Pablo Shopen  
Pilbara Task Force  
Department of Sustainability, Environment, Water, Population and Communities  
GPO Box 787  
CANBERRA ACT 2601

21 December 2012

Dear Mr Shopen

ADDITIONAL INFORMATION – THE NORTH STAR HEMATITE PROJECT

Fortescue Metals Group Limited (Fortescue) is currently developing the North Star Hematite Project (the Project), located approximately 110 km south-east of Port Hedland in the Pilbara region of Western Australia. As part of the assessment of this Project under the Environment Protection and Biodiversity Conservation Act 1999, the Department of Sustainability, Environment, Water Population and Communities, requested additional information regarding the Project on 16 October 2012. This additional information is enclosed in the following reports:

- NS-RP-EN-0011 Additional Information for EPBC Assessment by Preliminary Documentation: North Star Hematite Project; and

Please note that the EPBC Listed Threatened Fauna Management Plan is enclosed as Appendix A to the Additional Information for EPBC Assessment by Preliminary Documentation.

If you have any queries regarding the enclosed information please do not hesitate to contact Rachael Sharp, on 6218 8805 or at rsharp@fmgl.com.au.

Yours sincerely

FORTESCUE METALS GROUP

SEAN MCCUNNIGLE  
Manager, Environment - Approvals

Enc. NS-RP-EN-0011 Additional Information for EPBC Assessment by Preliminary Documentation: North Star Hematite Project  
Enc. CD
Additional Information for EPBC Assessment by Preliminary Documentation

North Star Hematite Project

21 December 2012
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<td>Ian Zlatnik</td>
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1. INTRODUCTION

FMG Iron Bridge Limited (FMG Iron Bridge) proposes to develop the North Star Hematite Project (the Project), located approximately 110 kilometres (km) south of Port Hedland in the Pilbara region of Western Australia (Figure 1). FMG Iron Bridge is a subsidiary company of Fortescue Metals Group Limited (Fortescue).

It is proposed to extract approximately 12 million tonnes (Mt) of mag-hematite (hematite) at an annual rate of up to 5 million tonnes per annum (Mtpa) for approximately 2.5 years. Ore will undergo crushing, screening and some magnetic separation, to produce approximately 1 Mtpa of saleable product. The conceptual Project layout is shown on Figure 2.

The Project was referred to the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) on 27 August 2012 (referral reference EPBC 2012/6530).

Fortescue was advised on 11 October 2012 that the Project was considered a controlled action, on the basis of impacts to listed threatened species and communities (Section 18 and 18 A), to be assessed by preliminary documentation. Correspondence received from DSEWPaC on 16 October 2012 outlined specific requirements for additional information to be provided to DSEWPaC. This document has been prepared in response to the request for additional information, in order to allow DSEWPaC to assess the Project under section 95A of the EPBC Act.
2. PROJECT DESIGN OPTIONS

The Project has been subject to feasibility studies and options analysis, to ensure that it can be constructed, operated and closed at optimum efficiency and economic benefit whilst minimising social and environmental impacts. For this Project, cost has not been the primary driver in Project design in many aspects of the Project; design has been driven by constraints such as operational feasibility, topography, resource location, product marketability and environmental factors. A brief summary of the options considered for major infrastructure is included in the sections below.

2.1 Mining Area (Pit)

The following options were considered for the mining area:

- pit size (large or small design).

The pit location was driven by the location of the resource, as determined during exploration drilling activities.

<table>
<thead>
<tr>
<th>Project Area</th>
<th>Option</th>
<th>Benefits</th>
<th>Constraints</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining area (pit)</td>
<td>Large pit design</td>
<td>- Increased flexibility for detailed mine planning.</td>
<td>Larger pit designs would necessitate the disturbance of several heritage sites which requires approval and results in delay to commencement of Project.</td>
<td>Small pit design selected.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Access to additional resource during the life of this Project.</td>
<td>Larger pit designs would result in direct impact on recorded Pilbara Leaf Nosed bat roosting habitat.</td>
<td>Location selected to avoid known Aboriginal Heritage sites and critical habitat for EPBC Act listed threatened species.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Additional pre-strip cost associated with increased footprint.</td>
<td></td>
</tr>
<tr>
<td>Small pit design</td>
<td></td>
<td>- Avoids direct impact on known EPBC Act listed threatened species and conservation significant habitat.</td>
<td>Reduced flexibility on fleet selection and pit scheduling.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Avoids sites of known Aboriginal heritage significance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Allows optimisation of earthworks and pre-strip costs for tonnes of resource mined.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.2 Ore Stockpiling and Processing

The following options were considered for the ore processing and stockpiling equipment and project design:

- processing (dry or wet)
- crushing equipment (fixed or mobile).

The layout of key infrastructure was developed to ensure:

- minimal disturbance footprint
- minimal haul distances
- operational feasibility and efficiency
- feasibility in terms of topographical constraints.

| Table 2: Options Analysis for Ore Stockpiling and Processing Area |
|-------------------|------------------|-----------------------------|-----------------------------|
| **Project Area**  | **Option**       | **Benefits**                | **Constraints**              | **Selection**              |
| Processing        | Dry processing  | • Lower construction cost.  | • Dry processing results in  | Dry processing              |
|                   |                 | • Lower operating cost.     | lower product grades.       |                            |
|                   |                 | • Smaller footprint for     | • Dry processing generates  |                            |
|                   |                 | processing infrastructure.  | more fugitive dust than wet |                            |
|                   | Wet processing  | • Wet processing reduces the| • Higher construction cost.  |                            |
|                   |                 | requirement for early       | • Higher operating cost.     |                            |
|                   |                 | project water.              | • Larger footprint for      |                            |
|                   |                 | • Wet processing results in | processing infrastructure.  |                            |
|                   | Fixed crushing  | • Less frequent maintenance.|                              |                            |
|                   | equipment       |                             | • Can be larger equipment   | Combination of fixed and    |
|                   |                 |                             | allowing for higher         | mobile crushing             |
|                   | Mobile          | • Mobile equipment can be   | • Mobile equipment must be   |                            |
|                   | crushing        | easily removed at the end   | individually maintained     |                            |
|                   | equipment       | of the Project life.        | more frequently.            |                            |
|                   |                 | • Flexibility in location of| • Some mobile equipment is   |                            |
|                   |                 | equipment: it can be moved  | not adequately sized for the |                            |
|                   |                 | as required during different| expected throughput.        |                            |
|                   |                 | stages of Project           |                              |                            |
|                   |                 | construction and operation  |                              |                            |
|                   |                 | in order to reduce transport |                              |                            |
|                   |                 | costs.                      |                              |                            |

2.3 Waste Rock Management

The following options were considered for waste rock management:

- no backfill of waste rock: permanent external waste landform
- backfill of waste rock at closure: temporary external waste stockpile
• progressive backfill of waste rock: no external waste landform

The location of the waste stockpile was developed to ensure:

• minimal final disturbance footprint
• minimal haul distances
• operational feasibility and efficiency
• feasibility in terms of topographical constraints.

Table 3: Options Analysis for Waste Rock Management

<table>
<thead>
<tr>
<th>Project Area</th>
<th>Option</th>
<th>Benefits</th>
<th>Constraints</th>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste Rock</td>
<td>No backfill of mine waste (permanent external waste landforms)</td>
<td>• Permanent landforms require single movement of waste rock.</td>
<td>• Design of waste landforms need to meet long term closure criteria for stability and rehabilitation.</td>
<td>Backfill at mine closure (temporary external waste landforms)</td>
</tr>
<tr>
<td></td>
<td>Backfill at mine closure (temporary external waste stockpile)</td>
<td>• Temporary stockpiles reduce overall final project footprint. • Waste stockpiles do not need to be designed for extended lifespan post closure.</td>
<td>• Cost for rehandling of material following operations. • Potential resource sterilisation at mine closure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Progressive backfill (no external landforms)</td>
<td>• Less footprint required • Reduced operational cost due to no requirement for haulage of waste outside pit boundary. • Reduced costs at mine closure.</td>
<td>• Cannot be facilitated under current mine plan or current pit footprint. • Potential resource sterilisation during operations.</td>
<td></td>
</tr>
</tbody>
</table>

2.4 Product Transport

The following options were considered for product transportation:

• road transport
• rail transport.

The location of the transport corridor was developed to ensure:

• use of existing infrastructure maximised
• avoidance of tenure constraints due to tenure availability and interaction with neighbouring and intersecting tenement holders
• maximum avoidance of sites of Aboriginal Heritage and areas of conservation significant flora, fauna or habitat
• minimised haul distances
• operational feasibility and efficiency
• feasibility in terms of topographical constraints.

