Environmental Review

Blue Hills Expansion

Prepared for
Sinosteel Midwest Corporation Ltd

August 2013

DOCUMENT TRACKING

Item	Detail
Project Name	Sinosteel Blue Hills Expansion Environmental Approvals
Project Number	11PERPLA-0019, 13PERPLA-0013
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Status	FINAL
Version Number	8
Last saved on	30 August 2013

This report should be cited as 'Eco Logical Australia 2013. *Environmental Review, Blue Hills Expansion Project*. Prepared for Sinosteel Midwest Corporation.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Sinosteel Midwest Corporation.

Contents

1 Introduction 1
1.1 Background 1
1.2 Proposal overview 2
1.3 Terminology 5
1.4 Location 5
1.5 The proponent 6
1.6 Purpose and scope 6
1.7 Justification and objectives for the Proposal 6
1.8 Alternatives 7
1.9 Legal framework and assessment process 7

2 Proposal overview 8
2.1 Overview of existing operations at Blue Hills 8
2.2 Proposal description 8
2.2.1 Site preparation 9
2.2.2 Mining and processing operations 9
2.2.3 Waste material 10
2.2.4 Access and haul roads 10
2.2.5 Support infrastructure and consumables 10
2.3 Modifications made to optimal mine plan to reduce impacts 10

3 Environmental setting 12
3.1 Climate 12
3.2 Geology, Geomorphology and Land Systems 13
3.3 Surface water and groundwater 16
3.4 Vegetation and flora 16
3.4.1 Survey history 16
3.4.2 Vegetation 17
3.4.3 Flora 17
3.5 Vertebrate fauna 18
3.5.1 Survey history 18
3.5.2 Vertebrate fauna species 18
3.6 Invertebrate fauna 19
3.6.1 Survey history 19
3.6.2 Invertebrate fauna species 19
3.7 Subterranean fauna 19
3.8 Heritage 19

5 Key environmental management issues 21

6 Potential environmental impacts and management 22

6.1 Vegetation and flora 22

6.1.1 Description 22

6.1.2 Assessment of potential impacts 32

6.1.3 Key management actions 40

6.2 Vertebrate fauna 41

6.2.1 Description 41

6.2.2 Assessment of potential impacts 47

6.2.3 Key management actions 49

6.3 Invertebrate fauna 52

6.3.1 Description 52

6.3.2 Assessment of potential impacts 54

6.3.3 Key management actions 54

7 Other environmental factors 56

7.1 Hydrology 56

7.2 Greenhouse gases 57

7.3 Noise and vibration 57

7.4 Acid mine drainage 57

7.5 Waste 58

7.6 Aboriginal heritage 58

7.7 Landscape and recreation 58

7.8 Rehabilitation and mine closure 58

8 Environmental management framework 60

8.1 Overview 60

8.2 Environmental policy 60

8.3 Principles of environmental protection 60

8.4 Summary of environmental control instruments 61

8.5 Site environmental management plans 61

8.5.1 Environmental Management Plan 61

8.5.2 Closure Plan 61

8.5.3 Implementation Strategy 62

8.5.4 Fire Prevention Strategy 62

8.5.5 Significant Flora Management Plan 62

8.6 Offsetting arrangements 62

8.7 Reporting 62

9 Conclusion 64

References **67**

Appendix A: Supporting survey reports **70**

Appendix B: Restoration Research Plan **71**

Appendix C: Significant Flora Management Plan **72**

List of figures

Figure 1: Regional location 3
Figure 2: Proposal layout 4
Figure 3: Diagrammatic representation of the DSO Project and Proposal elements 5
Figure 4: Climate data for Paynes Find 12
Figure 5: Topography 14
Figure 6: Land systems 15
Figure 7: Floristic Community Types 26
Figure 8: PEC 27
Figure 9: Regional *Acacia woodmaniorum* records 30
Figure 10: Regional priority flora records 31
Figure 11: Potential impacts to PEC 37
Figure 12: Potential impacts to *Acacia woodmaniorum* 38
Figure 13: Potential impacts to Priority flora 39
Figure 14: Fauna habitats and significant fauna records 45
Figure 15: Malleefowl Mound records 46
Figure 16: SRE records 53

List of tables

Table 1: Ground disturbance associated with the Proposal 9

Table 2: Land systems within the Proposal Area (Payne et al. 1998) 13

Table 3: FCTs occurring in the Proposal area (Woodman 2012) 23

Table 4: Conservation significant flora recorded within the Proposal area 28

Table 5: Ground disturbance requirements for the Proposal 32

Table 6: Ground disturbance requirements for the Expansion 32

Table 7: Impacts to the PEC 33

Table 8: Predicted impacts to FCTs 35

Table 9: Predicted impact to *Acacia woodmaniorum* and *Lepidosperma* sp Blue Hills (using results of ecologia 2013) 36

Table 10: Summary of SRE invertebrate species collected from the Approved Project area and surrounds 52

Table 11: Key information for EPA significance test criteria (Government of WA 2012) 65

