERB) reference collection. The presence of Threatened (Declared Rare) or Priority Flora was assessed.

#### 5.3.2 Fauna

Identification of fauna species was made in the field using available field guides. Where identification was not possible photographs of specimens were collected in a systematic manner to be later identified by in-house zoologists.

### 5.4 Hydrology

#### 5.4.1 Wetlands

No wetlands were recorded within the Project Area.

Wetlands are not considered to occur within or around the Project Area.



#### 5.4.2 Watercourses

No watercourses were identified during the field survey within the vicinity of the Project Area. A defined watercourse (the Lyndon River) was identified three kilometres south of the Project Area. GHD understands that the watercourse will not be impacted by the proposed works.

### 5.5 Vegetation

Project Area vegetation was assessed by traversing by vehicle and walking transects. Relevés and quadrates were surveyed where a defined vegetation change occurred to support vegetation description.

#### 5.5.1 Recorded Vegetation Types

A total of three vegetation types were recorded within the Project Area (Table 8), mapped on the basis of similar floristic composition, topography and soils as shown in Figure 2.

#### 5.5.2 Project Area Vegetation Extent

The vegetation types recorded in the Project Area are considered to be of *Least Concern*, with one being equivalent to existing Beard Vegetation Associations.

#### 5.5.3 Project Area Vegetation Condition

The vegetation in the Project Area was given a condition rating based on the vegetation condition ratings scale of Keighery (1994). Condition is based on:

- ▶ 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.

Vegetation condition consists of six rating levels as outlined below in Table 7.

**Table 7 Vegetation Condition Scale (after Keighery, 1994)**

| Assigned Number | Classification               | Description   |
|-----------------|------------------------------|---|
| 1               | <i>Pristine or Nearly So</i> | Pristine or nearly so, no obvious signs of disturbance.   |
| 2               | <i>Excellent</i>             | Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.  |
| 3               | <i>Very Good</i>             | Vegetation structure altered obvious signs of disturbance.  |
| 4               | <i>Good</i>                  | Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. |





| Assigned Number | Classification             | Description   |
|-----------------|----------------------------|---|
| 5               | <i>Degraded</i>            | Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. |
| 6               | <i>Completely Degraded</i> | The structure of the vegetation is no longer intact and the area is completely or almost without native species.  |


The Material Pits contained mostly unaltered vegetation, with the exception of where historical material extraction had occurred. The Project Area was observed to have *Good to Degraded* condition vegetation.



**Table 8 Project Area Vegetation Type**

| Vegetation Type | Short Description | Long Description  | Photograph   | Condition               | Vegetation Association |
|-----------------|-------------------|---|--|-------------------------|------------------------|
| 1               | Sandplain Rocky   | Open Shrubland of <i>Acacia synchronicia</i> , <i>A. sclerosperma</i> with <i>Grevillea eriostachya</i> , <i>A. tetragonophylla</i> over Low Shrubland of <i>A. gregorii</i> , <i>Eremophila cuneifolia</i> , <i>Melaleuca cardiophylla</i> with <i>Stylobasium spathulatum</i> , <i>Eremophila latrobei</i> , <i>Ptilotus obovatus</i> , <i>Enchylaena tomentosa</i> over Hummock Grassland of <i>Triodia basedowii</i> with Tussock Grassland of <i>*Cenchrus ciliaris</i> , <i>Eragrostis pergracilis</i> , <i>Aristida holathera</i> , <i>Eriachne aristidea</i> on rocky sand plain. |   | Very Good/Good/Degraded | Nil.                   |
| 2               | Heathland         | Heath dominated by <i>Eremophila cuneifolia</i> with Scattered <i>E. pterocarpa</i> subsp. <i>pterocarpa</i> , <i>Acacia ramulosa</i> , <i>Senna glutinosa</i> , <i>Lawrencia densiflora</i> over Scattered Low Shrubs of <i>Maireana lobiflora</i> , <i>Ptilotus divaricatus</i> , <i>Sclerolaena eriacantha</i> over Scattered Tussock Grasses of <i>Enneapogon caeruleus</i> .   |  | Good                    | Nil.                   |



| Vegetation Type | Short Description | Long Description  | Photograph  | Condition       | Vegetation Association |
|-----------------|-------------------|---|---|-----------------|------------------------|
| 3               | Degraded          | Material Pits, Scrapes, access tracks. Contain disturbance response species including grasses, scattered <i>Acacia startii</i> . Generally also contain weed species. |  A photograph showing a landscape of degraded vegetation. The ground is covered with sparse, low-lying green and greyish shrubs and grasses. The soil appears to be a reddish-brown color, typical of arid or semi-arid regions. The vegetation is patchy and unevenly distributed across the terrain. | <i>Degraded</i> | Nil.                   |



## 5.6 Threatened Ecological Communities

No Threatened Ecological Communities or Priority Ecological Communities were recorded in the Project Area during the field survey.

## 5.7 Flora

The results of the 2011 field survey indicated that 89 flora taxa from 25 families were recorded in the Project Area.

Dominant families were:

- ▶ Fabaceae (wattles) 26 taxa;
- ▶ Poaceae (grasses) Eight taxa; and
- ▶ Chenopodiaceae Eight taxa.

Dominant genera were:

- ▶ *Acacia* (wattles) 19 taxa;
- ▶ *Ptilotus* (mulla mullas) Five taxa; and
- ▶ *Senna* Six taxa.

The Project Area flora list is indicated in Table 16.

### 5.7.1 Threatened Flora

No Threatened (Declared Rare) Flora taxa were recorded within the Project Area during the 2011 field survey.

### 5.7.2 Priority Flora

One Priority 3 Flora taxa was recorded within the Project Area during the 2011 field survey:

*Acacia startii* (Priority 3) is described as dense, rounded, much-branched shrub, approximately one to two metres tall and up to three metres wide, with green-yellow flowers in July to August (*FloraBase* 2012) (Plate 1). A search was undertaken on *NatureMap* which reported 48 known recorded locations of this species within the Carnarvon IBRA region. This species is known to occur on calcareous loam with limestone pebbles, stony hills and near watercourses. This species is related to the common *Acacia bivenosa*, but within the vicinity of the Project Area the two taxa are not sympatric with *Acacia startii* occurring to the west and south of the range of *Acacia bivenosa*.

Recent surveys by GHD undertaken in 2010 along the Minilya-Exmouth Road indicated that this species is more widespread than indicated by *NatureMap* and *FloraBase* records. Within the vicinity of this Project Area, GHD has also recorded a large number of *Acacia startii* along the NWCH roadside, and in disturbed areas associated with other historical MRWA material pits and access tracks.



In 2011, 505 plants were noted within the NWCH Material Pit SLK 666B boundary and 417 plants outside the Material Pit boundary (Table 9). This species was associated with vegetation types 'Sandplain Rocky' and 'Cleared/Degraded' (Figure 2). A total of 253 plants were recorded within the 'Cleared/Degraded' area of the Material Pit and 252 plants within the 'Sandplain Rocky' vegetation type.

Given that the population within the Cleared/Degraded area of the Material Pit is equivalent to the population within the 'Sandplain Rocky' and responds to disturbance, GHD believes that the proposed project activities are likely to enhance the area of preferred habitat and increase germination of this species. GHD considers that this species population within the local and regional area will not be under threat from the proposed project activities, as this species is widespread, and likely to spread from project activities.





**Table 9** Location of *Acacia startii*

| Family   | Genus         | Species        | Status     | Plant Count | Easting | Northing | Inside Pit | Outside Pit |
|----------|---------------|----------------|------------|-------------|---------|----------|------------|-------------|
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 221936  | 7405116  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 221953  | 7405156  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 10          | 221991  | 7405156  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 19          | 221991  | 7405149  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 6           | 222015  | 7405134  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222099  | 7405115  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222216  | 7405025  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 9           | 222173  | 7405028  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 108         | 222149  | 7405076  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222178  | 7404990  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222233  | 7404954  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 8           | 222257  | 7404938  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 222257  | 7404899  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222179  | 7404744  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222149  | 7404715  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222137  | 7404698  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222079  | 7404768  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222035  | 7404784  | X          |             |



| Family   | Genus         | Species        | Status     | Plant Count | Easting | Northing | Inside Pit | Outside Pit |
|----------|---------------|----------------|------------|-------------|---------|----------|------------|-------------|
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 221999  | 7404820  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 221958  | 7404722  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 221943  | 7404785  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 12          | 221940  | 7404891  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 221890  | 7404674  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 221926  | 7404638  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 221897  | 7404612  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 221951  | 7404643  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 221965  | 7404659  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 6           | 221971  | 7404681  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 221986  | 7404701  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222041  | 7404694  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222042  | 7404623  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222041  | 7404596  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222056  | 7404568  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222016  | 7404554  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 13          | 222123  | 7404513  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 10          | 222110  | 7404553  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 222127  | 7404575  | X          |             |



| Family   | Genus         | Species        | Status     | Plant Count | Easting | Northing | Inside Pit | Outside Pit |
|----------|---------------|----------------|------------|-------------|---------|----------|------------|-------------|
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222147  | 7404583  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222203  | 7404575  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 222188  | 7404559  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222174  | 7404536  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222167  | 7404511  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 7           | 222144  | 7404508  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 9           | 222208  | 7404509  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 7           | 222230  | 7404510  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222252  | 7404558  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 6           | 222259  | 7404576  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222256  | 7404619  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 12          | 222257  | 7404652  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222263  | 7404728  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 6           | 222293  | 7404699  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222285  | 7404659  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222309  | 7404607  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 222302  | 7404590  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222273  | 7404575  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 8           | 222276  | 7404569  | X          |             |



| Family   | Genus         | Species        | Status     | Plant Count | Easting | Northing | Inside Pit | Outside Pit |
|----------|---------------|----------------|------------|-------------|---------|----------|------------|-------------|
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222262  | 7404527  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 7           | 222289  | 7405025  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222306  | 7404985  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222312  | 7404913  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 30          | 221927  | 7405214  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 221924  | 7405228  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 52          | 221881  | 7405359  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 25          | 221977  | 7405407  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 15          | 221990  | 7405461  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 221906  | 7405130  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 10          | 221976  | 7405116  | X          |             |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 221916  | 7404558  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 8           | 221911  | 7404569  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222017  | 7404477  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222016  | 7404459  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222007  | 7404391  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222025  | 7404361  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222039  | 7404323  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222050  | 7404342  |            | X           |