Table 4: Options Analysis for Product Transport

<table>
<thead>
<tr>
<th>Project Area</th>
<th>Option</th>
<th>Benefits</th>
<th>Constraints</th>
<th>Selection</th>
</tr>
</thead>
</table>
| Product Transport | Road Transport | • Road transport is able to provide a single-handle solution<br>
• Use of existing Great Northern Highway infrastructure.<br>
• Minimal footprint required for haul road.<br>
• Haul road is cost effective in terms of construction and maintenance. | • Will require significant traffic to transport 1 Mtpa of product. | Road transport |
| Rail Transport  | Use of existing Fortescue rail network. | • Use of rail would require the construction of a costly siding and loading facility<br>
• Large footprint required for rail loop, train loading and rail access roads.<br>
• Topographical constraints to develop rail loop in close proximity to the pit. | | |

2.5 Alternative Designs to Mitigate Impacts on MNES

This Project has been designed to avoid direct impact to critical habitat for EPBC Act listed threatened species. The Project footprint has been minimised as far as possible, to minimise clearing of vegetation and hence minimise impacts on foraging and dispersal habitat for these species.

The indirect impacts to EPBC Act listed threatened species and their habitats have been minimised as far as practicable. Additional information regarding the management measures in place are described in Section 5 and Appendix 1 of this document.
3. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

The decision on the Project referral indicated that the Project constitutes a controlled action on the basis of impacts to listed threatened species and communities (Section 18 and 18 A). Specifically, impacts to the following species were considered likely:

- Northern Quoll (*Dasyurus hallucatus*)
- Pilbara Leaf-nosed Bat (*Rhinonocteris aurantius*)
- Pilbara Olive Python (*Liasis olivaceus baroni*).

Information regarding these species and details on fauna surveys undertaken for the Project are provided below.

3.1 Fauna Surveys

In April 2011, *ecologia* Environment conducted the first phase of a Level 2 vertebrate fauna assessment of the Project area. During the survey, Northern Quolls were recorded and extensive suitable habitat was recorded for Northern Quoll, Pilbara Leaf-nosed Bat and Pilbara Olive Python. As the Northern Quoll is listed under the EPBC Act as endangered and Pilbara Leaf-nosed Bats and Pilbara Olive Pythons are listed as vulnerable, a targeted conservation survey of the Project area, associated infrastructure corridor and proposed infrastructure areas was undertaken. The purpose of the survey was to provide information regarding the presence and area of suitable habitat of the three threatened species within the Project area.

The targeted survey was conducted in two survey periods in July 2011. Trapping methods and layout were conducted in accordance with the referral guidelines for Northern Quolls, survey guidelines for threatened reptiles of Australia, survey guidelines for threatened mammals of Australia and survey guidelines for threatened bats of Australia. Northern Quolls were targeted using typically one trap (large Elliott trap or cage trap) placed approximately every 100 m along linear denning/shelter habitat. In total, 172 traps were placed in suitable accessible habitat within the Project area over seven nights. In addition to trapping, nine remote sensing cameras were set up at 34 locations for three consecutive nights, and searches for secondary signs (scats, tracks etc.) were conducted for 103.5 hours. Two SM2Bat recorders were set up at 25 locations within potential Pilbara Leaf-nosed Bat habitat for a total of 287.5 hours. Pilbara Olive Pythons were targeted during opportunistic surveys along cliff faces and rocky ridges for approximately 103.5 hours.

A detailed discussion of survey methodology, data collected and limitations is provided in the survey report (*ecologia* Environment, 2012) (Appendix 2).
3.2 Northern Quoll

The Northern Quoll is a marsupial of approximately 300–1,100 g in weight, with a distinctive dark body marked with white spots. The species is a key predator in the dry savannah landscapes in northern Australia consuming a wide range of prey including beetles, grasshoppers, spiders, scorpions and centipedes, and in addition also eat fruit and nectar, carrion and human refuse. Northern Quolls also hunt a wide variety of vertebrates including the Northern Brown Bandicoot, the Common Brushtail Possum, rats, Sugar Gliders, insectivorous bats, quails, bird eggs, snakes and frogs (DEWHA, 2009).

Northern Quolls are short-lived, with females living up to three years but the majority of males undergoing a ‘die-off’ (characteristic of some carnivorous marsupials) after their first mating season, with few living more than a year (Oakwood, 2008). This makes the species susceptible to impacts that affect the survival of female and juvenile animals, and to impacts that compromise annual recruitment, such as droughts and fires.

During the non-breeding season, home ranges are about 35 ha, but this increases to about 100 ha for males in the breeding season (Oakwood, 2008).

The Northern Quoll is listed as Endangered under the EPBC Act and as Schedule 1 (ranked as Endangered) under the *Wildlife Conservation Act 1950* (WA) (WC Act).

3.2.1 Regional Habitat, Known Locations and Presence in Reserves

**Habitat Use**

Across their entire range (i.e. northern Australia) Northern Quolls live in a reasonably wide range of habitats including rocky hills and escarpments, eucalypt forests and woodlands, rainforests and areas of human settlement (Oakwood, 2008). Northern Quolls are both terrestrial and arboreal and use a variety of den sites including rock crevices, tree hollows, logs, termite mounds, house roofs and goanna burrows (Oakwood, 2008). The draft recovery plan for the Northern Quoll (prepared by the Northern Territory, Western Australian, Queensland and Commonwealth environment departments) reiterates that rocky areas provide prime habitat for Northern Quolls (Hill & Ward, 2010).

**Regional Habitat**

Within the Pilbara, areas that have the highest potential to contain resident Northern Quolls are along gullies and creek lines and around rocky or stony scree slopes, rocky boulder fields and rocky ranges. The association of the Northern Quoll with rocky habitats in the Pilbara is likely to be driven by this species’ need for suitable den sites, as woodlands containing tree hollows of suitable size are very limited in the region. Rocky habitat types are widespread and common across the Pilbara, but in terms of area represent a small portion of the landscape.
Rocky and riparian habitat types suitable for Northern Quoll are associated with 32 of the 101 Land Systems of the Pilbara. These land systems cover a total of 120,301 km² within the Pilbara (63% of land area) (Figure 3).

There are six land systems (Rocklea, Macroy, Robe, Capricorn, Wona and River) which comprise approximately three quarters of Northern Quoll records for the Pilbara regions (Biota, 2005). These six land systems contain preferred quoll habitats of rocky hills, mesa, plateaux, larger open drainages and granite boulder fields (Biota, 2005). These land systems comprise a total of 44,951 km² within the Pilbara (23.4% of the land area).

3.2.2 Results of Targeted Fauna Surveys

The targeted survey undertaken by ecologia Environment (2011) mapped a total of 900.7 ha of suitable and potential Northern Quoll habitat in the area surrounding the Project. Of this area, approximately 295 ha was classified as critical denning habitat, comprising mainly of rocky slopes, ridges and gorges. An additional 108 ha was classified as potential denning/foraging habitat. Northern Quoll denning and foraging habitat is shown on Figure 4.

A total of 20 individual Northern Quolls were captured during the targeted survey. Four of these were female, indicating a permanent breeding population (ecologia Environment, 2011). Two female quolls were captured approximately 9.5 km north east of the Project while a third female was captured approximately 3.5 km to the south. All three of these females were captured outside of the Project tenements. The fourth female was captured close to the northern extent of the North Star plateau, approximately 1.1 km west of the proposed processing area. This individual was captured on three separate occasions with all captures within 250 m of each other and within a discrete area of mapped habitat, 22 ha in extent. As the home range of female quolls is generally regarded to be about 35 ha (Oakwood 2002), it is considered likely that this female will remain within the area of mapped habitat in which it was captured and is unlikely to move into habitat mapped further south along the ridgeline.

Captures of male quolls were distributed across the majority of trapping sites. The location of all Northern Quoll captures in proximity to the mining and processing areas is shown on Figure 5 and includes records where the same individual was re-captured multiple times. Areas where female quolls have been captured are considered to be of higher value to the local population as these areas represent critical breeding habitat.