Abbreviations

Abbreviation	Description
BIF	Banded Iron Formation
BoM	Bureau of Meteorology
Cth	Commonwealth
DEC	Department of Environment and Conservation
DER	Department of Environmental Regulation
DMP	Department of Mines and Petroleum
DPaW	Department of Parks and Wildlife
ELA	Eco Logical Australia
EMP	Environmental Management Plan
EP Act	*Environmental Protection Act 1986*
EPA	Environmental Protection Authority (WA)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ER	Environmental Review
ESD	Environmental Scoping Document
FCT	Floristic Community Type
GIS	Geographic Information System
ha	Hectares
Km/h	Kilometres per hour
kL	Kilolitres
mAHD	Metres Australian Height Datum
MS	Ministerial Statement
Mtpa	Million tonnes per annum
P	Priority
PEC	Priority Ecological Community
PER	Public Environmental Review
ROM	Run of Mine
SMC	Sinosteel Midwest Corporation Ltd
SRE	Short range endemic
WA	Western Australia
WC Act	*Wildlife Conservation Act 1950*
WMC	Western Mining Corporation

1 Introduction

Sinosteel Midwest Corporation Limited (SMC) is pursuing an expansion of its existing operations at the Blue Hills Iron Ore Mine in the mid-west of Western Australia (WA). This document outlines the supporting information to the referral of the proposed expansion under the *Environmental Protection Act 1986* (EP Act) to provide adequate information to the Office of the Environmental Protection Authority (OEPA) to allow a determination on whether to assess the proposal and the appropriate level of assessment.

1.1 Background

SMC is developing and operating several iron ore projects in the expanding mid-west resources region of WA, including the Koolanooka/Blue Hills (Mungada) Direct Shipping Iron Ore Project (herein, DSO Project). The DSO Project involves the mining, crushing, screening of ore from three pits; one pit at the Koolanooka Iron Ore Mine (Koolanooka) (approximately 160 km south-east of Geraldton) and two pits (known as Mungada East and West, located on the Mungada Ridge landform) (approximately 60 km east of the Koolanooka site) at the Blue Hills Iron Ore Mine (Blue Hills), as well as transport to the Geraldton Port (**Figure 1**).

Exploration was conducted for iron ore deposits in the Koolanooka/Blue Hills area in the 1960s and 1970s resulting in two high grade iron ore deposits, Mungada East and Mungada West, being mined by Western Mining Corporation (WMC) between 1970 and 1972 at the Blue Hill Project area. Records show that the Mungada West mine was known to contain high grade ore when mining ceased, following the fulfilment of the supply contracts then in place.

The DSO Project was originally referred for assessment under the EP Act in April 2007 and was assessed at the level of Public Environmental Review (PER). In its original report and recommendations the WA Environmental Protection Authority (EPA) advised that it considered mining of Mungada Ridge as environmentally unacceptable; indicating that mining at Mungada East could not be managed to meet the EPA's objectives in relation to the conservation of biodiversity and ecological integrity (EPA 2009). Key issues identified in the report related to impacts on flora and vegetation; fauna; landscape and recreational values; and, rehabilitation and mine closure. Following the provision of additional information relevant to these factors during the subsequent appeals process, State approval for the DSO Project was granted in November 2009 by way of Ministerial Statement (MS) 811.

The DSO Project was also referred under the Commonwealth (Cth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in October 2007. The DSO Project was determined to be a controlled action (with listed threatened species and communities, and listed migratory species as controlling provisions) and subsequently assessed under the bilateral agreement with the WA environmental approval process. Commonwealth approval was subsequently granted in January 2010.

Project operations commenced at Koolanooka in April 2010, and mining at both Blue Hills pits commenced in July 2013. The current life of mine of the approved DSO Project is up to four years.

Subsequent to the approval of the DSO Project, SMC identified expansion opportunities at Blue Hills. In March 2012, SMC made an application to the OEPA for a minor change to the proposal (*Blue Hills Iron Ore Project: Pit Expansion*) under the provisions of Section 45C of the EP Act. The Section 45C proposal reflected SMC's intention to mine the Blue Hills mine pits to a greater depth. It also reflected optimisation of the design, siting and footprint of the Mungada East and West waste dumps, pits,

access roads, haul roads and processing facilities, involving a total of 63.9 hectares (ha) of new ground disturbance. The Section 45C application was approved by the EPA on 3 May 2013 (Attachment 3 to MS 811). The Blue Hills component of the DSO Project, incorporating the approved Section 45C minor expansion, is herein referred to as 'the Approved Project'.