| Family   | Genus         | Species        | Status     | Plant Count | Easting | Northing | Inside Pit | Outside Pit |
|----------|---------------|----------------|------------|-------------|---------|----------|------------|-------------|
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 6           | 222058  | 7404380  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222042  | 7404383  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 13          | 222067  | 7404402  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 6           | 222096  | 7404408  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222085  | 7404435  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222055  | 7404438  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 14          | 222033  | 7404456  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222085  | 7404461  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 8           | 222074  | 7404493  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 8           | 222051  | 7404501  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222057  | 7404520  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 6           | 222080  | 7404522  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 9           | 222098  | 7404509  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 6           | 222135  | 7404481  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 10          | 222133  | 7404446  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 11          | 222098  | 7404417  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222088  | 7404379  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222088  | 7404303  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222123  | 7404319  |            | X           |



| Family   | Genus         | Species        | Status     | Plant Count | Easting | Northing | Inside Pit | Outside Pit |
|----------|---------------|----------------|------------|-------------|---------|----------|------------|-------------|
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 7           | 222130  | 7404340  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222183  | 7404356  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222202  | 7404383  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222235  | 7404402  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 222222  | 7404424  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222214  | 7404460  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 1           | 222214  | 7404470  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 222205  | 7404337  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 13          | 222209  | 7404307  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222212  | 7404262  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222180  | 7404187  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222217  | 7404168  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222252  | 7404137  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222298  | 7404172  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 10          | 222355  | 7404303  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222354  | 7404329  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 7           | 222347  | 7404370  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222368  | 7404395  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 18          | 222387  | 7404424  |            | X           |



| Family   | Genus         | Species        | Status     | Plant Count | Easting | Northing | Inside Pit | Outside Pit |
|----------|---------------|----------------|------------|-------------|---------|----------|------------|-------------|
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 4           | 222412  | 7404437  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222419  | 7404467  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 13          | 222412  | 7404504  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 14          | 222442  | 7404499  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 13          | 222473  | 7404430  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 21          | 222462  | 7404404  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 20          | 222536  | 7404351  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 22          | 222549  | 7404416  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 14          | 222564  | 7404453  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 5           | 222568  | 7404488  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 222575  | 7404550  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 10          | 222568  | 7404587  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 3           | 221734  | 7404355  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 10          | 221701  | 7404228  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 2           | 221654  | 7404025  |            | X           |
| Fabaceae | <i>Acacia</i> | <i>startii</i> | Priority 3 | 8           | 221581  | 7403892  |            | X           |



**Plate 1**      *Acacia startii* (specimen JFSP30)

### 5.7.3 Other Significant Flora

No other significant flora taxa were recorded within the Project Area during the 2011 field survey.

### 5.7.4 Weeds and Introduced Species

Only one weed species was recorded within the Project Area. This is considered to be a result of the remoteness of the location and relative undisturbed status of the area. The species recorded was widespread in the disturbed areas having been deliberately introduced as a fodder species for the pastoral industry.

- ▶ *\*Cenchrus ciliaris*                      Buffel Grass;
- ▶ *\*Asphodelus fistulosus*              Onion Weed.

### Weeds of National Significance

The spread of weeds across a range of land uses or ecosystems is important in the context of socio-economic and environmental values. The assessment of Weeds of National Significance (WONS) is based on four major criteria:

- ▶ Invasiveness;
- ▶ Impacts;



- ▶ Potential for spread; and
- ▶ Socio-economic and environmental values.

No WONS were recorded within the Project Area.

### 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* (ARRP Act). The Department of Agriculture and Food (DAFWA) 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 Area, all landholders are obliged to comply with the specific category of control. 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 five classes, which are detailed in Table 10.

**Table 10 Department of Agriculture and Food Declared Plant Control Classes**

| 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 Plants pursuant to the ARRP Act was recorded within the Project Area.

## Environmental Weed Rating

In developing the Environmental Weed Strategy for Western Australia (EWSWA 1999), criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity were formulated. Three criteria were selected to rate weeds. These were:

- ▶ Invasiveness,
- ▶ Distribution, and
- ▶ Environmental impacts.

A list of 467 weeds occurring within the DEC Mid-West region of WA were rated as either high, moderate, mild or low against these criteria. Twenty two weed species were rated as high.

The single weed species recorded within the Project Area has been given an Environmental Weed Rating, as shown in Table 11.

**Table 11 Environmental Weed Rating for Weed Species Recorded Within the Project Area**

| Genus               | Species           | Common Name  | Rating |
|---------------------|-------------------|--------------|--------|
| * <i>Cenchrus</i>   | <i>ciliaris</i>   | Buffel Grass | High   |
| * <i>Asphodelus</i> | <i>fistulosus</i> | Onion Weed   | Mild   |

In an effort to progress this strategy and an integrated approach to weed management in Western Australia, the Invasive Plant Prioritisation Process for DEC was developed. This is considered likely to supersede the EWSWA environmental weed rankings once complete. The DEC is in the process of examining the weed species for each region. As yet, the status for the majority of the weeds has not yet been determined, and as such the EWSWA ratings remain valid.

### 5.7.5 Weed Spread

The Project Area's vegetation is considered mostly unaltered and the potential for weeds to spread is considered to be high. Historically the weeds are associated with existing access tracks and historical pits activities. Buffel Grass is considered likely to spread due to livestock movements, fire and as a result of deliberate introduction.

## 5.8 Fauna

### 5.8.1 Fauna Records

A Level 1 fauna field assessment was conducted in conjunction with the flora survey over one day. The fauna survey was limited to daylight hours and only examined terrestrial animals occurring within the Project Area. A total of seven birds and one reptile were recorded from the Project Area.



### 5.8.2 Threatened and Priority Fauna Assessment

There were no Threatened or Priority Fauna identified during the survey within the Project Area.

The desktop assessment indicated that a number of protected fauna may occur within the Project Area. The requirements for preferred habitat and the likelihood of these species occurring are as follows:

#### **Barn Swallow (*Hirundo rustica*) Listed Migratory, Marine [EPBC Act]; Schedule 3 [WC Act]**

The Barn Swallow is migratory species that is widespread throughout Northern Australia and has been sighted in the Carnarvon bioregion. It occurs in open country comprising of low vegetation mainly pastures, meadows and farmlands. This species nests in culverts, stables and barns (DSEWPac, 2012).

**Assessment:** There is a very low probability of the Barn Swallow occurring within the Project Area because it does not comprise of the appropriate habitat. There is a low probability of this species flying over the area, due to the lack of recorded sightings within the vicinity of the Project Area. A search was undertaken on *NatureMap* and found the closest reported sighting to be more than 500 km from the Project Area. This species is considered unlikely to be impacted by the proposed works.

#### **Cattle Egret (*Ardea ibis*) Listed Migratory, Marine [EPBC Act]; Schedule 3 [WC Act]**

The Cattle Egret is a migratory species that are widespread in Australia. They inhabit tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. This species' diet consists mainly of grasshoppers, however it is known to consume other insects including cicadas, centipedes, spiders, cattle ticks, frogs (including cane toads), lizards (particularly skinks) and small mammals. In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg (DSEWPac, 2012).

**Assessment:** There is a low probability of the Cattle Egret occurring within the Project Area because it does not comprise of the appropriate habitat. There is a low probability of this species flying over the area, due to the lack of recorded sightings within the vicinity of Project Area. A search was undertaken on *NatureMap* and found the closest reported sighting to be more than 100 km from the Project Area. This species is considered unlikely to be impacted by the proposed works.

#### **Fork-tailed Swift (*Apus pacificus*) Listed Migratory, Marine [EPBC Act]; Schedule 3 [WC Act]**

Fork-tailed Swift is distributed along the coastal and sub-coastal areas between Augusta and Carnarvon, including some on near shore and offshore islands. They mainly occur in the inland plains and foothills of the coastal areas. It inhabits riparian woodlands and tea-tree swamps, low scrub, heathland or saltmarsh (DSEWPac, 2012).

**Assessment:** There is possibility of the Fork-tailed Swift occurring within the Project Area. A search was undertaken on *NatureMap* and found the closest reported sighting to be only 15 km from the Project Area. It is likely for this species to flyover, as sightings have also been recorded inland of the Project Area. GHD considers that this species is highly mobile and therefore it is unlikely to be impacted by the proposed works.

**Great Egret (*Ardea alba*) Listed Migratory, Marine [EPBC Act]; Schedule 3 [WC Act]**

The Great Egret is a migratory species that are widespread in Australia. They inhabit wetland areas including swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. This species' diet consists of fish, insects, crustaceans, molluscs, frogs, lizards, snakes and small birds and mammals. In Australia, the largest breeding colonies, and greatest concentrations of breeding colonies, are located in near-coastal regions of the Top End of the Northern Territory (DSEWPaC, 2012).

**Assessment:** There is a low probability of the Great Egret occurring within the Project Area because it does not comprise of the appropriate habitat. There is a low probability of this species flying over the Project Area, due to the lack of recorded sightings within the vicinity of the Project Area. A search was undertaken on *NatureMap* and found the closest reported sighting to be more than 200 km from the Project Area. This species is considered unlikely to be impacted the proposed works.

**Mulgara (*Dasyercus cristicauda*) Listed Vulnerable [EPBC Act]; Schedule 1 [WC Act]**

The Mulgara occurs in the arid sandy regions of Australia, mostly living in burrows on the flats between low sand-dunes of central Australia. The Mulgara preys on insects, other arthropods and small vertebrates (Strahan 2004).

**Assessment:** There is a low probability of the Mulgara occurring within the Project Area, although it contains a sandy habitat. A search was undertaken on *NatureMap* and found the closest reported sighting to be approximately 80 km from the Project Area. This species is considered unlikely to be impacted by the proposed works.

**Northern Quoll (*Dasyurus hallucatus*) Listed Endangered [EPBC Act]; Schedule 1 [WC Act]**

The Northern Quoll occurs north of Shark Bay, mainly within the Pilbara region and isolated populations in the Kimberly Region. This species generally inhabits rocky areas surrounded by low heath and shrublands. The rocky habitats are generally elevated from the ground. The Northern Quoll preys on invertebrates, particularly beetles, grasshoppers, spiders, scorpions and centipedes. They also eat fruit, nectar, and are known to feed on carrion and human refuse and vertebrates such as bandicoots, sugar gliders, brush-tailed possums, rats and some bird species. They also forage on plants, in particular wild grape (DSEWPaC, 2012).

**Assessment:** There is a low probability of the Northern Quoll occurring within the Project Area, although it contains a rocky habitat adjacent to heathland. A search was undertaken on *NatureMap* and found the closest reported sighting to be more than 200 km from the Project Area. This species is considered unlikely to be impacted by the proposed works.

**Oriental Plover (*Charadrius veredus*) Listed Migratory [EPBC Act]; Schedule 3 [WC Act]**

The Oriental Plover is a migratory species that occurs across northern and south-eastern Western Australia. They inhabit flat, open, semi-arid and arid grasslands. This includes claypans, dry paddocks, playing fields, lawns and cattle camps, along with open areas recently burnt. The species' diet mainly comprises of insects, including termites, beetles, grasshoppers and crickets (DSEWPac, 2012).