Suitable habitat for Northern Quoll is expected to be well represented in the wider region. The majority of records were from the Capricorn land system, which extends north east and south east of the Project area. Additionally, the Project area is located on the north western edge of a series of ranges which extend at least 70 km to the east and 45 km south of the Project area. These ranges are expected to provide additional suitable denning, foraging and dispersal habitat for the Northern Quoll. Outback Ecology (2011) undertook a review of surveys conducted within 150 km of Atlas Iron’s Abydos DSO project, which is located approximately 14.5 km north east of the Project area. This review found that, of the 14 surveys undertaken, 11
recorded the presence of Northern Quoll, mostly in rocky ridges, gorges, granite outcrops and watercourses (Outback Ecology, 2011). Outback Ecology (2011) recorded a total of 11 Northern Quolls from the 172 ha Abydos study area, including three females. This suggests that Northern Quolls are well represented in the local region and are likely to be found in areas of habitat similar to that found surrounding the Project area.

### 3.2.3 Population Trends in the Pilbara

In areas of human settlement, Northern Quoll appear to adjust readily to human presence and infrastructure, with some residing in houses and mine camps (Bamford, 2010), (Woiniasrski, et al., 2008).

The overall population trend (i.e. Australia wide) for the Northern Quoll is listed in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species as “decreasing” (Oakwood, 2008). Specifically, the following IUCN criteria have been applied to the Northern Quoll:

- “An observed, estimated, inferred or suspected population size reduction of ≥ 50% over the last 10 years or three generations... where the reduction or its causes may not have ceased or may not be understood or may not be reversible...”
- “...A population size reduction of ≥ 50%, projected or suspected to be met within the next 10 years or three generations..."
- “An observed, estimated, inferred, projected or suspected population size reduction of ≥ 50% over any 10 year or three generation period ... where the time period must include both the past and the future, and where the reduction or its causes may not have ceased or may not be understood or may not be reversible...”

For the Pilbara region, Northern Quoll populations have been “declining at least since the 1980s, through a time when altered fire regimes plus habitat degradation through over-grazing have occurred, although a causal link has not been established” (Hill & Ward, 2010).

Given the annual die off of male Northern Quolls, there is a need for annual recruitment of males to sustain the Northern Quoll population. Therefore the species is particularly susceptible to impacts including drought and large fires which may reduce numbers and decrease the likelihood of successful breeding over any particular season.

### 3.2.4 Threats

The Northern Quoll is distributed across tropical northern Australia, from the Kimberley in Western Australia to south-east Queensland, with a disjunct population in the Pilbara of Western Australia (Oakwood, 2008). The Pilbara population is considered important because it is the only large area of the species’ range which is currently free of Cane Toads (Bufo marinus) and not threatened by their imminent arrival. Cane Toads have severely decreased the abundance and distribution of the Northern Quoll by poisoning through ingestion.
Northern Quolls appear to be susceptible to predation if habitat refuges and shelters are removed or reduced (Jones, et al., 2003). There is also some evidence to suggest that quoll populations decline when understorey vegetation is removed or reduced by fire or grazing (Jones, et al., 2003). Feral cats and dingoes (*Canis lupus*) may predate directly on Northern Quolls (Jones, et al., 2003).

The major threats to the Northern Quoll listed in the National Recovery Plan for the Northern Quoll (Hill & Ward, 2010) relevant to the Pilbara are:

- feral predators
- inappropriate fire regimes
- habitat degradation (particularly by stock and large feral herbivores).

The major threats to the Northern Quoll listed by the IUCN, relevant to the Pilbara (Oakwood, 2008) were:

- livestock farming and ranching
- natural system modifications (fire and fire suppression)
- invasive and other problematic species and genes (invasive non-native/alien species).

### 3.2.5 Conservation Programs in the Pilbara

The main conservation effort for Northern Quolls in Western Australia involves the preparation and implementation of Cane Toad management measures by the Department of Environment and Conservation (DEC). The Cane Toad Strategy for Western Australia: 2009-2019 (DEC, 2009) includes:

- strengthening toad quarantine and abatement measures
- identifying potential refuge areas for native fauna potentially impacted by cane toads
- identifying high value biodiversity assets and potential locations for targeted conservation programs.

State government funding has also been provided to the Kimberley Toad Busters, a community-based charitable volunteer organisation, to prevent the spread of toads through the Kimberley and into the Pilbara.

DEC also undertake broad scale pest animal control programs on an annual basis which include targeting donkeys and other feral herbivores in the eastern Pilbara as well as the eastern Chichester Ranges (C. Rummery, DEC pers comm, 2010).
Outside the Pilbara, translocations of mainland Northern Quolls to islands have been trialled to secure and quarantine quoll populations, particularly from the cane toad (Rankmore, et al., 2008).

### 3.3 Pilbara Leaf-nosed Bat

The Pilbara Leaf-nosed Bat is the Pilbara form of the Orange Leaf-nosed Bat and is listed as Vulnerable under the EPBC Act. It is a moderate-sized bat with short fur, relatively small ears and a fleshy nose-leaf structure surrounding the nostrils. The bat is nocturnal and carnivorous and is thought to feed primarily on moths, beetles and opportunistically on termites, emerging from its daytime roost to forage for prey after dusk. In general the Orange Leaf-nosed Bat has a poor ability to maintain its heat and water balance (Baudinette, Churchill, Christian, Nelson, & Hudson, 2000) and is therefore dependent on warm and humid environmental conditions. The Pilbara Leaf-nosed Bat is able to persist within the now arid Pilbara environment by choosing humid and warm day roosts such as deep caves.

#### 3.3.1 Regional Habitat, Known Locations and Presence in Reserves

As with all cave-roosting bats, the Pilbara Leaf-nosed Bat has separate diurnal and nocturnal habitats - the roost and foraging sites. Dry season roosting sites for the Pilbara Leaf-nosed Bat are restricted to caves and mine adits (horizontal shafts) with stable, warm and humid microclimates because of its poor ability to thermoregulate and retain water (DSEWPaC, 2010). The roost is usually over pools of water, or deep in an area that maintains elevated temperature and humidity. Thus, the roosting site is often at depth in mines; in small crevices within caves - usually those ascending between sedimentary rock layers; and with associated groundwater seeps (DSEWPaC, 2010). In the Pilbara, few actual roost clusters have been observed, perhaps the only one being that in the Comet mine (Marble Bar) prior to 1992 (Armstrong K., 2001). Simple vertical shafts are not used by Pilbara Leaf-nosed Bats and shallow caves beneath mesa bluffs are also unlikely roost sites (Armstrong K., 2001).

Foraging habitat is diverse owing to the wide distribution of the Pilbara Leaf-nosed Bat; however in the Pilbara, it has been observed in the following habitats (DSEWPaC, 2010):

- Triodia hummock grasslands covering low rolling hills and shallow gullies with scattered *Eucalyptus camaldulensis* along the creeks
- over small watercourses amongst granite boulder terrain and around nearby koppies (small hills rising up from the spinifex grasslands)
- over pools and low shrubs in ironstone gorges
- above low shrubs and around pools in gravelly watercourses with *Melaleuca leucodendron*, such as in Barlee Range Nature Reserve.

The limiting factor for Pilbara Leaf-nosed Bat numbers is therefore considered to be roosting habitat.
The species is limited to the Pilbara and Gascoyne regions. Colonies of the Pilbara Leaf-nosed Bat are found in three distinct areas: in the mines of the eastern Pilbara; scattered throughout the Hamersley Range in smaller colonies; and in sandstone formations south of the Hamersley Range in a small number of significant colonies (Armstrong K., 2001). This includes the confirmed roosts of Bamboo Creek mine, Copper Hills mine, Klondyke Queen mine, Lalla Rookh mine and one cave in Barlee Range; and eight other likely permanent occurrences (DSEWPaC, 2010).

A major component of the Pilbara Leaf-nosed Bat population, from both a demographic and genetic perspective, occurs in Barlee Range Nature Reserve, Western Australia. No roost has been confirmed in any other reserve system in the region (DSEWPaC, 2010). The remainder of known roosts and observations of bats in flight or specimens collected occur on mining and pastoral leases. Apart from being protected in Barlee Range Nature Reserve, there is no active management of the species (DSEWPaC, 2010).

Roosting habitat for Pilbara Leaf-nosed Bat is limited to areas that are likely to contain suitable caves. These may occur in hills and ranges, plateaux, mesa, breakaways, tor fields or along river gorges. It is considered that 17 of the Pilbara Land System units are suitable habitat for Pilbara Leaf-nosed bat. A total of 83,320 km² or 43 % the Pilbara may contain suitable roosting habitat for this species (Figure 6).

### 3.3.2 Results of Targeted Fauna Surveys

The targeted survey undertaken by *ecologia* Environment (2011) mapped approximately 713 ha of terrain which may contain caves suitable as potential roost habitat for the Pilbara Leaf-nosed bat. Of this area, 418.6 ha is classed as potential wet season roost habitat and is located along the Turner River to the west of the project area. The remaining 294.4 ha is potential dry season roost habitat and is generally found along cliffs associated with ridgelines and in gorges. Potential dry and wet season roost habitat is shown on Figure 7.