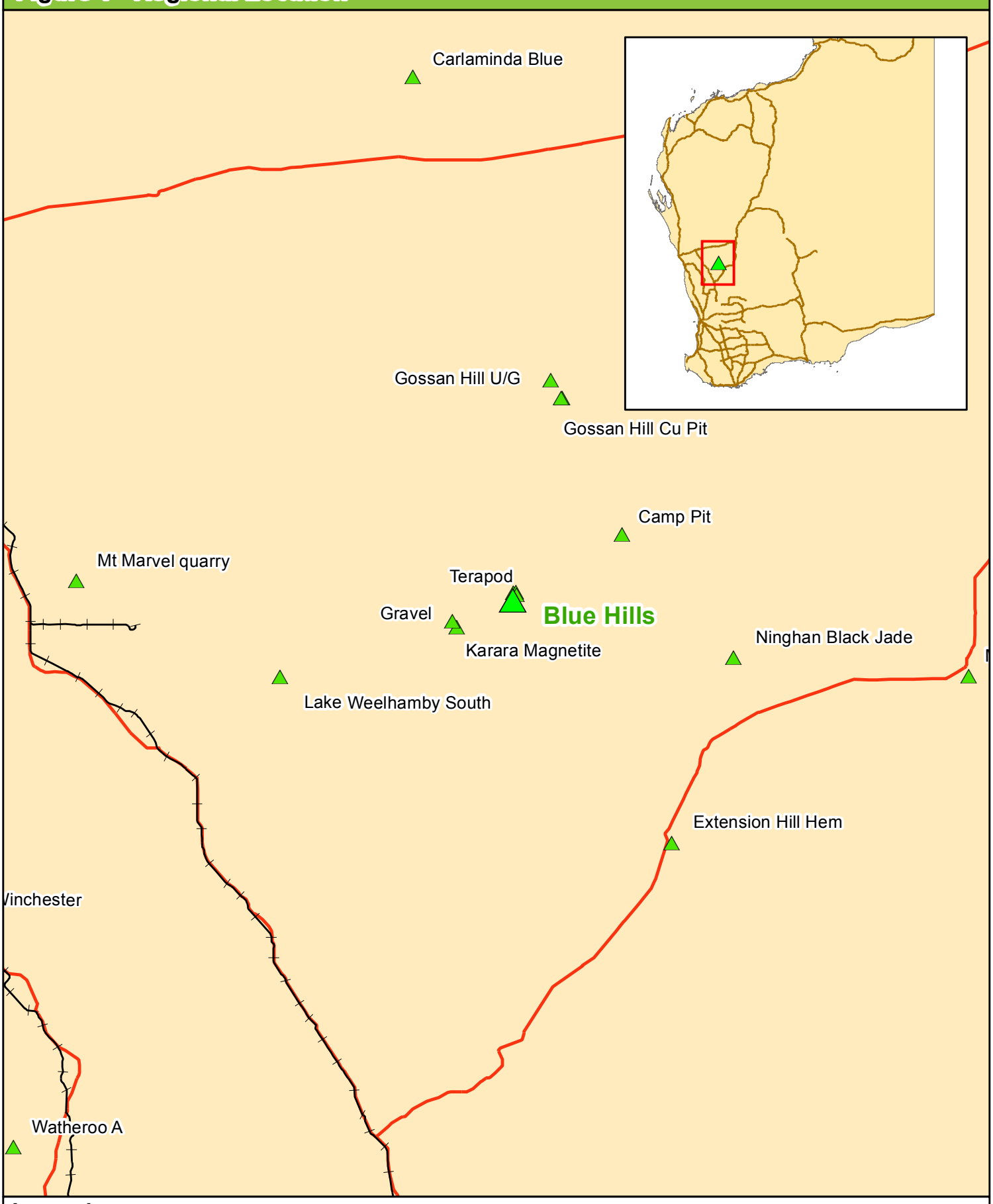
1.2 Proposal overview

SMC is proposing a further additional expansion of Blue Hills which forms the focus of this Environmental Review (herein, the Proposal). The Proposal involves the construction and operation of two new mine pits (one each at Mungada East and West), one additional waste rock dump, a processing plant, and additional road infrastructure (**Figure 2**).

The Proposal is expected to produce an additional 1.5 Million tonnes per annum (Mtpa) of haematite iron ore suitable for export via direct shipping from Geraldton Port.

The Proposal will see the life of operations for the Approved Project extended from approximately four years to approximately six years and will result in new ground disturbance of approximately 63.9 ha. A detailed description of the Proposal is provided in Section 2.2.

Figure 1 - Regional Location



Legend

- Major Town
- Mine
- Major River
- Sealed Road
- Railway

0 5 10 20
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

Data Sources:
(e.g. Microsoft Virtual Earth
DECCW)