**Assessment:** There is a low probability of the Oriental Plover occurring within the Project Area because it does not comprise of the appropriate habitat. A search was undertaken on *NatureMap* and found the closest reported sighting to be approximately 80 km from the Project Area, it is likely for the species to fly over the Project Area, as sightings have also been recorded inland of the Project Area. This species is considered unlikely to be impacted the proposed works.

**Rainbow Bee-eater (*Merops ornatus*) Listed Migratory, Marine [EPBC Act]; Schedule 3 [WC Act]**

The Rainbow Bee-eater is a migratory marine species that is widespread across Australia. This species occurs in open forests and woodlands, shrublands and in various cleared or semi-cleared habitats, including farmlands and developed areas. This species' diet consists of insects such as beetles, moths, butterflies, damselflies, dragonflies, flies, ants and bugs (DSEWPac, 2012).

**Assessment:** There is high probability of this species occurring within Project Area, as it comprises of the appropriate vegetation type. There is a high probability of this species flying over the Project Area, due to the numerous recorded sightings within the vicinity of the Project Area and the greater surrounds. GHD considers that this species is highly mobile and therefore it is unlikely to be impacted by the proposed works.

**White-bellied Sea Eagle (*Haliaeetus leucogaster*) Listed Migratory, Marine [EPBC Act]; Schedule 3 [WC Act]**

The White-bellied Sea-eagle is a migratory species are widespread along the coastal areas of Western Australia. They occur on coastal dunes, tidal flats, grasslands, heathland, woodlands and within developed areas. This species also is known to occur within the vicinity of freshwater swamps, lakes, reservoirs, billabongs, saltmarshes and sewage ponds. This species' diet comprises of fish, birds, reptiles, mammals and crustaceans (DSEWPac, 2012).

**Assessment:** There is low probability of this species occurring within the Project Area, as it does not comprise of the appropriate habitat type. There is a low probability of this species flying over the area, due to the lack of recorded sightings within the vicinity of Project Area. A search was undertaken on *NatureMap* and found the closest



reported sighting to be approximately 60 km from the Project Area. This species is considered unlikely to be impacted the proposed works.

### **5.8.3 Exotic Fauna**

There were no exotic fauna recorded within the Project Area, during the two day field assessment.

### **5.8.4 Habitat Value**

The majority of the Project Area was assessed as *Good to Degraded* vegetation condition. Disturbances appear to be limited to the maintenance zone of the side access tracks and from historical excavation from Material Pits.

The amount of clearing of two hectares every two years is not considered to impact on the habitat value of the Project Area.

### **5.8.5 Fauna Habitat Types**

A total of three fauna habitat types were recorded in the Project Area. These habitats included Cleared/Degraded occur in the local and regional area in as good or better condition:

- ▶ Sand Plain Rocky
- ▶ Heathland; and
- ▶ Cleared/Degraded

### **5.8.6 Habitat Linkages**

Habitat linkages are important as it provides fauna a means of moving between areas. Furthermore such linkage also provides a habitat for all ground and aerial fauna for resting and reproduction. It is important to maintain these habitat linkages in areas where extensive clearing has occurred.

The majority of the Project Area comprises of previously disturbed vegetation. MRWA advises that approximately two hectares of vegetation over the timeframe of two years will be impacted by the proposed works; this is less than four percent of the total Project Area. GHD considers that habitat linkages are unlikely to be impacted the proposed works. In addition, MRWA has advised that they will take a staged pit development approach, which means each one to two hectares will be re-vegetated at each stage, before opening up new areas for clearing.

## 6. Clearing of Native Vegetation

Clearing applications are assessed against ten principles outlined in Schedule 5 of the *Environmental Protection Act* 2003. These principles aim to ensure that all potential impacts resulting from the removal of native vegetation can be assessed in an integrated way. The principles address three main environmental areas:

- ▶ Biodiversity significances;
- ▶ Land degradation; and
- ▶ Ground and surface water quality.

These principles apply to all lands throughout Western Australia. If the project involves significant impacts other than on native vegetation, or the clearing is exempt under Section 51C but is considered to have a significant impact, it should be referred to the EPA for consideration.

Any clearing of native vegetation requires a permit under Part V of the *Environmental Protection Act* 1986, except where exemptions apply under Schedule 6 of the Act or are prescribed in the Environmental Sensitive Areas (ESAs).

### 6.1 Assessment Against the Ten Clearing Principles

This project has been assessed against the Ten Clearing Principles (Appendix D) and they are not at variance with the Ten Clearing Principles with the exception being Clearing Principle (a). GHD has considers that the proposed works are “unlikely to be at variance” with this principle.

Clearing Principle (a) includes an examination of Priority Flora taxa, of which *Acacia startii* (Priority 3) was recorded in the Project Area at a number of locations. A total of 253 plants were recorded within the ‘Cleared/Degraded’ area of the Material Pit and 252 plants within the ‘Sandplain Rocky’ vegetation type.

Given that the population within the ‘Cleared/Degraded area of the Material Pit is equivalent in number to the population recorded within the ‘Sandplain Rocky’ and it responds to disturbance, GHD believes that the proposed project activities are likely to enhance the preferred habitat and increase germination of this species. GHD considers that this species is widespread within the local and regional area and the population not be under threat from the proposed project activities. Additional habitat for this species occurs to the south of the Material Pit.



## 7. Approvals Required

### 7.1 Approvals

#### 7.1.1 Commonwealth Government

A review of the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) online database was conducted as part of preparing this PEIA. That no environmental impacts or issues considered as having significant impact on nation environmental significance, which would render the project a “Controlled Action” or invoke the Commonwealth EPBC Act.

Formal referral of this project to the Commonwealth Minister for the Environment is not considered warranted.

#### 7.1.2 Government of Western Australia

##### **Environmental Protection Authority**

The project proposes to extract material from two pit areas at SLK 666.

Based on the small scale of this Project, associated level of public interest and minimal environmental impact, it is recommended that this Project does not warrant formal referral by the Environmental Protection Authority (EPA).

Main Road Purpose Permit (818/6) which has been granted to MRWA under Section 51E of the *Environmental Protection Act 1986* allows for the clearance of native vegetation for this project activity. However, this Permit does not authorise the clearance of native vegetation for project activities where:

- ▶ The clearing may be seriously at variance with the clearing principles; or
- ▶ Those project activities are incorporated in any proposal that is referred to and assessed under Part IV of the *Environmental Protection Act 1986* by the EPA.

Clearing Principle (a) has been assessed as ‘unlikely at variance’.

##### **Department of Environment and Conservation**

This project found Clearing Principle (a) to be ‘unlikely at variance’. GHD considers that the MRWA Purpose Permit (818/6) is likely to be adequate for the purposes of this project.



## 8. References

- ABRS 2009. *Australian Faunal Directory*. Australian Biological Resources Study, Canberra. (Online)  
<http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/index.html>. Accessed March 2012
- BoM (2012). *Climate Statistics for Australian Locations*. (Online)  
[http://www.bom.gov.au/climate/averages/tables/cw\\_006066.shtml](http://www.bom.gov.au/climate/averages/tables/cw_006066.shtml). Accessed March 2012
- Department of Agriculture, Fisheries and Forestry (2011) Australian Soil Resource Information System. (Online) <http://www.asris.csiro.au/asris/>. Accessed November 2011
- Department of Environment and Conservation (2011) Contaminated Sites Database. (Online)  
<https://secure.dec.wa.gov.au/idelve/css/>. Accessed November 2011
- Department of Environment and Conservation (2012) Native Vegetation Map Viewer. (Online)  
<http://maps.dec.wa.gov.au/idelve/nv/index.jsp>. Accessed March 2012
- Department of Environment and Conservation (2012) NatureMap; *Mapping Western Australia's Biodiversity*. Search Species By Area. (Online)  
<http://naturemap.dec.wa.gov.au>. Accessed March 2012
- Department of Environment and Conservation (2012) Vegetation Statistics Statewide 2011 Full report.xls. (Online)  
<https://www2.landgate.wa.gov.au/web/guest/downloader>. Downloaded March 2012
- Department of Indigenous Affairs (2011) Aboriginal Heritage Inquiry System. (Online)  
<http://www.dia.wa.gov.au/AHIS/default.aspx>. Accessed November 2011
- Department of Sustainability, Environment, Water, Population and Communities (2011). Australian Heritage Database. (Online)  
<http://www.environment.gov.au/cgi-bin/ahdb/search.pl>. Accessed November 2011
- Department of Sustainability, Environment, Water, Population and Communities (2011). Protected Matters Search Tool. (Online)  
<http://www.environment.gov.au/epbc/pmst/index.html>. Accessed November 2011
- Department of Sustainability, Environment, Water, Population and Community (2012). Species Profile and Threats Database (Online)  
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl> Accessed March 2012
- Department of Water (2011) Geographic Data Atlas. (Online)  
<http://www.water.wa.gov.au/idelve/dowdataext/index.jsp>. Accessed March 2012
- Government of Australia (2010). *Weeds in Australia*. (Online)  
<http://www.weeds.gov.au/index.html>. Accessed March 2012



Government of Western Australia (2008) Shared Land Information Platform, Natural Resource Management. (Online) [http://spatial.agric.wa.gov.au/slip/products\\_view.asp](http://spatial.agric.wa.gov.au/slip/products_view.asp). Accessed March 2012

Keighery, B.J. (1994) Bushland Plant Survey. A Guide to Plant Community Survey for the Community. Wildflower Society of WA.

Kendrick and Mau (2002) Carnarvon 1 (CAR1 – Cape Range subregion), Subregional description and biodiversity values. A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Conservation and Land Management, October 2002.

NRM Info (2012). Department of Agriculture and Food WA – Natural Resource Management (NRM) Shared Land Information Portal (SLIP) online maps: <http://spatial.agric.wa.gov.au/slip/framesetup.asp> accessed 30/03/2012.