Pilbara Leaf-nosed Bats were recorded from 14 locations during the 2011 survey. Four of these were considered to represent potential roost caves with three considered to be potential dry season roost caves. Three of the four potential roost caves are at least 500 m from the proposed mining and processing activities. The remaining cave is about 125 m from the southern edge of the proposed open pit. Construction/mining activity within 50 m of roost caves may result in disturbance of the bats and abandonment of the roost (Outback Ecology 2011). The locations of these caves and other records are provided on Figure 8. The survey results suggest that western cliff edges may provide roost habitat for this species (*ecologia* Environment, 2011).

The Project area is part of an extensive series of ranges and the landforms of the Project area are therefore not considered unique in the region. While these ranges have not been extensively surveyed, it is expected that suitable roost habitat will occur across the area in similar land systems and landforms as found at the Project area. Surveys undertaken as part of
the Pilbara Biological Survey indicate that the Pilbara Leaf-nosed Bat is more common than previously thought (McKenzie & Bullen, 2009). A large colony of 50 to 100 Pilbara Leaf-nosed Bats has been recorded at the Lalla Rookh Mine approximately 10 km to the north east (DSEWPaC, 2012b).

### 3.3.3 Population Trends in the Pilbara

For the Pilbara Leaf-nosed Bat, data suggest that most roost populations are stable, although accurate estimations of population sizes are difficult to achieve (DSEWPaC, 2010). There may be fluctuations in the occupancy and numbers within a roost cave or mine as a result of disturbance and subsequent relocation.

### 3.3.4 Threats

The major threats to the Pilbara Leaf-nosed Bat (DSEWPaC, 2010) are:

- heat and water loss due to the species poor ability to thermoregulate and retain water
- habitat disturbance and destruction (mine collapse, flooding of mine roosts, mine development, blasting in adjacent mine workings; human entry of roosts, infill of mine shafts during mine rehabilitation)
- natural predators (snakes, Ghost Bat)
- collisions with vehicles.

The Pilbara Leaf-nosed Bat is also particularly sensitive to human intrusion (DSEWPaC, 2010), and so may be forced to migrate from an area if noise and vibration disturbances are significant.

### 3.3.5 Conservation Programs in the Pilbara

At present there is no specific conservation programme for the Pilbara Leaf-nosed Bat in Western Australia. There are a number of proposed conservation programmes, initiatives and research directives for the management of the Pilbara Leaf-nosed Bat, but these have yet to be initiated (Metcalf & Bamford, 2010). However, a population of this species is protected in the Barlee Range Nature Reserve.

### 3.4 Pilbara Olive Python

The Pilbara Olive Python is a dull olive-brown to pale fawn or rich brown python with a white/cream belly and an average length of 2.5 m, but has been recorded at lengths up to 4 m. The Pilbara Olive Python is listed as Vulnerable under the EPBC Act and is restricted to ranges within the Pilbara region of north-western Western Australia such as the Hamersley Range, and islands of the Dampier Archipelago.
3.4.1 Regional Habitat, Known Locations and Presence in Reserves

The Pilbara Olive Python is restricted to areas within the Pilbara region of Western Australia in areas such as the Hamersley Range, and islands of the Dampier Archipelago. It is known to occur at 21 general locations within the Pilbara (TSSC 2008), with populations occurring near Pannawonica, Millstream, Tom Price and the Burrup Peninsula (Pearson, 1993).

Pilbara Olive Pythons are usually found in rocky areas or gorges, especially in rocky habitat associated with water courses however, they may also be found in hollow logs or burrows beneath rocks (DSEWPaC, 2012c). The species is an adept swimmer, often hunting in water and feeding on a variety of vertebrates including wallabies, fruit bats, ducks and pigeons. Individuals will usually spend the cooler months sheltering in caves and rock crevices and in the warmer months will move widely but usually in close proximity to water and rock outcrops (ecologia Environment, 2010). A large portion of the Pilbara Olive Python habitat is conserved in Karijini National Park.

A total of 21 Pilbara Land Systems are considered to include suitable habitat for the Pilbara Olive Python. These land systems have a total area of 97,188 km² or 51% of the Pilbara area (Figure 9).

3.4.2 Results of Targeted Fauna Surveys

A total of approximately 1,045 ha of potentially suitable Pilbara Olive Python habitat was mapped during the 2011 targeted survey by ecologia Environment. Of this area, the majority (418.6 ha, 40%) is associated with the Turner River. The habitat along the Turner River is considered critical habitat by ecologia Environment (2011). Small areas of critical habitat also occur in association with water pools in rocky gorges. Some critical habitat has been identified along the edge of the rocky ridge west of the proposed open pit and associated with a creekline to the east of the mine infrastructure area. The remaining 613 ha has been classified as Potential habitat or Inaccessible. Pilbara Olive Python habitat is shown on Figure 11.

A total of six Pilbara Olive Pythons have been recorded during the 2011 surveys. An additional three observations of secondary evidence (skin, scats or remains) were recorded during the targeted survey. All sightings of live pythons were at locations where surface water was present. One individual was recorded at Fig Pool, Cow Spring and near Dirty Water Pool while three individuals were recorded at Site 12 Pool (Figure 10). All locations are outside of areas proposed to be cleared for the Project (Figure 12).

3.4.3 Population Trends in the Pilbara

There are 21 locations within the Pilbara where the Pilbara Olive Python is known to occur with populations occurring at Pannawonica, Millstream, Tom Price and Burrup Peninsula (Ecoscape, 2010). Some authors including Kendrick (2001) have reported that the species is common and
wide spread in the Pilbara and that it should not be listed as threatened or declining. More broadly the species is considered stable and in sizable numbers at some known sites however population size estimates are difficult to make given the species cryptic nature and the lack of reliable trapping and census data (DSEWPaC, 2012c).

Due to a lack of research, it is currently unclear how Pilbara Olive Python populations respond to disturbance. While there are no quantitative measures of the resilience and re-establishment of a population following a disturbance, the species has been recorded utilising man-made water sources and structures.

### 3.4.4 Threats

Predation by feral cats and foxes, especially on juveniles is considered to be the single greatest threat to the Pilbara Olive Python, followed by the predation of food sources (quolls and rock wallabies) by foxes, major fires and the destruction of habitat by gas and mining developments (DSEWPaC, 2012c). Given the species limited range and restricted habitat, the Pilbara Olive Python may also be vulnerable to disturbance through increasing numbers of tourists using water holes and some individuals have been deliberately killed when mistaken for venomous snakes.

Mining developments have the potential to affect habitat, alter prey availability and increase deaths through vehicle collisions. Additional water bodies such as storage ponds and sewage ponds, associated with mining or development however, appear to benefit the snake and provide extra habitat where none existed before (DSEWPaC, 2012c).

### 3.4.5 Conservation Programs in the Pilbara

Kendrick and McKenzie (2001) suggested that no recovery plan is required for the Pilbara Olive Python as the species is considered common, widespread and not in population decline.

The Threatened Species Scientific Committee (TSSC, 2008) compiled conservation advice for the Pilbara Olive Python, which outlined priority research and actions to assist in the protection of this species. It is not known if any of the actions described in the advice have been implemented to date.
4. **RELEVANT IMPACTS**

Potential impacts to terrestrial fauna species and habitats as a result of development of the Project are discussed below. Aspects of the Project that may result in direct or indirect impacts to terrestrial fauna and habitat are:

- habitat loss
- habitat fragmentation
- changes to surface hydrology
- alteration in fauna behaviour due to noise and vibration, and light emissions
- competition from feral fauna species
- fauna mortality or injury due to Project operations or fauna – workforce integrations.

These potential impacts are discussed in more detail below in terms of their relevance to the three EPBC Act listed threatened species.

The aspect of primary relevance to potential impacts on EPBC Act listed threatened species in the mine area is the clearing and earthworks associated with the construction of the Project. The Project has been designed to avoid or minimise impacts to fauna habitat of conservation significance, roost caves for the Pilbara Leaf-nosed Bat, and impacts to semi-permanent or permanent water pools.

Development of the Project will result in the disturbance of about 645 ha of fauna habitat. Of this total disturbance, 370 ha will be cleared from within specified locations for infrastructure and 275 ha will be cleared within L45/293 and L45/294 for borrow pits. Table 5 describes this disturbance by habitat type together with the percentage of habitat cleared in relation to the currently mapped extent.