N

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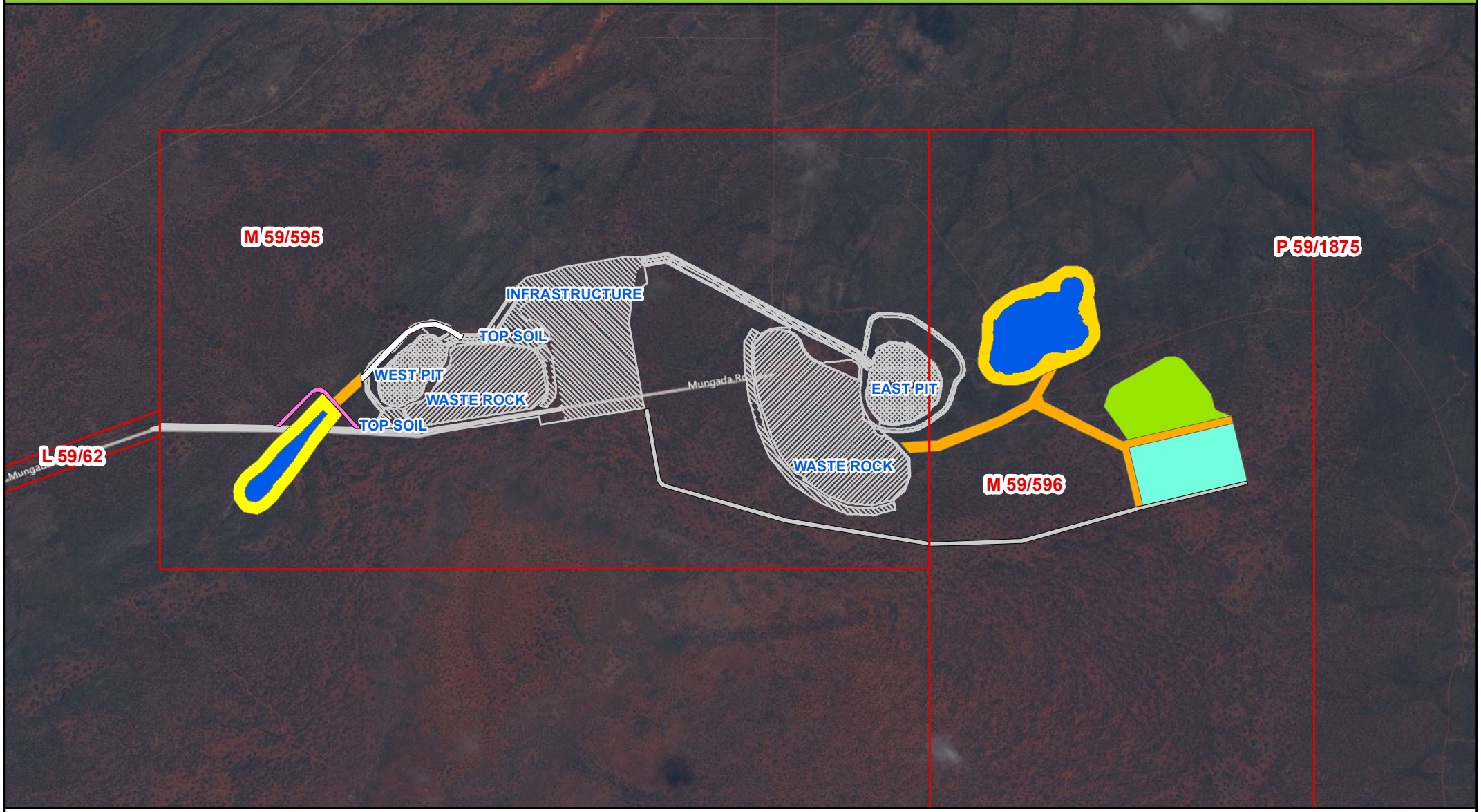
Figure 2 - Proposal Layout



Legend

- SMCL Tenements
- Layout of approved project

Proposal Layout

- MEE Access Road
- MEE Extension Pit
- MEE Haul Roads
- MEE Infrastructure
- MEE Vegetation
- MEE Waste Dump
- MWE Access Road
- MWE Existing Haul
- MWE Extension Pit
- MWE Haul Road
- MWE Vegetation

0 0.25 0.5 1
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

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Data Sources: Microsoft Virtual Earth

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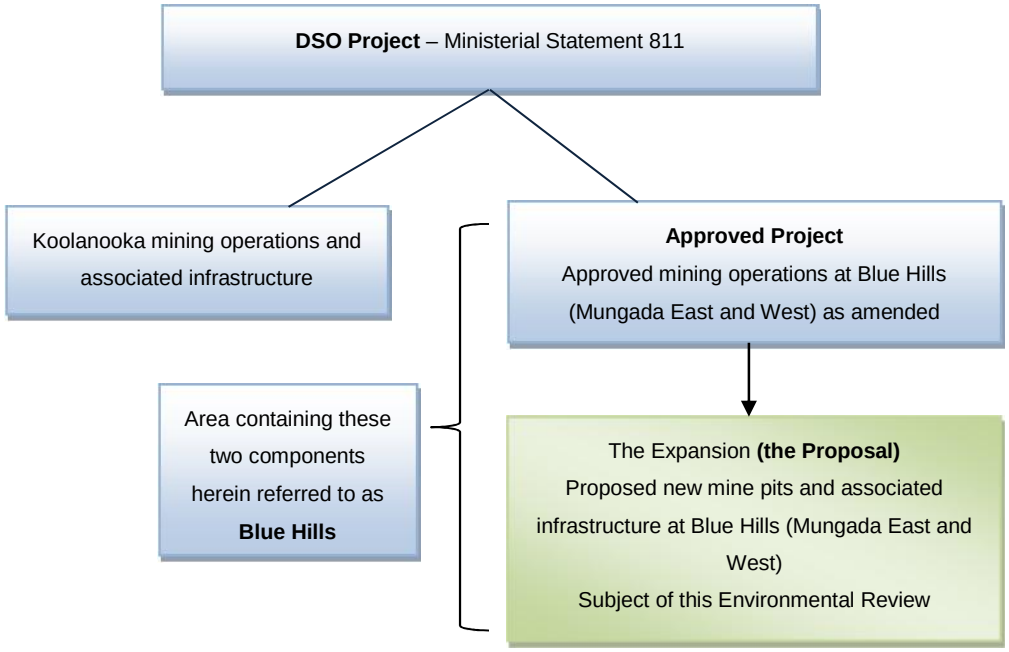
1.3 Terminology

For the purposes of this ER document, the following terms are used to describe the various elements of the project (**Figure 3**):

- **DSO Project** – the Koolanooka/Blue Hills DSO Project as described in MS 811, as amended in the (including both Koolanooka and Blue Hills mining operations)
- The **Approved Project** – comprising the approved Blue Hills (Mungada East and West) Project, a component of the overall DSO Project, as amended under Section 45C of the EP Act.
- The Expansion proposal (herein, the **Proposal**), the subject of this ER document; highlighted green in **Figure 3**.