Stahan, R (2009) *The mammals of Australia*. Angus and Robertson, 1983

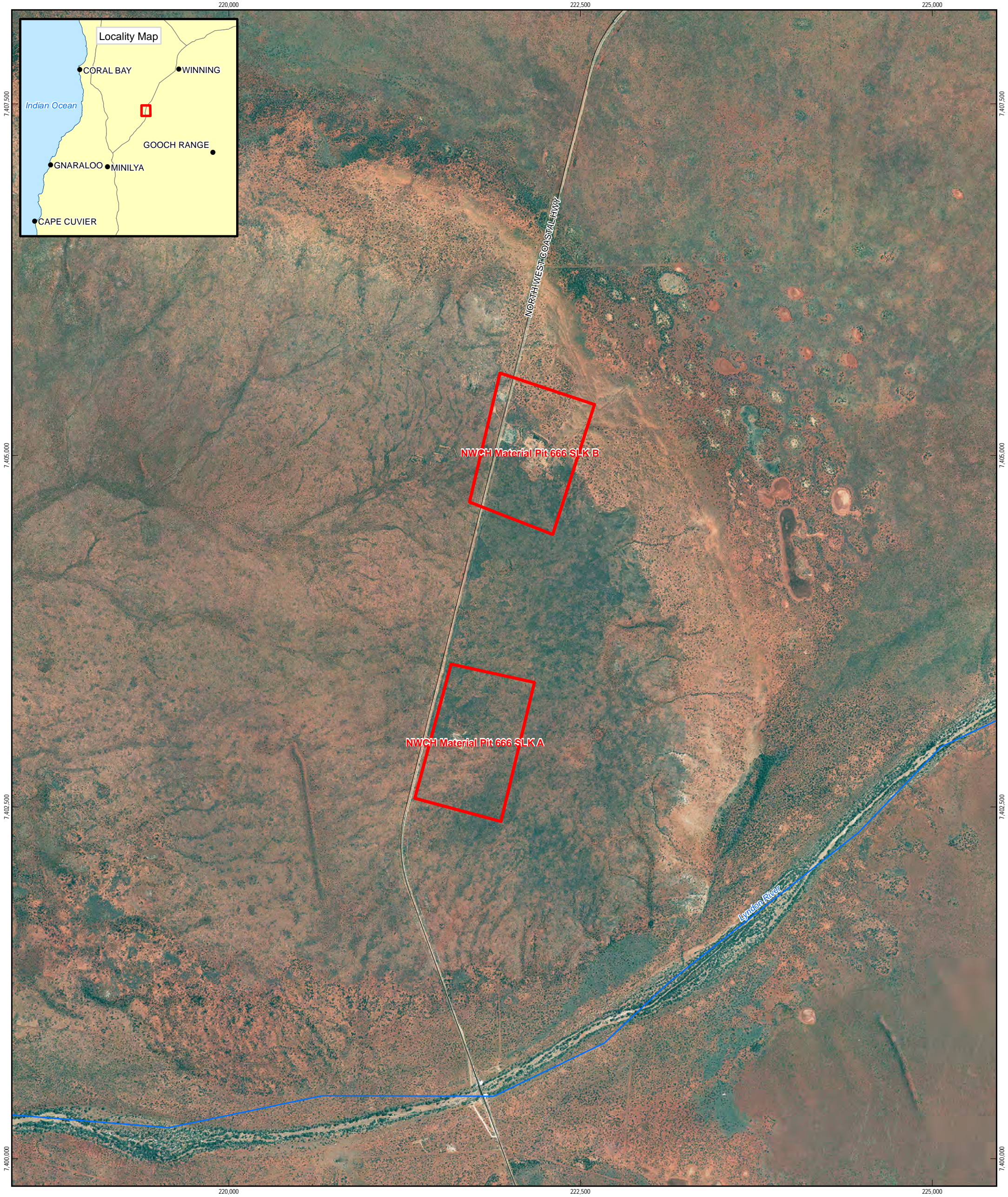
Western Australian Herbarium (1998–). FloraBase—the Western Australian Flora. Department of Environment and Conservation. (Online) <http://florabase.dec.wa.gov.au>. Accessed March 2012



Figures

## Project Figures





LEGEND

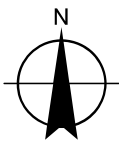
- Roads
- Rivers
- Study Area

1: 25,000 (at A3)

0 125 250 500 750 1,000 1,250

Metres

Map Projection: Transverse Mercator  
Horizontal Datum: Geocentric Datum of Australia  
Grid: Map Grid of Australia 1994, Zone 50



CLIENTS | PEOPLE | PERFORMANCE

powered by SLIP ENABLER

Main Roads WA  
MRWA ETS  
NWCH Strategic Material Pits 666 SLK A and B  
Preliminary Environment Impact Assessment

|            |             |
|------------|-------------|
| Job Number | 61-27568    |
| Revision   | 0           |
| Date       | 12 Apr 2012 |

Locality Map

Figure 1





1:10,000 (at A3)

0

50

100

200

300

400

500

Metres

N

LEGEND

●

Priority 3, *Acacia startii* inside Pit Area

●

Priority 3, *Acacia startii* outside Pit Area

—

Roads

Cleared/Degraded

Sandplain Rocky

Heathland

Study Area

GHD

mainroads

WESTERN AUSTRALIA

powered by

SLIP ENABLER

CLIENTS | PEOPLE | PERFORMANCE

Main Roads WA

MRWA ETS

NWCH Strategic Material Pits 666 SLK A

Preliminary Environment Impact Assessment

Job Number

Revision

Date

61-27568

0

12 Apr 2012

Vegetation Type

Sheet 1 of 2

Figure 2

G:\6127568\GIS\Maps\MXD\6127568\_G002\_Fig2\_Rev0.mxd  
© 2012. Whilst every care has been taken to prepare this map, GHD, MRWA, GA and Landgate make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.  
Data source: Landgate: Barrabiddy 2007 Mosaic, Mia Mia 2007 Mosaic; MRWA: Study Area - 201203016, Roads - 20111004; GHD: Vegetation Type - 20120323, Acacia startii - 20120323; GA: Geodata Topo 250K Series III - 2006. Created by: cagilbert, slee2, mczekaj