The Project is a greenfields, stand-alone Project, as such, cumulative and facilitated impacts are not considered relevant.
<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>Vegetation Description</th>
<th>Area of Habitat Mapped (ha)</th>
<th>Area of Habitat expected to be Cleared (ha)</th>
<th>Percentage ofMapped Habitat Disturbed (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia shrubland on hard soil</td>
<td>Moderate density, ground cover comprises low shrubs and medium sized Spinifex clumps. Hard soil does not allow the construction of burrows.</td>
<td>485</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Creek line</td>
<td>Large eucalypt trees fringing water courses, lemon grass and sword grass.</td>
<td>1,586</td>
<td>3</td>
<td>0.2%</td>
</tr>
<tr>
<td>Granite Outcrop</td>
<td>Large boulders of granite domes with low Spinifex tussock grassland and occasional low shrubs.</td>
<td>51</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Rocky Plains with Spinifex</td>
<td>Moderate layer of Spinifex and denser shrub layer</td>
<td>6,069</td>
<td>21</td>
<td>0.4%</td>
</tr>
<tr>
<td>Rocky ridges, breakaways and rocky gorges</td>
<td>Usually surrounded by large areas of rocky Spinifex hills, differ in vegetation structure, substrate, and landform. Rocky gorges associated with semi-permanent waterholes.</td>
<td>520</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Rocky Spinifex Hills</td>
<td>Open vegetation structure, small clumps of Spinifex and scattered low and mid-sized shrubs.</td>
<td>23,843</td>
<td>337</td>
<td>1.4%</td>
</tr>
<tr>
<td>Sandy Plains with Spinifex and Scattered Granites</td>
<td>Predominated by small to medium sized Spinifex clumps and scattered small granite domes.</td>
<td>2,889</td>
<td>8</td>
<td>0.3%</td>
</tr>
<tr>
<td>Eriachne tussock grassland</td>
<td>Sparse vegetation, dominated by Eriachne tussock grasses</td>
<td>106</td>
<td>1</td>
<td>0.9%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>35,549</td>
<td>370</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

An additional 275 ha of fauna habitat will be cleared from within the L45/293 and L45/294 lease areas for the purpose of borrow pits. Geotechnical assessment of borrow material are still underway so the exact location of the borrow areas cannot be specified at this time. Borrow will not be removed from within the following fauna habitat areas, which have been identified as potential habitat for EPBC listed threatened fauna species:

- creek line
- rocky ridges, breakaways and rocky gorges
- granite outcrop.

### 4.1 Northern Quoll

#### Loss of Habitat

The Rocky Ridges, Breakaways and Rocky Gorges habitat occurs along the edges of ridgelines, in particular occurring in association with the Gorge Range within which the Project area is located. Mapping undertaken by ecologia Environment (2011) recorded 520 ha of this
habitat in the Project area and surrounds. The habitat is likely to be well represented in the wider region with ridges, plateaus and gorges extending at least 70 km to the east and 45 km to the south of the Project area.

About 249 ha (42%) of The Rocky Ridges, Breakaways and Rocky Gorges habitat has been identified as suitable denning and breeding habitat for the Northern Quoll. Up to 606 ha of habitat has been identified as foraging and dispersal habitat for the Northern Quoll (ecologia Environment, 2011). This includes the remainder of the Rocky Ridges, Breakaways and Rocky Gorges habitat, as well as portions of the Granite Outcrop habitat and Creek line habitat along the Turner River.

In addition to the critical and foraging habitat identified in the targeted surveys, the Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the endangered northern quoll (DSEWPaC 2011) specify that due to a lack of understanding about the characteristics of foraging or dispersal habitat for the Northern Quoll, any land comprising predominantly native vegetation located within 2 km of denning habitat should be considered potential foraging and dispersal habitat for the species. The majority of direct disturbance for the mine area of the Project occurs within 2 km of denning habitat. In the Project area, this incorporates portions of Rocky Spinifex Hills habitat type. Figure 4 shows the extent of the foraging and dispersal habitat defined by the 2 km zone, identified as ‘DSEWPaC-defined Foraging and Dispersal Habitat’. This zone covers approximately 34,400 ha, of which approximately 328 ha is proposed to be disturbed by the Project, excluding any disturbance required for the establishment of borrow areas.

No direct impacts due to clearing are anticipated within the Rocky Ridges, Breakaways and Rocky Gorges habitat or the Granite Outcrop habitat. Up to 3 ha (0.2%) of the mapped extent of the Creek line habitat will be cleared in order to construct a crossing for the Mine Access and Haul Road. This equates to direct disturbance (clearing) of about 0.4% of the mapped extent of potential denning, foraging, breeding and dispersal habitat for the Northern Quoll identified during the targeted survey, excluding the DSEWPaC-defined foraging and dispersal habitat.

The Rocky Ridges, Breakaways and Rocky Gorges habitat may be subject to indirect impacts from elevated levels of dust deposition, particularly immediately to the west of the proposed processing area.

Dust modelling indicates that vegetation comprising the Rocky Ridges, Breakaways and Rocky Gorges habitat to the west of the proposed processing infrastructure area habitat has the potential to be temporarily impacted by elevated levels of dust deposition during the short duration of the Project. This indirect impact has the potential to reduce the health of the vegetation and, consequently, degradation of this habitat.

Northern Quoll habitat immediately to the west of the proposed open pit may be indirectly impacted through elevated levels of dust deposition during the life of the Project. However, as there were no female quolls recorded, it is likely that this area does not provide suitable breeding habitat and instead is used for foraging and dispersal, with male Northern Quolls
moving through the area in order to access habitat and home ranges of female quolls to the north and south.

The area of habitat along the northern end of the North Star plateau (north-west of the proposed processing infrastructure) is likely to constitute the home range of the female captured in this area and is therefore considered to be of greater importance to the breeding population than the habitat immediately west of the proposed open pit. Being further away from dust emission sources, this area has a low risk of indirect impacts from elevated levels of dust deposition.

<table>
<thead>
<tr>
<th>Habitat Unit</th>
<th>Area Subject to Direct Impact (Clearing) (ha)</th>
<th>Area Subject to Indirect Impacts (ha)</th>
<th>Type of Indirect Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky ridges, breakaways and rocky gorges (denning and breeding habitat)</td>
<td>0</td>
<td>40</td>
<td>Dust deposition</td>
</tr>
<tr>
<td>Granite Outcrop (foraging and dispersal habitat)</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Creek line (foraging and dispersal habitat)</td>
<td>3</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Fragmentation of Habitat**

Vegetation clearing, especially for linear infrastructure, has the potential to result in fragmentation of fauna habitat reducing the connectivity of fauna populations. Fauna with large home ranges, such as ground mammals, are likely to be most at risk of habitat fragmentation.

Fragmentation is most likely to occur as a result of construction of the Mine Access and Haul Road. The access road does not pass through any critical habitat for the Northern Quoll, or habitats of conservation significance. The habitats through which it does pass are well represented in the region.

**Changes to Hydrology or Hydrogeology**

A number of semi-permanent and permanent water pools have been located across the Project area and surrounds (Figure 10). Development of the project has the potential to impact on the hydrology of the area and potentially alter flows into or through these pools. Semi-permanent and permanent water pools may act as refuges for fauna during drier periods. Project infrastructure has been located to avoid direct impacts to these pools.

A desktop surface water assessment has been undertaken for the Project. This assessment predicts that surface water flows into and/or through these pools will not be adversely affected by the implementation of the Project. The catchment area for the majority of pools will not be impacted by implementation of the Project. The exception to this is Site 12 Pool.

The temporary waste rock stockpile will fill part of the upper catchment associated with Site 12 Pool, however, the area of the catchment to be impacted makes up a small portion of the pool’s entire catchment and impacts are therefore expected to be minor (WorleyParsons, 2012).
Additionally, the observed movement through the pool and type of vegetation present indicates the pool is spring fed (ecologia Environment, 2011) and therefore less likely to be reliant on inflows from the catchment. Waste rock is expected to be environmentally benign and any runoff from the temporary waste rock stockpile is unlikely to alter the quality of surface water inflows to the pool.

The surface water assessment undertaken by WorleyParsons (2012) found that implementation of the Project was not likely to significantly impact surface water flows as there was no major redirection, storage or interception of flows. Given this, it is predicted that there will be no significant impact to groundwater recharge in the area and therefore any follow on impacts to groundwater fed springs or pools will be insignificant.

**Injury or Mortality of Fauna**

Injury to or mortality of fauna may occur as a result of:

- clearing and earthworks
- fire
- vehicle strikes
- accidental ingestion of solid or liquid wastes, chemicals or fuels
- entrapment in water storage structures.