Note: The Proposal subject to this ER is highlighted green in the diagram above.

Figure 3: Diagrammatic representation of the DSO Project and Proposal elements

1.4 Location

SMC's Blue Hills tenements; M59/595 and M59/596, containing the Proposal subject to this Environmental Review (herein referred to as the Proposal Area) are located in the Southern Murchison region of WA, within the Shire of Perenjori. The closest major towns are Geraldton and Morawa, which are approximately 225 km north-west and 90 km west of the Blue Hills, respectively.

1.5 The proponent

SMC is the proponent for the Proposal. SMC currently owns, operates and manages the existing DSO Project.

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1.6 Purpose and scope

This Environmental Review (ER) document is intended to provide supplementary information to support the referral of the Proposal under the EP Act. This ER document provides:

- A description of the Proposal and measures undertaken to modify the mine plan to reduce environmental impact
- An overview of the environmental setting of the Proposal area
- A preliminary evaluation of the potential environmental impacts that may occur as a result of the Proposal such that the OEPA can make an assessment on whether the Proposal is likely to have a significant effect on the environment
- An outline of the proposed management framework for the Approved Project which will be implemented for the Proposal.

1.7 Justification and objectives for the Proposal

The value of WA's mineral and petroleum industry reached $97 billion in 2012. Iron ore remains the State's largest sector in terms of value accounting for $51 billion or 70% of total mineral sales in 2012. The iron ore sector increased output by 12% however this was insufficient to counter lower prices resulting in a drop of $11.7 billion in sales from the 2011 period [Department of Mines and Petroleum (DMP) 2013)].

Feasibility studies have indicated that there is sufficient global demand to warrant expanding the Approved Project. New and expanding mining projects are necessary to maintain ongoing benefits to the WA economy from iron ore exports.

The Proposal will enable mining at Blue Hills to continue beyond the expected four year mine life at a mining rate of 1.5 Mtpa. The advantages of scale, ore quality, and existing infrastructure (approved for development) make the Proposal a highly desirable option for continuing SMC's operations, with consequent benefits for the local and wider community.

Implementation of the Proposal will generate royalties and taxation payments for both the State and the Commonwealth governments. The Proposal will also enable an operational workforce to be maintained

beyond the lifespan of the existing mine and will provide ongoing opportunities for local businesses and communities. SMC has previously received strong community support for the development of mining at Blue Hills.

1.8 Alternatives

The 'do nothing' alternative would result in the loss of opportunity to add value to WA's raw materials, the loss of economic, social and employment opportunities (particularly within the mid-west region) and the loss of potential for future developments in downstream processing of raw materials. The world's increasing demand for iron ore would likely be met through the development of new deposits and processing facilities or the development of overseas projects resulting in the loss of associated benefits to Morawa, Perenjori and other communities in the mid-west region of WA.

SMC recognises the environmental values of Blue Hills and, as part of its management approach, has developed and pursued alternative mine plans (to the optimum engineering and economic mine plan) including the backfill of pits from the currently approved mine and the placement of waste dumps and associated mine infrastructure outside of areas of higher conservation significance as mine planning has progressed. The processes of avoidance and minimisation of impacts to key environmental factors that have been undertaken in developing the layout of the Proposal, are discussed further in Section 2 and 6.

1.9 Legal framework and assessment process

The Proposal will be required to comply with relevant Local, State and Federal legislation. Construction and operations will also be guided by the State and Federal policy framework for environmental management. This legislative and policy framework was considered in the original PER prepared for the assessment and approval of the DSO Project by ecologia Environment (ecologia). Further information on the legal framework relevant to Blue Hills is provided in Section 2.1.1 of the *Koolanooka – Blue Hills Direct Shipping Iron Ore Mining Project, Public Environmental Review* (ecologia 2008a).

2 Proposal overview

2.1 Overview of existing operations at Blue Hills

Current operations at Blue Hills involve haematite ore mining from two above-watertable pits at Mungada East and Mungada West. The development of these pits involved the expansion of historic mine pits (remnants of mining at Blue Hills between 1960 and 1970). Waste from the pits is deposited into two waste dumps at Blue Hills, one adjacent to the Mungada East pit and one adjacent to the Mungada West pit. A semi-mobile dry crushing and screening plant operates adjacent to the Mungada West waste dump, which blends and processes the ore into lump and fine products at a rate of up to 2 Mtpa. High grade haematite ore is transported by road from the crushing plant at Blue Hills to Koolanooka for blending. Export product is then transported from Koolanooka/Blue Hills along existing roads to the Geraldton Port for export.