239 Adelaide Terrace Perth WA 6004 Australia

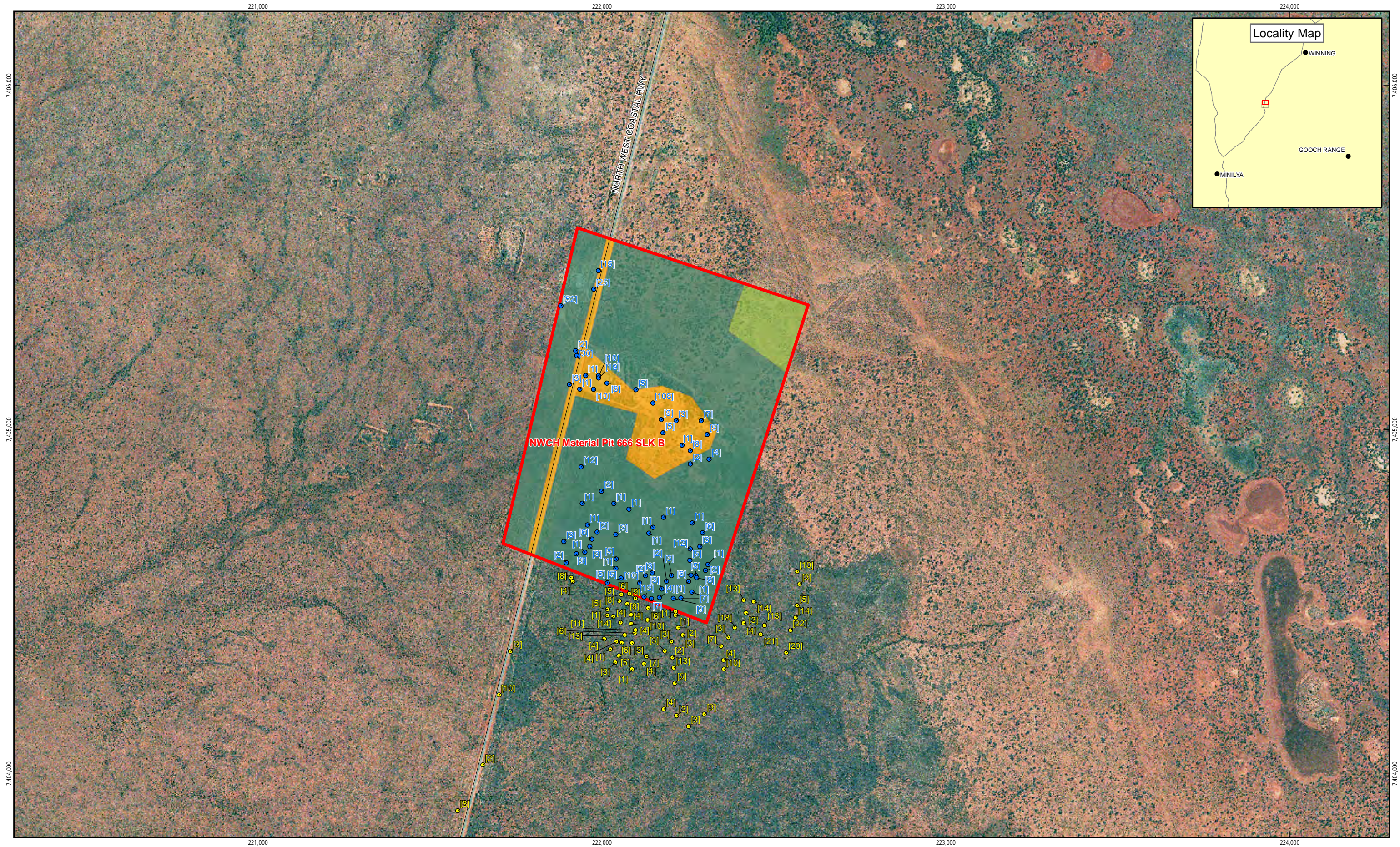
T 61 8 6222 8222

F 61 8 6222 8555

E permail@ghd.com.au

W www.ghd.com.au

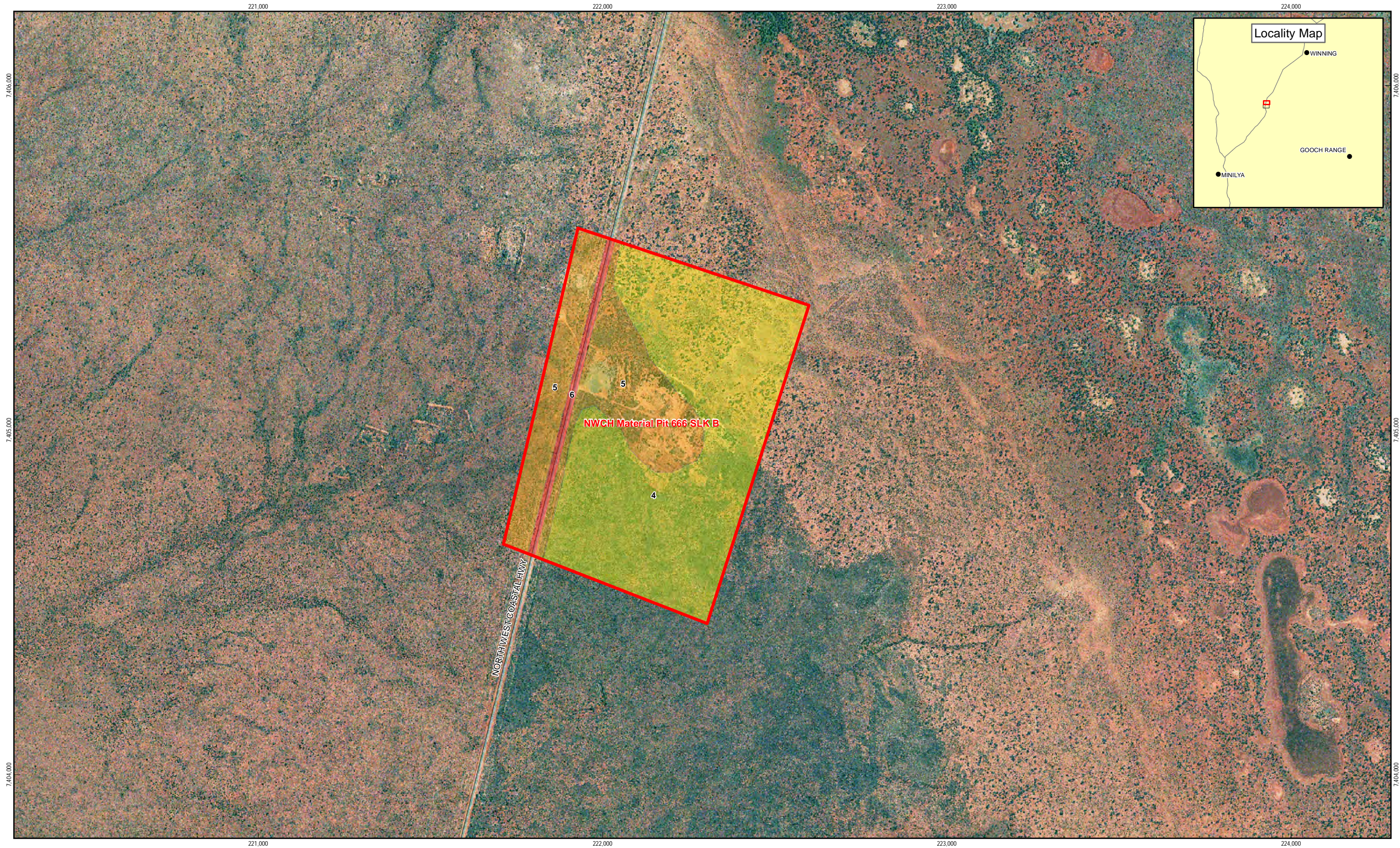




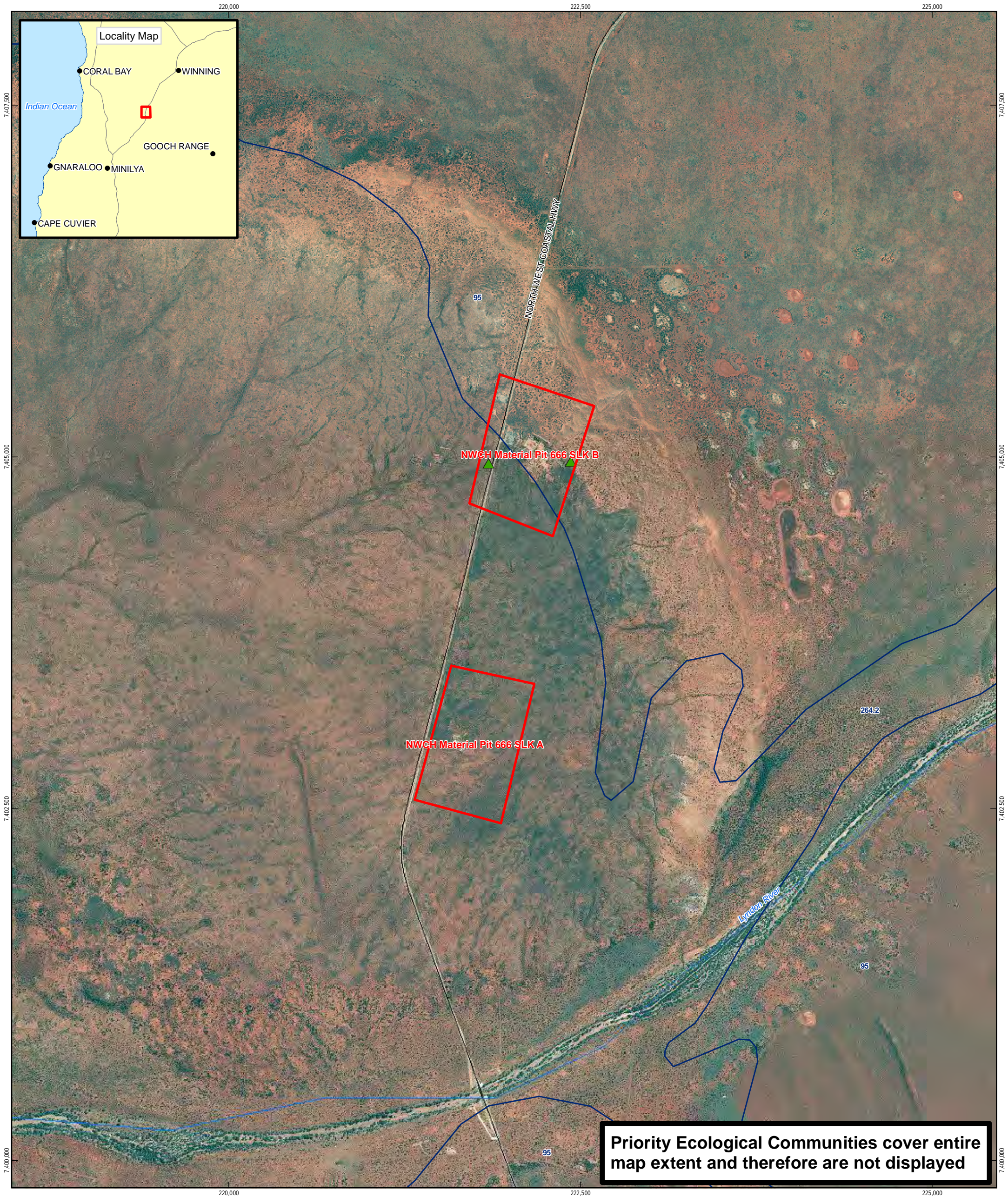












LEGEND

Threatened (Declared Rare) & Priority Flora

▲ (T) Threatened Flora - Extant Taxa

▲ Priority 1 - Poorly Known Taxa

▲ Priority 2 - Poorly Known Taxa

▲ Priority 3 - Poorly Known Taxa

▲ Priority 4 - Rare Taxa

— Roads

— Rivers

— Pre-European Vegetation

Study Area

1: 25,000 (at A3)

0 125 250 500 750 1,000 1,250

Metres

Map Projection: Transverse Mercator

Horizontal Datum: Geocentric Datum of Australia

Grid: Map Grid of Australia 1994, Zone 50

GHD

CLIENTS | PEOPLE | PERFORMANCE

mainroads

WESTERN AUSTRALIA

powered by

SLIP ENABLER

Main Roads WA

MRWA ETS

NWCH Strategic Material Pits 666 SLK A and B

Preliminary Environment Impact Assessment

Environmental Constraints

Job Number

Revision

Date

61-27568

0

12 Apr 2012

Figure 4

G:\6127568\GIS\Maps\MXD\6127568\_G004\_Fig4\_Rev0.mxd

© 2012. Whilst every care has been taken to prepare this map, GHD, DoW, DEC, MRWA, GA and Landgate make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: DEC: Threatened (Declared Rare) & Priority Flora - 20111221, Threatened & Priority Ecological Communities - 20120208; DAFWA: Pre-European Vegetation - 20120327; MRWA: Study Area - 20120327, Roads - 20120327; DoW: Rivers - 20120327; Landgate: Mia Mia 2007 Mosaic; GA: Geodata Topo 250K Series III - 2006.

Created by: mczekaj

239 Adelaide Terrace Perth WA 6004 Australia T 61 8 6222 8222 F 61 8 6222 8555 E permail@ghd.com.au W www.ghd.com.au





## Appendix A

# Conservation Categories

EPBC Act Conservation Codes

WC Act Conservation Codes

DEC Conservation Codes



## **EPBC Act Fauna Conservation Categories**

### ***Listed threatened species and ecological communities***

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- ▶ Extinct in the wild,
- ▶ Critically Endangered,
- ▶ Endangered, or
- ▶ Vulnerable.

See Table 12.

### ***Critically endangered and endangered species***

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- ▶ Lead to a long-term decrease in the size of a population, or
- ▶ Reduce the area of occupancy of the species, or
- ▶ Fragment an existing population into two or more populations, or
- ▶ Adversely affect habitat critical to the survival of a species, or
- ▶ Disrupt the breeding cycle of a population, or
- ▶ Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- ▶ Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat\*, or
- ▶ Interfere with the recovery of the species.

*\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

### ***Vulnerable species***

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- ▶ Lead to a long-term decrease in the size of an important population of a species, or
- ▶ Reduce the area of occupancy of an important population, or
- ▶ Fragment an existing important population into two or more populations, or
- ▶ Adversely affect habitat critical to the survival of a species, or
- ▶ Disrupt the breeding cycle of an important population, or
- ▶ Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or



- ▶ Result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat\*, or
- ▶ Interferes substantially with the recovery of the species.
- ▶ An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:
  - ▶ Key source populations either for breeding or dispersal,
  - ▶ Populations that are necessary for maintaining genetic diversity, and/or
  - ▶ Populations that are near the limit of the species range.