Clearing activities may result in the loss of individual animals that are unable to move out of the way of heavy machinery. Burrowing mammals are likely to be most susceptible to collisions with heavy machinery during land clearing activities, and as such, impacts to the Northern Quoll are considered unlikely.

Clearing may also result in a local reduction in the populations of fauna, as individuals relocate into areas of similar habitat outside of the Project area. Due to the short mine life, this effect is expected to be short lived with individuals recolonising the Project area once operations cease and disturbed areas are rehabilitated.

Fauna species may also be injured or killed as a result of collisions with vehicles on mine roads and tracks. Suitable habitat for the Northern Quoll exists both north and south of the proposed Mine Access and Haul Road, with suitable foraging/dispersal habitat located along the Turner River. This has potential to increase the risk of Northern Quolls being struck by vehicles on the access road as they are likely to move between the habitat areas on either side of the road.

**Changes in Fauna Behaviour**

Typical fauna behaviour may be modified by the physical presence of Project infrastructure, noise and vibration emissions, light spill, water storages, and vehicular and human traffic associated with construction and operation of the Project. These changes may be particularly noticeable around the mine area.
Scavenging fauna (such as the Northern Quoll) may be attracted to domestic waste storage areas.

**Introduction or Attraction of Feral Fauna Species**

Feral fauna species may be introduced or attracted to the area through incorrect disposal or storage of organic waste or the presence of permanent and accessible water sources. Of the three species of feral fauna recorded from the Project area and surrounds, one (the feral camel) is listed on DAFWA’s Declared Animal List under the *Agriculture and Related Resources Protection Act 1976* (WA). This species is listed as category A5 meaning numbers are to be controlled or reduced.

Without appropriate management, the introduction or attraction of feral fauna species may indirectly impact on native fauna through increased rates of competition for resources and degradation of habitat, and may ultimately result in reduced biodiversity.

### 4.2 Pilbara Leaf-nosed Bat

**Loss of Habitat**

Targeted fauna surveys identified 713 ha of potential roost habitat for the Pilbara Leaf-nosed Bat from within the survey area (ecologia Environment, 2011). Up to 294 ha of potential dry season roost cave habitat was identified from within the Rocky Ridges, Breakaways and Rocky Gorges habitat and 419 ha of potential wet season roost cave habitat was identified from within the Creek lines habitat (ecologia Environment, 2011).

Four potential roost caves for the Pilbara Leaf-nosed Bat have been identified during the 2011 surveys of the Project Area and surrounds. The nearest of these caves is about 125 m from the southern edge of the proposed open pit. Three of these were identified as potential dry season roost caves and one as a potential wet season roost cave.

No direct impacts due to clearing are anticipated within the Rocky Ridges, Breakaways and Rocky Gorges habitat. Up to 3 ha (0.4%) of the mapped extent of the Creek line habitat will be cleared in order to construct a crossing for the Mine Access and Haul Road. This equates to direct disturbance (clearing) of about 0.4% of the mapped extent of potential roost cave habitat for the Pilbara Leaf-nosed Bat. Dust deposition has the potential to result in indirect impacts to approximately 40 ha of dry season Pilbara Leaf-nosed Bat Habitat within the Rocky Ridges, Breakaways and Rocky Gorges habitat unit.
Table 7: Potential Direct and Indirect Impacts to Pilbara Leaf-nosed Bat Habitat

<table>
<thead>
<tr>
<th>Habitat Unit</th>
<th>Area Subject to Direct Impact (Clearing) (ha)</th>
<th>Area Subject to Indirect Impacts (ha)</th>
<th>Type of Indirect Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky ridges, breakaways and rocky gorges (dry season roost habitat)</td>
<td>0</td>
<td>40</td>
<td>Dust deposition</td>
</tr>
<tr>
<td>Creek line (wet season roost habitat)</td>
<td>3</td>
<td>0</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Injury or Mortality of Fauna**

Injury to or mortality of fauna may occur as a result of:

- clearing and earthworks
- fire
- vehicle strikes
- accidental ingestion of solid or liquid wastes, chemicals or fuels
- entrapment in water storage structures.

Clearing activities may result in the loss of individual animals that are unable to move out of the way of heavy machinery. This activity is considered unlikely to result in impacts to the Pilbara Leaf-nosed Bat, as they are a highly mobile species.

Clearing may also result in a local reduction in the populations of fauna, as individuals relocate into areas of similar habitat outside of the Project area. Due to the short mine life, this effect is expected to be short lived with individuals recolonising the Project area once operations cease and disturbed areas are rehabilitated.

Fauna species may also be injured or killed as a result of collisions with vehicles on mine roads and tracks. Pilbara Leaf-nosed Bats are known to forage close to the ground and may therefore be susceptible to vehicle strikes.

**Changes in Fauna Behaviour**

Typical fauna behaviour may be modified by the physical presence of Project infrastructure, noise and vibration emissions, light spill, water storages, and vehicular and human traffic associated with construction and operation of the Project. These changes may be particularly noticeable around the mine area.

The Pilbara Leaf-nosed Bat is known to be sensitive to noise and vibration disturbances within or in close proximity to roost caves and have been known to abandon caves where construction or mining activities occur within 50 m of the roost (Outback Ecology 2011). Disturbances which occur at least 85 m from the roost however, may not result in abandonment (Armstrong K., 2010). Displaced bats are susceptible to death through dehydration, particularly during the dry season.
The nearest potential roost cave to the proposed Project infrastructure is about 125 m south of the edge of the open pit and about 200 m from the hot tyre park up area and access road. Noise and vibration impacts to this roost cave are likely to be minimal. The remaining caves are more than 500 m from any disturbance.

While blasting in proximity to roost caves may cause Pilbara Leaf-nosed Bats to abandon roosts (DSEWPaC, 2012b) this has been shown to have no impact on foraging of Pilbara Leaf-nosed Bats in nearby habitat (BHP Billiton Iron Ore, 2005).

Studies at roosts have demonstrated that artificially increased light levels can significantly delay the timing of bat emergence (Downs, Beaton, Guest, Polanski, Robinson, & Racey, 2003); (Duverge, 2000) and disturb their use of commuting routes (Stone, Jones, & Harris, 2009), both of which will reduce the time available for foraging. However, all identified potential roost caves are at least 1.5 km from permanent light sources associated with the proposed processing area, administration area and accommodation camp. Lighting within the proposed open pit will move based on the mining schedule and lights can be positioned such that they are directed away from potential roost caves, thereby reducing light spill in the direction of these caves. Additionally, the nearest potential roost cave to the proposed open pit faces to the west, which reduces the potential for light to spill directly into the cave. A series of ridges occur between the identified potential roost caves and other light sources (such as the accommodation camp and administration area) which will reduce the amount of light that may be visible from these caves. As with lighting for the proposed open pit, lighting required for other areas of the operation can be directed to minimise light spill towards potential roost caves.

Insectivorous fauna (such as birds and bats) may be attracted to light sources due to the concentration of insects in well lit areas.

### 4.3 Pilbara Olive Python

**Loss of Habitat**

Targeted fauna surveys identified 1045 ha of potential habitat for the Pilbara Olive Python from within the survey area (ecologia Environment, 2011). Up to 432 ha of this habitat consists of creek lines with pools and rock faces and permanent water pools along rocky gorges and is considered to be critical habitat. This critical habitat is located within portions of the Creek line and Rocky Ridges, Breakaways and Rocky Gorges habitat types. A total of 11 water pools have been recorded in the vicinity of the Project area. With the exception of Central Creek Pool, the remaining pools are likely to provide critical habitat for the Pilbara Olive Python. No direct impacts to these pools are expected as a result of the Project.

An additional 513 ha was considered to be potential habitat, consisting of cliffs, dry rock faces and creek lines without rock faces (ecologia Environment, 2011). This includes areas identified as potential habitat by desktop assessment, which were unable to be ground-thruthed due to...
inaccessibility. This potential habitat is located within portions of the Granite Outcrop, Creek line and Rocky Ridges, Breakaways and Rocky Gorges habitat types.

No direct impacts due to clearing are anticipated within the Rocky Ridges, Breakaways and Rocky Gorges habitat or the Granite Outcrops habitat. Up to 3 ha (0.4%) of the mapped extent of the Creek line habitat will be cleared in order to construct a crossing for the Mine Access and Haul Road. This equates to direct disturbance (clearing) of about 0.3% of the mapped extent of potential roost cave habitat for the Pilbara Olive Python.