Existing supporting infrastructure at Blue Hills includes an office, workshop, warehouse and magazine buildings, power and water supplies and communications infrastructure. The production of DSO lump and fine fractions, using dry crushing and screening, requires limited water use. Daily water use of approximately 300 kilolitres (kL) is required at Blue Hills with an additional 50 kL/day for haul road dust suppression. Potable water, required for mine operation, is sourced from existing local bores. Water treatment is achieved via a reverse osmosis plant.

Electrical power required for the crushing and screening circuit and associated infrastructure at Blue Hills is approximately 500-1000 kW. This is below the threshold requiring licensing and is supplied by portable diesel fuelled power generators, maintained and operated by contractors. Diesel for the generators is stored in the Approved Project area in double skinned fuel tanks.

The Blue Hills workforce is accommodated at existing accommodation facilities at the nearby Karara mine site.

2.2 Proposal description

The Proposal involves the development of two new mine pits (one each at Mungada East and West), one additional waste rock dump (at Mungada East), an additional processing plant (similar to the existing plant) and additional road infrastructure. The activities associated with the Proposal will generally be undertaken in the same manner as those associated with the existing Approved Project, unless otherwise stated. A description of the activities planned as part of the Proposal is presented in the following sections.

2.2.1 Site preparation

Ground disturbance and vegetation clearing

The additional mine footprint will require up to 63.9 ha of native vegetation to be cleared to implement the Proposal (**Table 1**).

Table 1: Ground disturbance associated with the Proposal

Aspect	Clearing Footprint (ha)
Two additional mine pits (including 50 m clearance boundary surrounding pits)	27.6
Waste dump at Mungada East	11
Processing Plant	11.3
Haul roads	7.9
Access roads	6.1
Total area of ground disturbance	**63.9**

Note: the existing Mungada West waste dump will not require further clearing

Topsoil and overburden removal

Topsoil and vegetation within the Proposal area will be stripped and stockpiled in dedicated stockpile areas for later use in rehabilitation. Topsoil stockpiling will occur in small volumes given that a portion of Blue Hills is already cleared of vegetation and that soil profiles naturally contain only a thin topsoil horizon.

As far as possible, topsoil will be placed directly onto areas ready for revegetation to minimise the need for topsoil stockpiling. Where stockpiling is unavoidable, designated stockpiles will be placed within the approved stockpile areas.

Surface water diversions

There are no major waterways requiring modification or diversion as a result of the Proposal.

Localised modification of surface sheetflow paths will be necessary to protect mine infrastructure from flood risks. It will also be necessary to install culverts, crossings, and roadside drainage along the new haul and access roads.

Control of interactions between natural surface water drainage, mining operations, and waste dumps will be managed through standard management practices which typically include a series of diversion bunds, levees, drains, silt traps, and in-pit sumps.

Acid mine drainage and residue disposal

Acid mine drainage is not considered to be a likely impact of the Proposal because of the low sulphur content of the ore.

2.2.2 Mining and processing operations

Conventional open pit mining techniques will be employed for the Proposal. These will involve drilling, blasting, excavation, stockpiling, loading and hauling.

Mungada West

Ore from the new Mungada West pit will be transported by a typical mining fleet to run of mine (ROM) pads adjacent to the existing pit, for processing and blending via the existing semi-mobile dry crushing and screening plant. Using only dry screening techniques, the ore will be separated into lump and fine fractions with ore from the existing pit. The two products will be stored on existing stockpiles adjacent to the crushing and screening plant before transport to Geraldton via existing roads.

Mungada East

Ore from the new Mungada East pit will be unable to be processed using the existing plant, due to the large distance between the proposed pit and the plant. A new processing facility is proposed to the south-east of Mungada East to be used to process material from the new pit. Ore will then be stored at existing stockpiles and transported by road to Geraldton.

2.2.3 Waste material

Approximately 65% of the waste produced from the new Mungada East pit will be used in backfilling the existing Mungada East mine pit. The remaining 35% will be disposed of via the new waste dump to the south-east of the additional Mungada East mine pit. All waste from the new Mungada West pit will be used in backfilling the existing Mungada West pit.

2.2.4 Access and haul roads

Access

To facilitate access to the new Mungada West pit, the existing haul road running east-west will need to be diverted and a new access road constructed, approximately 460 m in length to the north of the new pit. A new access road is also required for the new Mungada East pit, which will be constructed from the existing haul road, to run to the south of the existing Mungada East pit and waste dump, connecting to the new processing plant and new Mungada East haul road. The new access road will be approximately 2.8 km in length.

Haulage

One additional portion of haul road approximately 150 m in length is proposed to connect the new Mungada West pit with the existing ROM haul road to the north. A further two new haul roads will be required to facilitate movement of ore at the new Mungada East pit. The first will be constructed between the new and existing pits to facilitate backfilling of the existing Mungada East pit. The second, a transport haul road, will connect the first haul road to the new processing facility and waste dump. The new haul roads at Mungada East will total approximately 1.8 km in length.

2.2.5 Support infrastructure and consumables

Existing supporting infrastructure, water and power supplies will be used to support the Proposal. As the mining rate will not be increased as a result of the Proposal, only the mine life, power and water use will generally remain consistent with current use.