*\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.*

### **Listed Migratory species**

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The criteria below are relevant to migratory species that are not threatened.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- ▶ Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- ▶ Result in invasive species that is harmful to the migratory species becoming established\* in an area of important habitat of the migratory species, or
- ▶ Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

1. Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
2. Habitat utilised by a migratory species which is at the limit of the species range, or
3. Habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

*\*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.*



**Table 12 Conservation Categories and Definitions for *Environmental Protection and Biodiveristy Conservation Act (1999)* Listed Flora and Fauna Species**

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

**Table 13 *Western Australia Wildlife Conservation Act (1950)* Conservation Codes**

| <b>Conservation Code</b> | <b>Description</b>  |
|--------------------------|---|
| 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 14 Department of Environment and Conservation Priority Fauna Codes<sup>1</sup>**

| 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.  |

**Table 15 Department of Environment and Conservation Priority Flora Codes**

| Code | Conservation Category                                  | Definition   |
|------|--|--|
| X    | Presumed Extinct Flora (Declared Rare Flora – Extinct) | Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such (Schedule 2 under the Wildlife Conservation Act 1950).   |
| T    | Threatened Flora (Declared Rare Flora – Extant)        | <p>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 (Schedule 1 under the Wildlife Conservation Act 1950).</p> <p>Threatened Flora are further ranked by the Department according to their level of threat using IUCN Red List criteria:</p> <ul style="list-style-type: none"> <li>• CR: Critically Endangered – considered to be facing an extremely high risk of extinction in the wild;</li> <li>• EN: Endangered – considered to be face a very high risk of extinction in the wild; and</li> <li>• VU: Vulnerable – considered to be facing a high risk of extinction in the wild.</li> </ul> |
| P1   | Priority 1 – Poorly Known                              | Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or   |

<sup>1</sup> Species not listed under the Wildlife Conservation Act (1950), but for which there is some concern.



| Code | Conservation Category   | Definition  |
|------|---|---|
|      | Taxa  | pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.  |
| P2   | Priority 2 – Poorly Known Taxa  | Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.   |
| P3   | Priority 3 – Poorly Known Taxa  | Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.   |
| P4   | Priority 4 – Rare, Near Threatened and other taxa in need of monitoring | <ul style="list-style-type: none"> <li> <b>Rare.</b> Taxa that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands. </li> <li> <b>Near Threatened.</b> Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. </li> <li> Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy. </li> </ul> |
| P5   | Priority 5 – Conservation Dependent Taxa                                | Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.  |



## Appendix B

# Project Area Flora List





**Table 16 Flora List for North West Coastal Highway Strategic Material Pit SLK 666A and B**

| <b>Family</b>  | <b>Genus</b>         | <b>Species</b>                     | <b>Common Name</b>   | <b>Status</b> |
|----------------|----------------------|------------------------------------|----------------------|---------------|
| Amaranthaceae  | <i>Ptilotus</i>      | <i>axillaris</i>                   | Mat Mulla Mulla      |               |
| Amaranthaceae  | <i>Ptilotus</i>      | <i>arthrolasius</i>                |                      |               |
| Amaranthaceae  | <i>Ptilotus</i>      | <i>clementii</i>                   | Tassel Top           |               |
| Amaranthaceae  | <i>Ptilotus</i>      | <i>divaricatus</i>                 | Climbing Mulla Mulla |               |
| Amaranthaceae  | <i>Ptilotus</i>      | <i>obovatus</i>                    | Cotton Bush          |               |
| Asphodelaceae  | <i>Asphodelus</i>    | <i>fistulosus</i>                  | Onion Weed           | *             |
| Asparagaceae   | <i>Acanthocarpus</i> | <i>verticillatus</i>               |                      |               |
| Asteraceae     | <i>Pterocaulon</i>   | <i>sphacelatum</i>                 | Apple Bush           |               |
| Asteraceae     | <i>Pluchea</i>       | <i>rubelliflora</i>                |                      |               |
| Asteraceae     | <i>Angianthus</i>    | <i>acrohyalinus</i>                | Hook-leaf Angianthus |               |
| Boraginaceae   | <i>Trichodesma</i>   | <i>zeylanicum</i>                  | Camel Bush           |               |
| Boraginaceae   | <i>Halgania</i>      | <i>cyanea</i> var. Allambi Station |                      |               |
| Boraginaceae   | <i>Heliotropium</i>  | <i>glanduliform</i>                |                      |               |
| Brassicaceae   | <i>Lepidium</i>      | <i>pedicellsum</i>                 |                      |               |
| Chenopodiaceae | <i>Enchylaena</i>    | <i>tomentosa</i>                   | Barrier Saltbush     |               |
| Chenopodiaceae | <i>Bonamia</i>       | <i>erecta</i>                      |                      |               |
| Chenopodiaceae | <i>Dissocarpus</i>   | <i>paradoxus</i>                   | Cannon Balls         |               |
| Chenopodiaceae | <i>Maireana</i>      | <i>lobiflora</i>                   |                      |               |



| Family         | Genus              | Species              | Common Name      | Status |
|----------------|--------------------|----------------------|------------------|--------|
| Chenopodiaceae | <i>Salsola</i>     | <i>sp.</i>           |                  |        |
| Chenopodiaceae | <i>Sclerolaena</i> | <i>densiflora</i>    |                  |        |
| Chenopodiaceae | <i>Sclerolaena</i> | <i>diacantha</i>     | Grey Copperburr  |        |
| Chenopodiaceae | <i>Sclerolaena</i> | <i>eriacantha</i>    | Tall Bindii      |        |
| Dilleniaceae   | <i>Hibbertia</i>   | <i>stenophylla</i>   |                  |        |
| Euphorbiaceae  | <i>Euphorbia</i>   | <i>tannensis</i>     |                  |        |
| Euphorbiaceae  | <i>Euphorbia</i>   | <i>australis</i>     | Namana           |        |
| Fabaceae       | <i>Acacia</i>      | <i>ancistrocarpa</i> | Fitzroy Wattle   |        |
| Fabaceae       | <i>Acacia</i>      | <i>bivenosa</i>      |                  |        |
| Fabaceae       | <i>Acacia</i>      | <i>coriacea</i>      | Wirewood         |        |
| Fabaceae       | <i>Acacia</i>      | <i>gregorii</i>      | Gregory's Wattle |        |
| Fabaceae       | <i>Acacia</i>      | <i>inaequilatera</i> | Baderi           |        |
| Fabaceae       | <i>Acacia</i>      | <i>jamesiana</i>     |                  |        |
| Fabaceae       | <i>Acacia</i>      | <i>ligulata</i>      |                  |        |
| Fabaceae       | <i>Acacia</i>      | <i>pyrifolia</i>     | Ranji Bush       |        |
| Fabaceae       | <i>Acacia</i>      | <i>ramulosa</i>      | Horse Mulga      |        |
| Fabaceae       | <i>Acacia</i>      | <i>sclerosperma</i>  | Limestone Wattle |        |
| Fabaceae       | <i>Acacia</i>      | <i>startii</i>       |                  | P3     |
| Fabaceae       | <i>Acacia</i>      | <i>stellaticeps</i>  |                  |        |
| Fabaceae       | <i>Acacia</i>      | <i>synchronicia</i>  |                  |        |



| Family          | Genus               | Species   | Common Name          | Status |
|-----------------|---------------------|---|----------------------|--------|
| Fabaceae        | <i>Acacia</i>       | <i>tetragonophylla</i>                            | Kurara               |        |
| Fabaceae        | <i>Acacia</i>       | <i>wiseana</i>                                    |                      |        |
| Fabaceae        | <i>Acacia</i>       | <i>xiphophylla</i>                                |                      |        |
| Fabaceae        | <i>Chorizema</i>    | <i>racemosum</i>                                  |                      |        |
| Fabaceae        | <i>Indigofera</i>   | <i>monophylla</i>                                 |                      |        |
| Fabaceae        | <i>Petalostylis</i> | <i>labicheoides</i>                               | Slender Petalostylis |        |
| Fabaceae        | <i>Senna</i>        | <i>artemisioides subsp. helmsii</i>               |                      |        |
| Fabaceae        | <i>Senna</i>        | <i>artemisioides subsp. oligophylla</i>           |                      |        |
| Fabaceae        | <i>Senna</i>        | <i>artemisioides subsp. oligophylla x helmsii</i> |                      |        |
| Fabaceae        | <i>Senna</i>        | <i>glutinosa subsp. glutinosa</i>                 |                      |        |
| Fabaceae        | <i>Senna</i>        | <i>glutinosa subsp. pruinosa</i>                  |                      |        |
| Fabaceae        | <i>Senna</i>        | <i>venusta</i>                                    |                      |        |
| Fabaceae        | <i>Tephrosia</i>    | <i>uniovulata</i>                                 |                      |        |
| Goodeniaceae    | <i>Goodenia</i>     | <i>microptera</i>                                 |                      |        |
| Goodeniaceae    | <i>Scaevola</i>     | <i>sericophylla</i>                               |                      |        |
| Goodeniaceae    | <i>Scaevola</i>     | <i>acacioides</i>                                 |                      |        |
| Gyrostemonaceae | <i>Codonocarpus</i> | <i>cotinifolius</i>                               | Native Poplar        |        |
| Lamiaceae       | <i>Pityrodia</i>    | <i>loxocarpa</i>                                  |                      |        |
| Malvaceae       | <i>Alyogyne</i>     | <i>pinoniana</i>                                  | Sand Hibiscus        |        |



| Family        | Genus              | Species                                      | Common Name            | Status |
|---------------|--------------------|--|------------------------|--------|
| Malvaceae     | <i>Corchorus</i>   | <i>sidoides</i>                              |                        |        |
| Malvaceae     | <i>Hibiscus</i>    | <i>burtonii</i>                              |                        |        |
| Malvaceae     | <i>Lawrenzia</i>   | <i>densiflora</i>                            |                        |        |
| Molluginaceae | <i>Mollugo</i>     | <i>molluginea</i>                            |                        |        |
| Myrtaceae     | <i>Eucalyptus</i>  | <i>victrix</i>                               |                        |        |
| Myrtaceae     | <i>Melaleuca</i>   | <i>cardiophylla</i>                          | Tangling Melaleuca     |        |
| Myrtaceae     | <i>Corymbia</i>    | <i>zygophylla</i>                            |                        |        |
| Poaceae       | <i>Aristida</i>    | <i>aristidea</i>                             |                        |        |
| Poaceae       | <i>Aristida</i>    | <i>contorta</i>                              | Bunched Kerosene Grass |        |
| Poaceae       | <i>Aristida</i>    | <i>holathera</i>                             |                        |        |
| Poaceae       | <i>Cenchrus</i>    | <i>ciliaris</i>                              | Buffel Grass           | *      |
| Poaceae       | <i>Eragrostis</i>  | <i>pergracilis</i>                           |                        |        |
| Poaceae       | <i>Paspalidium</i> | <i>basicladum</i>                            |                        |        |
| Poaceae       | <i>Triodia</i>     | <i>basedowii</i>                             | Lobed Spinifex         |        |
| Poaceae       | <i>Triodia</i>     | sp.1 Insufficient material                   |                        |        |
| Proteaceae    | <i>Grevillea</i>   | <i>eristachya</i>                            | Flame Grevillea        |        |
| Proteaceae    | <i>Grevillea</i>   | <i>stenobotrya</i>                           |                        |        |
| Proteaceae    | <i>Hakea</i>       | <i>preissii</i>                              | Needle Tree            |        |
| Proteaceae    | <i>Hakea</i>       | <i>stenophylla</i> subsp. <i>stenophylla</i> |                        |        |
| Proteaceae    | <i>Hakea</i>       | <i>lorea</i> subsp. <i>borealis</i>          |                        |        |