The proposed temporary waste rock stockpile will fill part of the upper catchment of Site 12 Pool and thereby potentially result in indirect impacts to the pool through decreased flows and water quality, particularly sediment load. However, the area of the catchment to be impacted makes up a small portion (less than five percent) of the pool’s entire catchment and impacts are therefore expected to be minor (WorleyParsons, 2012). Additionally, the observed movement of water through the pool and type of vegetation present indicates the pool is groundwater fed (ecologia Environment, 2012) and therefore less likely to be reliant on inflows from the catchment.

Dust deposition has the potential to result in indirect impacts to approximately 5 ha of critical habitat and 35 ha of potential habitat for the Pilbara Olive Python within the Rocky Ridges, Breakaways and Rocky Gorges habitat unit.

Table 8: Potential Direct and Indirect Impacts to Pilbara Olive Python Habitat

<table>
<thead>
<tr>
<th>Habitat Unit</th>
<th>Area Subject to Direct Impact (Clearing) (ha)</th>
<th>Area Subject to Indirect Impacts (ha)</th>
<th>Type of Indirect Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky ridges, breakaways and rocky gorges (denning and breeding habitat)</td>
<td>0</td>
<td>40</td>
<td>Dust deposition</td>
</tr>
<tr>
<td>Granite Outcrop (foraging and dispersal habitat)</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Creek line (foraging and dispersal habitat)</td>
<td>3</td>
<td>Negligible</td>
<td>Impedance to catchment flows (Site 12 Pool)</td>
</tr>
</tbody>
</table>

Fragmentation of Habitat

Vegetation clearing, especially for linear infrastructure, has the potential to result in fragmentation of fauna habitat reducing the connectivity of fauna populations. Fauna with large home ranges, such as ground mammals, are likely to be most at risk of habitat fragmentation.

Fragmentation is most likely to occur as a result of construction of the Mine Access and Haul Road. The access road does pass through critical habitat for the Pilbara Olive Python, in the Turner River area.

Changes to Hydrology or Hydrogeology

Refer to the section above: Direct Loss of Habitat, for information regarding potential impacts to surface water pools considered to be critical habitat for the Pilbara Olive Python.
The surface water assessment undertaken by WorleyParsons (2012) found that implementation of the Project was not likely to significantly impact surface water flows as there was no major redirection, storage or interception of flows. Given this, it is predicted that there will be no significant impact to groundwater recharge in the area and therefore any follow on impacts to groundwater fed springs or pools will be insignificant.

Pilbara Olive Pythons have also been known to benefit from additional water sources associated with mining, such as water storage ponds (Hill & Ward, 2010).

Injury or Mortality of Fauna

Injury to or mortality of fauna may occur as a result of:

- clearing and earthworks
- fire
- vehicle strikes
- accidental ingestion of solid or liquid wastes, chemicals or fuels
- entrapment in water storage structures.

Clearing activities may result in the loss of individual animals that are unable to move out of the way of heavy machinery. Clearing may result in a local reduction in the populations of fauna, as individuals relocate into areas of similar habitat outside of the Project area. Due to the short mine life, this effect is expected to be short lived with individuals recolonising the Project area once operations cease and disturbed areas are rehabilitated.

Fauna species may also be injured or killed as a result of collisions with vehicles on mine roads and tracks. Pilbara Olive Pythons may be particularly vulnerable to vehicle strikes as roads are often preferred basking spots for snakes. Suitable habitat for the Pilbara Olive Python occurs on either side of the access road, particularly in association with the Turner River.

Changes in Fauna Behaviour

Noise and vibration emissions resulting from blasting in the proposed open pit may cause Pilbara Olive Pythons to relocate to areas of suitable habitat further from noise and vibration sources. However, this effect is expected to be temporary with pythons moving back into areas previously occupied once mining and processing operations cease.
5. PROPOSED SAFEGUARDS AND MITIGATION MEASURES

Project infrastructure has been designed and located so as to avoid or minimise impacts to fauna species protected under the EPBC Act and conservation significant habitats for these species. Management measures proposed to avoid or minimise impact from the implementation of the Project on EPBC Act listed threatened species include:

- The open pit has been set back from the edge of the plateau in order to avoid clearing of Northern Quoll denning and breeding habitat.
- The mine pit has been planned to maximise the separation distance between blasting operations and potential roost caves for the Pilbara Leaf-nosed Bat.
- Clearing for the road crossing of the Turner River will be kept to the minimum required to provide a safe working environment.
- A suitable buffer will be established and maintained around identified potential roost caves for the Pilbara Leaf-nosed Bat.
- Borrow pits will be designed to be self-draining wherever possible by being positioned in an elevated, sloping position in the landscape so that water is able to drain from the pit.
- Borrow pits will cause no entrapment, injury or death of fauna. The free draining nature of the borrow pits allows fauna egress from the drainage point.
- Borrow material will not be sourced from within Creek Line, Granite Outcrop or Rocky ridges, breakaways and rocky gorge habitat areas.
- Internal GDPs (ground disturbance permits) will be implemented for all clearing activities prior to commencement of works.
- Clearing of native vegetation/fauna habitat will be minimised during construction.
- Clearing limits will be identified on design and construction documentation.
- Clearing limits will be pegged in the field prior to commencement of clearing operations.
- Clearing in/of sensitive flora and fauna habitats including creek lines, ridges, outcrops, gullies and crevices will be kept to the minimum necessary for safe construction and operation of the project.
- Trees of outstanding habitat value will be identified and retained where practicable.
- Where possible, large rocks will be left in situ within borrows pits as a habitat feature.
- Information on MNES relevant to the Project and employee/contractor/visitor responsibilities will be included as part of the site induction program.
- Vehicle speed limits will be enforced for all Project roads and tracks.
● Off road driving will be prohibited unless authorised or in emergency situations.

● Driving at dawn, dusk or night will be minimised as far as practicable.

● “Confined” blasting techniques (where inert material such as crushed stone is used to seal off or ‘stem’ the blast holes and contain the energy released by the detonation of the explosives in the blast hole inside the rock) will be used in preference to unconfined methods.

● The water storage pond will be landscaped to allow animal egress or have specific animal egress points (for example egress matting) installed.

● Known locations of Northern Quoll, Pilbara Leaf-nosed Bat and Pilbara Olive Python have been mapped and access to these areas will be restricted as far as practicable.

● Access to water pools will be restricted.

● Unauthorised access to potential roost caves for the Pilbara Leaf-nosed Bat will be restricted.

● A fire prevention and control strategy will be developed and implemented.

● Fauna relocation will only be undertaken by suitably qualified personnel, in accordance with DEC regulations and licencing requirements.

● Fauna capture methods will depend on circumstances and species, and may be manual, calico bag and hoop net or pre-baiting and rigid cage or Elliott traps.

● All traps, bags and tools will be cleaned and sterilised prior to utilisation, between captures and prior to setting on each occasion.

● Traps will be located in a position which is sheltered from sun and rain, marked with flagging tape and their position will be recorded by GPS. Cage traps will be covered with heavy weight hessian.

● Injured fauna will be reported to the site environmental officer who will determine the appropriate course of action.

● Any deaths of fauna species protected under the EPBC Act will be reported to DEC and DSEWPaC.

● Monitoring will be undertaken in accordance with the Mine and Rail Dust Management Plan in relation to dust impacts on vegetation of the Rocky Ridges, Breakaways and Rocky Gorges habitat.

● All machinery, vehicles and plant arriving on site will required to be free of vegetative matter and soil/mud.

● Design and construct final landforms such that the surface is stable and not prone to erosion and the risk to people or animals entering the area is minimised.

● Borrow pit slopes will be to 1:5 or gentler on end of borrow pit use.
• Progressive rehabilitation will be undertaken when cleared areas are no longer required.

• Education and awareness training will inform employees of their requirement to report sightings of feral animals, that no domestic pets are allowed onsite and that no feeding of native and or feral animals is permitted.

• No pets will be allowed on site, including at the accommodation camp.

• All opportunistic feral animal sightings will be reported through the incident reporting procedures.

• Feral animals recorded during annual EPBC species monitoring programs will be reported within the annual monitoring report.

• Project facilities including food and domestic water management will be managed to minimise the presence of non-indigenous fauna. This may include covering of bins, installation of fences and general housekeeping.

• Should the results of annual EPBC monitoring or opportunistic sightings record a significant increase of feral animals in the Project area, approved control methods will be implemented in consultation with the DEC and pastoralists. This may include humane trapping or baiting.

• Lighting will be kept to that required for the safe construction and operation of the Project and the welfare of personnel.