2.3 Modifications made to optimal mine plan to reduce impacts

The proposed mine plan represents the outcome of a process of avoidance and minimisation of environmental impacts. An original mine plan was developed that provided the optimum layout for best economic return and also most straight forward engineering requirements. This was subject to a preliminary environmental review and subsequently major modifications were made to reduce in particular the extent of the mining footprint on the Mungada Ridge, which supports higher conservation values.

These changes included:

- Placement of the new waste dump further away from the new Mungada East pit and off the Mungada Ridge
- Realignment of the associated haul roads to reduce disturbance on Mungada Ridge
- Backfilling of approved mine pits.

3 Environmental setting

3.1 Climate

The climate of Blue Hills is semi-arid with a mean annual rainfall of approximately 283 mm. The highest average monthly rainfall occurs between May to July (**Figure 4**).

Wind patterns are highly seasonal. During summer, morning wind speeds of 11 kilometres per hour (km/h) to 30 km/h from the north-east and south-east prevail, shifting to the south and south-west in the afternoon. During the winter months, winds abate to generally less than 10 km/h, with less distinctive wind patterns. The combination of high wind speeds and high temperatures during summer contributes to elevated evaporation rates. Prevailing ambient dust levels are extremely high in these conditions (ecologia 2008a).

The closest official Bureau of Meteorology (BoM) weather recording station is at Paynes Find (Station No. 007139), where climate data has been collected since 1919 (BoM 2013). Key climatic indicators from this location are summarised below and shown in **Figure 4**:

- Mean daily maximum temperature: 37.3°C (January) – 18.4°C (July)
- Mean daily minimum temperature: 21.1°C (January) – 5.4°C (July)
- Mean annual rainfall: 283.1 mm
- Mean annual rain days (≥1 mm): 22.5 days

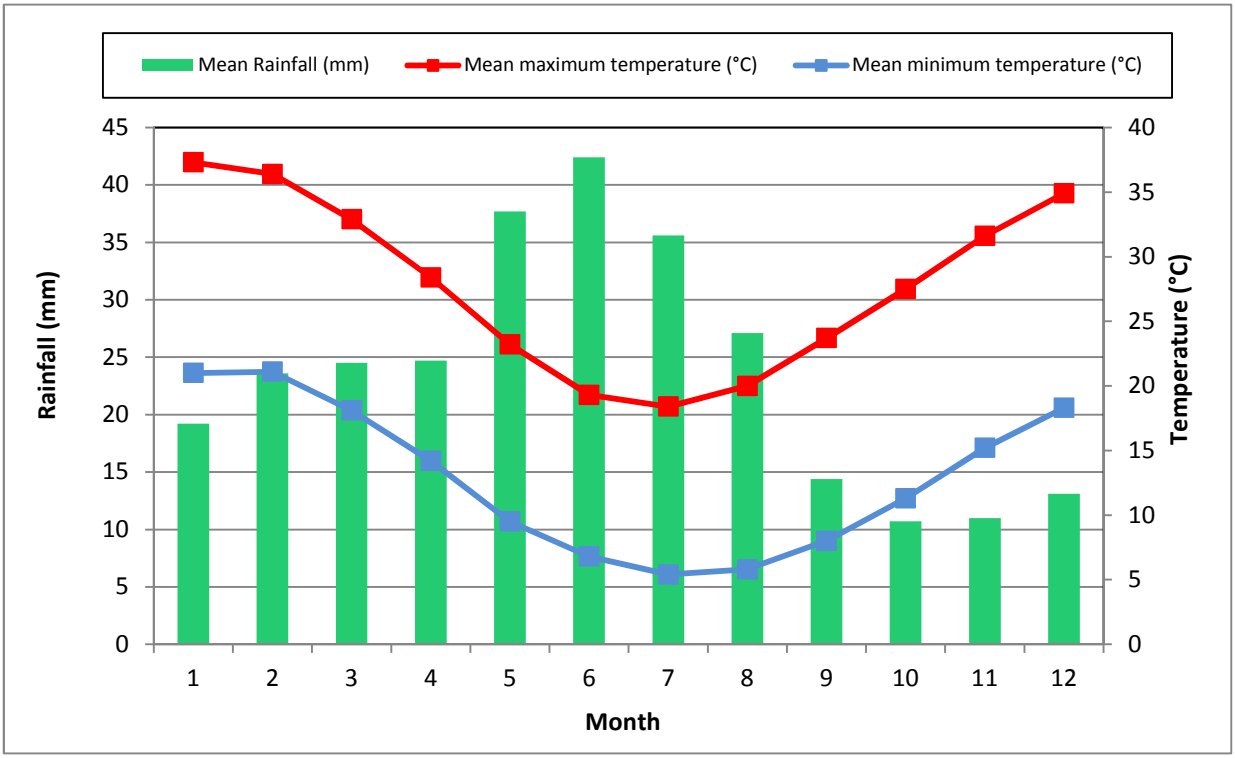


Figure 4: Climate data for Paynes Find

3.2 Geology, Geomorphology and Land Systems

The following is a summary of the regional geology of the region containing the Proposal area, as described by Rockwater (2006). The Proposal area lies on the Yilgarn Craton of mainly crystalline Archaean rocks. The Yilgarn Craton in the exploration areas comprises mainly granitoid rocks containing enclaves of older metamorphosed and folded supracrustal sedimentary, mafic and volcanic rocks. The older rocks include banded iron-formation (BIF) which generally forms prominent linear ridges that protrude from the comparatively flat areas that are underlain by granitoid rocks. The surface of the Archaean rocks has been weathered so that fresh rock may be overlain by 100 m or more of weathered material.