| Family           | Genus              | Species                                      | Common Name         | Status |
|------------------|--------------------|--|---------------------|--------|
| Santalaceae      | <i>Exocarpos</i>   | <i>aphyllus</i>                              | Leafless Ballart    |        |
| Sapindaceae      | <i>Alectryon</i>   | <i>oleifolius</i>                            |                     |        |
| Sapindaceae      | <i>Diplopeltis</i> | <i>eriocarpa</i>                             |                     |        |
| Scrophulariaceae | <i>Eremophila</i>  | <i>cuneifolia</i>                            | Pinyuru             |        |
| Scrophulariaceae | <i>Eremophila</i>  | <i>forrestii</i> subsp. <i>forrestii</i>     | Wilcox Bush         |        |
| Scrophulariaceae | <i>Eremophila</i>  | <i>latrobei</i>                              | Warty Fuchsia Bush  |        |
| Scrophulariaceae | <i>Eremophila</i>  | <i>ptercocarpa</i> subsp. <i>ptercocarpa</i> |                     |        |
| Solanaceae       | <i>Solanum</i>     | <i>lasiophyllumi</i>                         | Flannel Bush        |        |
| Solanaceae       | <i>Solanum</i>     | <i>phlomoides</i>                            |                     |        |
| Stylidiaceae     | <i>Stylidium</i>   | <i>spathulatum</i>                           | Creamy Triggerplant |        |
| Thymelaeaceae    | <i>Pimelea</i>     | <i>ammocharis</i>                            |                     |        |
| Zygophyllaceae   | <i>Tribulus</i>    | <i>Macrocarpus</i>                           |                     |        |

Where: \*=Exotic species, P3= Priority 3



## Appendix C

# Project Area Fauna List



**Table 17 Fauna List for North West Coastal Highway Strategic Material Pit SLK 666A and B**

| Type | Family           | Genus               | Species                | Common Name               | EPBC   | WC | DEC | Exotic | Record | Observed Pit 6 | Observed Pit 7 |
|------|------------------|---------------------|------------------------|---------------------------|--------|----|-----|--------|--------|----------------|----------------|
| Bird | Acanthizidae     | <i>Pyrrholaemus</i> | <i>brunneus</i>        | Redthroat                 |        |    |     |        | N      |                |                |
| Bird | Accipitridae     | <i>Aquila</i>       | <i>audax</i>           | Wedge-tailed Eagle        |        |    |     |        | N      |                |                |
| Bird | Accipitridae     | <i>Circus</i>       | <i>assimilis</i>       | Spotted Harrier           |        |    |     |        | N      |                |                |
| Bird | Accipitridae     | <i>Haliastur</i>    | <i>sphenurus</i>       | Whistling Kite            | Ma     |    |     |        | N      |                | x              |
| Bird | Accipitridae     | <i>Haliaeetus</i>   | <i>leucogaster</i>     | White-bellied Sea-Eagle   | Mi; Ma | S3 |     |        | EPBC   |                |                |
| Bird | Apodidae         | <i>Apus</i>         | <i>pacificus</i>       | Fork-tailed Swift         | Mi; Ma | S3 |     |        | EPBC   |                |                |
| Bird | Ardeidae         | <i>Ardea</i>        | <i>alba</i>            | Great Egret               | Mi; Ma | S3 |     |        | EPBC   |                |                |
| Bird | Ardeidae         | <i>Ardea</i>        | <i>ibis</i>            | Cattle Egret              | Mi; Ma | S3 |     |        | EPBC   |                |                |
| Bird | Artamidae        | <i>Artamus</i>      | <i>cinereus</i>        | Black-faced Woodswallow   |        |    |     |        | N      |                |                |
| Bird | Campephagidae    | <i>Coracina</i>     | <i>novaehollandiae</i> | Black-faced Cuckoo-shrike | Ma     |    |     |        | N      |                |                |
| Bird | Casuariidae      | <i>Dromaius</i>     | <i>novaehollandiae</i> | Emu                       |        |    |     |        | N      | x              |                |
| Bird | Charadriidae     | <i>Charadrius</i>   | <i>veredus</i>         | Oriental Plover           | Mi, Ma | S3 |     |        | EPBC   |                |                |
| Bird | Cinclostomatidae | <i>Psophodes</i>    | <i>occidentalis</i>    | Western Wedgebill         |        |    |     |        | N      |                | x              |
| Bird | Columbidae       | <i>Ocyphaps</i>     | <i>lophotes</i>        | Crested Pigeon            |        |    |     |        | N      |                |                |
| Bird | Corvidae         | <i>Corvus</i>       | <i>orru</i>            | Torresian Crow            |        |    |     |        | N      |                | x              |



| Type | Family       | Genus                | Species             | Common Name              | EPBC   | WC | DEC | Exotic | Record | Observed Pit 6 | Observed Pit 7 |
|------|--------------|----------------------|---------------------|--------------------------|--------|----|-----|--------|--------|----------------|----------------|
| Bird | Cracticidae  | <i>Cracticus</i>     | <i>tibicen</i>      | Australian Magpie        |        |    |     |        | N      |                |                |
| Bird | Dicruridae   | <i>Grallina</i>      | <i>cyanoleuca</i>   | Magpie-lark              |        |    |     |        | N      |                |                |
| Bird | Dicruridae   | <i>Rhipidura</i>     | <i>leucophrys</i>   | Willie Wagtail           |        |    |     |        | N      |                |                |
| Bird | Estrillidae  | <i>Emblema</i>       | <i>pictum</i>       | Painted Finch            |        |    |     |        | N      |                |                |
| Bird | Estrillidae  | <i>Taeniopygia</i>   | <i>guttata</i>      | Zebra Finch              |        |    |     |        | N      |                |                |
| Bird | Falconidae   | <i>Falco</i>         | <i>cenchroides</i>  | Australian Kestrel       | Ma     |    |     |        | N      |                |                |
| Bird | Falconidae   | <i>Falco</i>         | <i>longipennis</i>  | Australian Hobby         |        |    |     |        | N      |                |                |
| Bird | Halcyonidae  | <i>Dacelo</i>        | <i>leachii</i>      | Blue-winged Kookaburra   |        |    |     |        | N      |                |                |
| Bird | Hirundinidae | <i>Hirundo</i>       | <i>rustica</i>      | Barn Swallow             | Mi ;Ma | S3 |     |        | EPBC   |                |                |
| Bird | Maluridae    | <i>Malurus</i>       | <i>leucopterus</i>  | White-winged Fairy-wren  |        |    |     |        | N      | x              |                |
| Bird | Meliphagidae | <i>Acanthagenys</i>  | <i>rufogularis</i>  | Spiny-cheeked Honeyeater |        |    |     |        | N      |                |                |
| Bird | Sylviidae    | <i>Cincloramphus</i> | <i>mathewsi</i>     | Rufous Songlark          |        |    |     |        | N      |                | x              |
| Bird | Meliphagidae | <i>Lichenostomus</i> | <i>keartlandi</i>   | Grey-headed Honey-eater  |        |    |     |        | N      | x              |                |
| Bird | Meliphagidae | <i>Lichenostomus</i> | <i>penicillatus</i> | White-plumed Honeyeater  |        |    |     |        | N      |                |                |
| Bird | Meliphagidae | <i>Lichenostomus</i> | <i>virescens</i>    | Singing Honeyeater       |        |    |     |        | N      |                |                |
| Bird | Meliphagidae | <i>Manorina</i>      | <i>flavigula</i>    | Yellow-throated Miner    |        |    |     |        | N      |                |                |





| Type    | Family          | Genus               | Species            | Common Name          | EPBC   | WC | DEC | Exotic | Record | Observed Pit 6 | Observed Pit 7 |
|---------|-----------------|---------------------|--------------------|----------------------|--------|----|-----|--------|--------|----------------|----------------|
| Bird    | Meropidae       | <i>Merops</i>       | <i>ornatus</i>     | Rainbow Bee-eater    | Mi; Ma | S3 |     |        | EPBC   |                |                |
| Bird    | Pachycephalidae | <i>Oreoica</i>      | <i>gutturalis</i>  | Crested Bellbird     |        |    |     |        | N      |                |                |
| Bird    | Pomatostomidae  | <i>Pomatostomus</i> | <i>temporalis</i>  | Grey-crowned Babbler |        |    |     |        | N      |                |                |
| Bird    | Psittacidae     | <i>Cacatua</i>      | <i>sanguinea</i>   | Little Corella       |        |    |     |        | N      |                |                |
| Bird    | Psittacidae     | <i>Nymphicus</i>    | <i>hollandicus</i> | Cockatiel            |        |    |     |        | N      |                |                |
| Mammal  | Bovidae         | <i>Capra</i>        | <i>hircus</i>      | Goat                 | *      |    |     |        | EPBC   |                |                |
| Mammal  | Canidae         | <i>Vulpes</i>       | <i>vulpes</i>      | Red Fox              | *      |    |     |        | EPBC   |                |                |
| Mammal  | Dasyuridae      | <i>Dasycercus</i>   | <i>cristicauda</i> | Mulgara              | V      | S1 |     |        | EPBC   |                |                |
| Mammal  | Dasyuridae      | <i>Dasycercus</i>   | <i>hallucatus</i>  | Northern Quoll       | E      | S1 |     |        | EPBC   |                |                |
| Mammal  | Felidae         | <i>Felis</i>        | <i>catus</i>       | Cat                  | *      |    |     |        | EPBC   |                |                |
| Mammal  | Leporidae       | <i>Oryctolagus</i>  | <i>cuniculus</i>   | Rabbit               | *      |    |     |        | EPBC   |                |                |
| Reptile | Agamidae        | <i>Ctenophorus</i>  | <i>rubens</i>      | Red Dragon Lizard    |        |    |     |        | N      | x              |                |
| Reptile | Gekkonidae      | <i>Gehyra</i>       | <i>pilbara</i>     |                      |        |    |     |        | N      |                |                |

Where: V= Vulnerable, E= Endangered, S1= Schedule 1, S3=Schedule 3, \* =Exotic, Ma=Marine, Mi=Migratory