• Directional lighting will be installed in project buildings if within 500 m of a significant bat roost and visible from the cave.

• Lighting required at the southern end of the open pit will be located such that it does not result in increased light levels at the nearest bat roost cave.

• Contingency measures such as regulation of blast size, frequency or timing will be considered if abandonment of Pilbara Leaf-nosed Bat roosts occurs and can be attributed to blasting activities.

In accordance with correspondence received from DSEWPaC on 16 October 2012, an EPBC Listed Threatened Fauna Management Plan has been developed for the Project. It is provided in Appendix 1.
6. PROPOSED OFFSET MEASURES

In accordance with approvals granted under both the EP Act and the EPBC Act, Fortescue is required to offset the impact on environmental assets as a result of construction and operational activities for some of its projects.

These conditions may include the provision of funds for research and the acquisition of land for conservation, and the development and implementation of biodiversity offset plans.

Fortescue is currently working with the EPA, the DEC and DSEWPaC to determine the most efficient and effective way to meet the conditions that require the implementation of biodiversity offset plans.

In consultation with the DEC, Fortescue has developed a Strategic Land Management Plan. The plan identifies the key threats to EPBC Act listed threatened species and communities impacted by Fortescue operations and outlines landscape scale management strategies to address these threats in an area of over 1,000,000 ha.

Key management options include feral herbivore control, baiting for feral predators such as cats and foxes and fire management.

The Plan is being currently being considered by DSEWPaC. If approved, this plan will allow Fortescue to work in collaboration with other parties including the DEC, pastoralists, Rangelands NRMs and other mining proponents, to ensure consistent management approaches are implemented in an efficient and targeted manner.

The area of land selected for the implementation of the Strategic Land Management actions is large enough to offset any impacts of this Project and includes habitat for the Northern Quoll, Pilbara Leaf-nosed Bat and Pilbara Olive Python.
7. **ECOLOGICALLY SUSTAINABLE DEVELOPMENT**

Table 9 provides and assessment of the Project against the ‘ecologically sustainable development principles’.

<table>
<thead>
<tr>
<th>Principle</th>
<th>Assessment</th>
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<tr>
<td>The long-term and short-term economic, environmental, social and equitable considerations, including potential impacts and benefits to remote indigenous communities.</td>
<td><strong>Not at Variance</strong>&lt;br&gt;FMG Iron Bridge recognises the importance of maximising social and economic benefits and minimising environmental impacts as it is vital in ensuring Fortescue’s longevity, success, growth and positioning in the domestic and global markets. FMG Iron Bridge aims to gain a level of achievement beyond legal obligations. This will be achieved by successful management of potential risks.&lt;br&gt;This Project will provide revenue and economic benefits at a local, state and national level.&lt;br&gt;An integral part of the Fortescue’s policy has been its approach to opportunities for Aboriginal people. To facilitate training and employment opportunities, in 2006, Fortescue established the Vocational Training Employment Centre (VTEC) in South Hedland in 2006 and the Roebourne VTEC in 2010. Fortescue reached its Summit 300 target in June 2011 to employ 300 Aboriginal people in its operations. Fortescue continues to support opportunities for Aboriginal people across its operation, both in contracting and direct employment.</td>
</tr>
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<td>The precautionary principle which states that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</td>
<td><strong>Not at Variance</strong>&lt;br&gt;FMG Iron Bridge recognises the importance of minimising environmental impacts as it is vital in ensuring Fortescue’s longevity, success, growth and positioning in the domestic and global markets. FMG Iron Bridge aims to gain a level of achievement beyond legal obligations. This will be achieved by successful management of potential risks.&lt;br&gt;Part of this process includes undertaking detailed site investigations of the biological and physical environs. Where these investigations identify significant conservation issues, management measures are incorporated into the project design to avoid, where practicable, and/or minimise any potential impacts.&lt;br&gt;FMG considers that all key baseline environmental studies and surveys required to understand the nature and significance of environmental impacts which may occur as a result of the Project have been completed. Results of these studies have informed the development and design of the Project in order to minimise potential impacts to the key environmental values of the local flora, vegetation and fauna.</td>
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<td>The principle of intergenerational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.</td>
<td><strong>Not at Variance</strong>&lt;br&gt;The Proponent’s decision-making processes incorporate sustainability principles and the implementation of new and better technologies where feasible. The proponent aims to inspire an ethic and attitude that strives for continuous improvement and ongoing learning. FMG Iron Bridge encourages employees to engage in positive attitudes and behaviour concerning respect for the environment. We recognise sustainability cannot be achieved without the contribution and action of the entire team.</td>
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<td>The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.</td>
<td><strong>Not at Variance</strong>&lt;br&gt;Conservation of biological diversity and ecological integrity is fundamental to the approach to environmental management and is a major environmental consideration for the Project. Biological investigations have been undertaken by FMG Iron Bridge early in the project planning process to identify values of environmental conservation significance required to be protected from disturbance.&lt;br&gt;This Project has been designed to minimise potential impacts to the key environmental values of the surrounding flora and vegetation and significant fauna species. FMG Iron Bridge has committed to restoring disturbed environments upon decommissioning, as well as ongoing rehabilitation of vegetation around the Project area. The aim of all rehabilitation is to establish sustainable endemic vegetation units consistent with reconstructed landforms and surrounding vegetation.</td>
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<tr>
<td>Principle</td>
<td>Assessment</td>
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| Improved valuation, pricing and incentive mechanisms should be promoted. | **Not at Variance**  
FMG Iron Bridge acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when and wherever possible. For example:  
- Environmental factors have played a role in determining infrastructure locations.  
- The FMG Iron Bridge has put in place procedures that will ensure that pollution-type impacts are minimised as far as practicable.  
The cost of rehabilitation and closure requirements has been incorporated into the costs of the product from the commencement of operation. |
8. OTHER APPROVALS AND CONDITIONS

Environmental approvals have been sought under the Environmental Protection Act 1986 (WA) (the EP Act). The Project was determined to be ‘not assessed – public advice given’ under Part IV or the EP Act. As such, no conditions of approval will be granted in the form of a Ministerial Statement. Approval will be sought under Part V of the EP Act, namely in terms of works approvals and licences for ‘prescribed premises’ within the project, and approval to clear native vegetation under a ‘purpose permit’. Applications for these approvals are yet to be submitted, and as such, no conditions of approval exist to date.

Approval will be sought under the Mining Act 1978 (WA). A Mining Proposal is currently in preparation. Programmes of Work approvals have been granted to allow mineral exploration activities to date in the North Star area.

Approval will be sought under the Rights in Water and Irrigation Act 1914 (WA), under section 5C (to construct a well) and 26D (to abstract groundwater). Section 5C and 26D approvals have been granted, subject to conditions, to support the water requirements of mineral exploration activities undertaken to date in the North Star area.
REFERENCES


DSEWPaC. (2011a). EPBC Act 1999 referral guidelines for the endangered northern quoll, Dasyurus hallucatus. DSEWPaC.


Rankmore, Griffiths, Woinarski, Ganambarr, Taylor, Brennan, et al. (2008). Island translocation of the northern quoll *Dasyurus hallucatus* as a conservation response to the spread of the cane toad *Chaunus (Bufo) marinus* in the Northern Territory, Australia. Report submitted to the Natural Heritage Trust Strategic Reserve Program, as a component of Project 2005/162: Monitoring and Management of Cane Toad Impact in the Northern Territory by the Biodiversity Conservation Division. Department of Natural Resources, Environment and the Arts, Palmerston, Northern Territory.


Figure 1: North Star Hematite Project Location Plan
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Figure 2: Conceptual Project Layout
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Figure 3: Regional Habitat for Northern Quoll
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Figure 4: Northern Quoll Habitat
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Figure 8: Pilbara Leaf-nosed Bat Survey Records
Figure 9: Regional Habitat for Pilbara Olive Python
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Figure 10: Hydrology of the Project Area and Surrounds
Figure 11: Pilbara Olive Python Habitat
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Figure 12: Pilbara Olive Python Survey Records
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Pilbara Olive Python Survey Records
North Star

Requested By: R. Sharp
Date: 6/12/2012
Drawn By: R. Macorache
Size: A3L
Scale: 1:50,000
Revision: 0
Projection: GDA 1994 MGA Zone 50
Confidentiality: 1
Doc Name: NS_MP_EN_0046.011_r0
Appendix 1: EPBC Listed Threatened Fauna Management Plan: North Star Hematite Project
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Appendix 2: North Star Project: Level 2 Terrestrial Vertebrate Fauna Assessment