Appendix D

## Assessment Against the Ten Clearing Principles



**(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Plant Species</b></p> <ul style="list-style-type: none"> <li>▶ Total Vascular Plant Taxa <ul style="list-style-type: none"> <li>– A total of 89 flora taxa from 25 families were recorded within the Project Area, representing a moderate level of diversity, with one weed species. This total is considered to be similar to that found in the local and regional area.</li> </ul> </li> <li>▶ Vascular Plant Taxa Diversity <ul style="list-style-type: none"> <li>– Diversity in the Project Area is considered to be comparable to that found in the local area; in similar habitat that has areas of disturbance (e.g. roads, tracks, pastoral stations).</li> </ul> </li> <li>▶ Priority Flora, Significant Flora <ul style="list-style-type: none"> <li>– One Priority Flora taxa was recorded within the Project Area: <ul style="list-style-type: none"> <li>• <i>Acacia startii</i> (Priority 3).</li> </ul> </li> <li>– A total of 253 plants were recorded within the 'Cleared/ Degraded' area of the Material Pit and 252 plants within the 'Sandplain Rocky' vegetation type. Given that the population within the 'Cleared/Degraded area of the Material Pit is equivalent to the population within the 'Sandplain Rocky' and it thrives from disturbances, GHD believes that the proposed project activities are likely to enhance the preferred habitat and increase germination of this species. GHD considers that this species population within the local and regional area will not be under threat from the proposed project activities, as this species is widespread.</li> </ul> </li> </ul> <p><b>Fauna Species</b></p> <ul style="list-style-type: none"> <li>▶ Total Fauna Taxa <ul style="list-style-type: none"> <li>– The reconnaissance fauna survey recorded seven birds and one reptile within the Project Area. The survey result was considered to be a relatively good reflection of fauna species present.</li> </ul> </li> </ul> <p><b>Ecosystem Diversity</b></p> <ul style="list-style-type: none"> <li>▶ Number of Ecological Communities (Plant, Fauna) <ul style="list-style-type: none"> <li>– A total of three vegetation types and three fauna habitats were recorded within the Project Area. This includes a cleared/degraded vegetation type/habitat. These communities are also present in the local area in similar or better condition.</li> </ul> </li> <li>▶ Habitat Diversity <ul style="list-style-type: none"> <li>– Habitats (macro- and microhabitats) found in the Project Area are also present in the local area in similar or better condition.</li> </ul> </li> <li>▶ Variety of Soil Types/Geological Formations <ul style="list-style-type: none"> <li>– Soil types or geological formations in the Project Area are also present in the local and regional area.</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered unlikely at variance with this Principle. The <i>Acacia startii</i> has been identified as a disturbance response species. GHD considers that this species is widespread within the local and regional area, with the population not under threat from the proposed project activities.   |



**(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.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Significant Fauna</b></p> <ul style="list-style-type: none"> <li>▶ Threatened Fauna <ul style="list-style-type: none"> <li>– The desktop assessment indicated that threatened fauna may potentially utilise the Project Area. Significant habitat for threatened fauna was not recorded within the Project Area, with the habitat considered to be common in the local and regional area. No Threatened Fauna taxa were recorded from the Project Area.</li> </ul> </li> <li>▶ Priority Fauna <ul style="list-style-type: none"> <li>– The desktop assessment indicated that priority fauna may potentially utilise the Project Area for foraging. No Priority fauna species were recorded within the Project Area.</li> </ul> </li> <li>▶ Other Significant Fauna <ul style="list-style-type: none"> <li>– The desktop assessment indicated that significant fauna may occur in the Project Area. No EPBC Act Marine and/or Migratory Listed species were recorded within the Project Area.</li> </ul> </li> </ul> <p><b>Habitat</b></p> <ul style="list-style-type: none"> <li>▶ Significant Habitat / Habitats of Significance <ul style="list-style-type: none"> <li>– No habitat deemed to be significant occurs in the Project Area. Habitat in the Project Area also occurs in the local area in similar or better condition. The habitat in the Project Area is disturbed by road maintenance, and pastoral activities.</li> </ul> </li> <li>▶ Habitat Extent and Retention <ul style="list-style-type: none"> <li>– Habitats recorded within the Project Area are also found in the local area in similar or better condition. The proposed Project will not significantly diminish the extent of these habitats.</li> </ul> </li> <li>▶ Ecological Corridors <ul style="list-style-type: none"> <li>– The habitat in the Project Area occurs in a region with relatively undisturbed ecological corridors. Existing corridors are not considered to be significantly modified by the proposed project.</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered to be not at variance with this clearing principle.   |

**(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Rare Flora</b></p> <ul style="list-style-type: none"> <li>▶ Presence <ul style="list-style-type: none"> <li>– No Threatened (Declared Rare) Flora taxa were indicated to occur within the vicinity of the Project Area as a result of database searches. No Threatened (Declared Rare) Flora taxa were recorded in the Project Area during the field survey.</li> </ul> </li> </ul> |



|                   |  |
|-------------------|--|
|                   | <ul style="list-style-type: none"> <li>▶ Habitat             <ul style="list-style-type: none"> <li>– No habitat considered to be required for the continued existence of Threatened Flora is considered to be present in the Project Area.</li> </ul> </li> </ul> |
| <b>Assessment</b> | Project is considered to be not at variance with this 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.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Vegetation</b></p> <ul style="list-style-type: none"> <li>▶ Extent and Status             <ul style="list-style-type: none"> <li>– Vegetation Associations within the vicinity of the Project Area are considered to be of Least Concern with &gt;90% remaining.</li> <li>– One vegetation type recorded in the Project Area is considered to be equivalent to the Vegetation Associations indicated by Beard.</li> </ul> </li> <li>▶ Communities             <ul style="list-style-type: none"> <li>– No Threatened Ecological Communities were recorded within the Project Area.</li> <li>– The buffer of four Priority Ecological Communities overlaps the Project Area. These PECs includes CB 76, CB 77, CB 78 and CB 79 of the Lake MacLeod Invertebrate Assemblages. GHD considers that no TECs or PECs will be impacted by this project.</li> </ul> </li> <li>▶ Areas             <ul style="list-style-type: none"> <li>– No Environmentally Sensitive Areas occur in or within the immediate vicinity of the Project Area.</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered to be not at variance with this 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.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Vegetation</b></p> <ul style="list-style-type: none"> <li>▶ Extent and Status <ul style="list-style-type: none"> <li>– Vegetation Associations within the vicinity of the Project Area are considered to be of Least Concern with &gt;90% remaining.</li> <li>– One vegetation type recorded in the Project Area is considered to be equivalent to the Vegetation Associations indicated by Beard.</li> </ul> </li> <li>▶ Regionally Significant Areas <ul style="list-style-type: none"> <li>– Vegetation within the Project Area is not considered to contain communities required to maintain ecosystem services (e.g. hydrological processes).</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered to be not at variance with this 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.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Watercourses and Wetlands</b></p> <ul style="list-style-type: none"> <li>▶ Hydrology <ul style="list-style-type: none"> <li>– No watercourses or wetlands occur within the Project Area in the desktop assessment.</li> <li>– No ephemeral watercourses were recorded within the vicinity of the Project Area, during the field survey.</li> </ul> </li> <li>▶ Groundwater Dependent Ecosystems <ul style="list-style-type: none"> <li>– No groundwater dependent ecosystems occur within or adjacent to the Project Area.</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered to be not at variance with this clearing principle.   |



**(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Land Degradation</b></p> <ul style="list-style-type: none"> <li>▶ Soil Erosion <ul style="list-style-type: none"> <li>– Erosion from wind or water is considered to be minimal. Much of the surrounding land surface is well vegetated.</li> <li>– The clearing of native vegetation is not expected to alter the quality or quantity of water run-off in or adjacent to the Project Area. Waterlogging and changes to nutrient levels are not expected to be altered by the clearing of vegetation in the Project Area.</li> </ul> </li> <li>▶ Soil Acidity <ul style="list-style-type: none"> <li>– The clearing of vegetation is not considered to alter soil acidity in or adjacent to the Project Area.</li> </ul> </li> <li>▶ Salinity <ul style="list-style-type: none"> <li>– The clearing of vegetation is not considered to significantly alter the hydrological balance and cause a change in the salinity either on or off-site.</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered to be not at variance with this clearing principle. MRWA proposes to clear one to two hectares of vegetation every two years, or when maintenance and project works are required. MRWA has advised that they will take a staged pit development approach, which means each one to two hectares will be revegetated at each stage, before opening up new areas of clearing.  |

**(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.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Conservation Areas</b></p> <ul style="list-style-type: none"> <li>▶ Protected Areas <ul style="list-style-type: none"> <li>– It not expected that the material test pits will impact conservation areas.</li> </ul> </li> <li>▶ Fragmentation <ul style="list-style-type: none"> <li>– The Project Area occurs in an area where the vegetation is relatively un-fragmented.</li> </ul> </li> <li>▶ Ecological Linkages <ul style="list-style-type: none"> <li>– The Project Area occurs in a region where the vegetation ecological linkages remain mostly intact. Existing ecological linkages are not considered to be impacted by the proposed works.</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered to be not at variance with this 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.**

|                       |  |
|-----------------------|--|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results   |
| <b>Survey Results</b> | <p><b>Water Quality</b></p> <ul style="list-style-type: none"> <li>▶ Catchment Areas <ul style="list-style-type: none"> <li>– The Project Area does not occur within a proclaimed Public Drinking Water Supply Catchment.</li> </ul> </li> <li>▶ Groundwater <ul style="list-style-type: none"> <li>– The clearing of vegetation is not considered to cause an alteration to the quality of groundwater in or adjacent to the Project Area.</li> <li>– No groundwater dependent ecosystems occur in or adjacent to the Project Area.</li> </ul> </li> <li>▶ Surface Water <ul style="list-style-type: none"> <li>– The clearing of vegetation is not considered to cause an alteration to the quality of surface waters in or adjacent to the Project Area.</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered to be not at variance with this clearing principle.  |

**(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.**

|                       |   |
|-----------------------|---|
| <b>Methodology</b>    | Desktop assessment of available information and field survey results  |
| <b>Survey Results</b> | <p><b>Water Quantity</b></p> <ul style="list-style-type: none"> <li>▶ Flooding <ul style="list-style-type: none"> <li>– The clearing of vegetation in the Project Area is not considered to alter the frequency or intensity of flood events. Runoff coefficients in the Project Area are not likely to be significantly altered by the clearing of native vegetation.</li> </ul> </li> </ul> |
| <b>Assessment</b>     | Project is considered to be not at variance with this clearing principle.   |





**GHD** Pty Ltd

Level 1, 209 Foreshore Drive Geraldton WA 6530

T: (08) 9920 9400 F: (08) 9920 9499 E: getmail@ghd.com.au

© **GHD 2012**

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

**Document Status**

| Rev No. | Author     | Reviewer  |   | Approved for Issue |   |            |
|---------|------------|-----------|---|--------------------|---|------------|
|         |            | Name      | Signature   | Name               | Signature   | Date       |
| 0       | C. Wharton | J. Foster |  | J. Foster          |  | 11/04/2012 |
|         |            |           |   |                    |   |            |
|         |            |           |   |                    |   |            |
|         |            |           |   |                    |   |            |