The Blue Hills range forms some of the highest land elevation in the local area. Slopes are generally steep and where the BIFs outcrop the topography is often rugged. The ground elevation at Blue Hills ranges from approximately 355 metres Australian Height Datum (mAHD) to more than 440 mAHD north-west of the existing Mungada West pit. The local topographic high is located immediately to the east of Blue Hills where Windaning Hill rises to 508 mAHD. The topography of the Proposal area is shown on **Figure 5**.

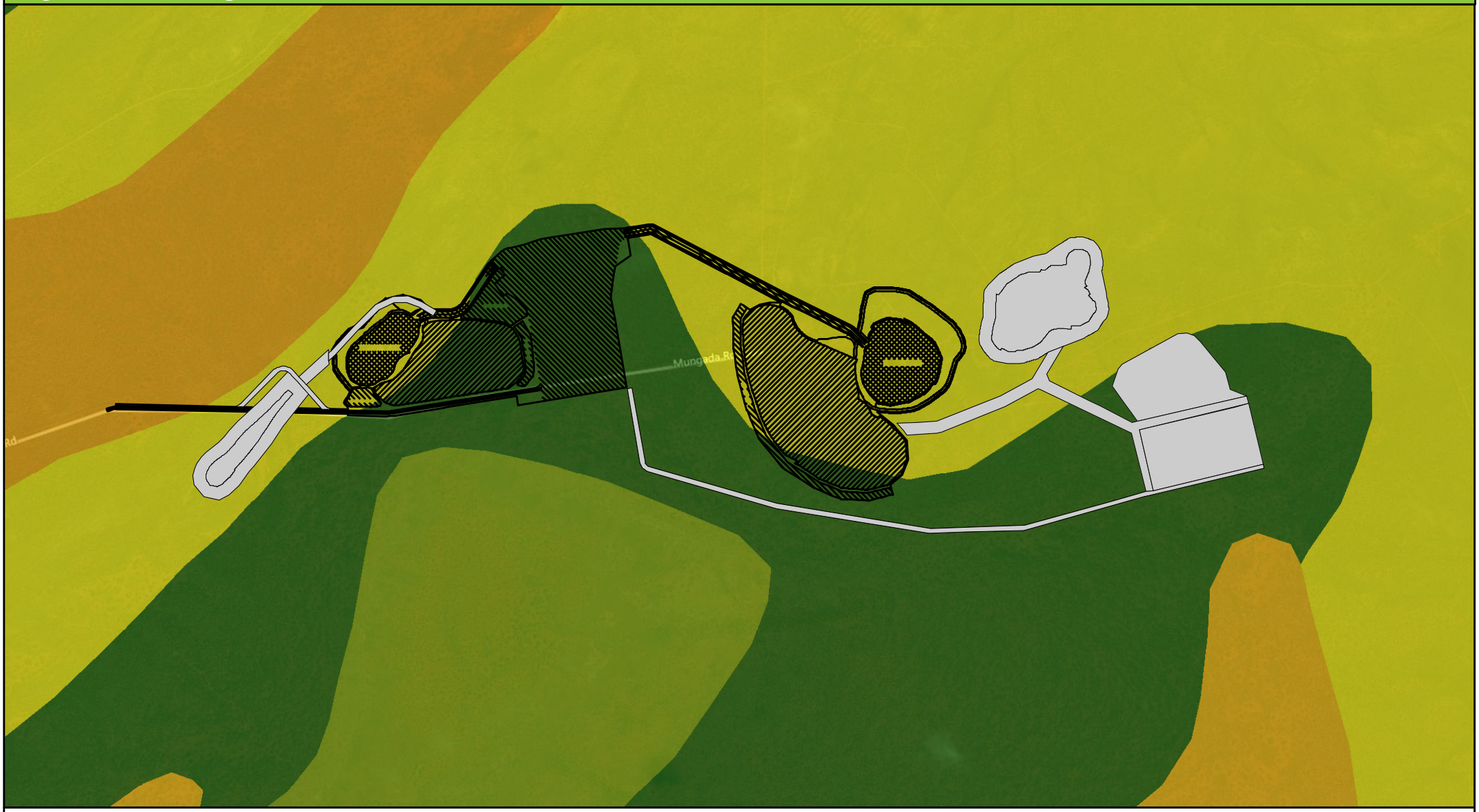
Two land systems occur within the Proposal area (Payne et al. 1998). These are described in **Table 2** and shown on **Figure 6**.

Table 2: Land systems within the Proposal Area (Payne et al. 1998)

Land System	Description
Tallering	Characterised by prominent ridges and hills of banded ironstone, dolerite and sedimentary rocks. The soils of the hillslopes and ridges are shallow red earths and stony red earths with smaller areas of red clayey sands with ferruginous gravel found on the stony and gravely plains.
Yowie	Dominated by loamy plains and has soils of variable depth including red clayey sands, hardpan loams and red earths on hardpan. Smaller areas of variable depth exist, with red clayey sands and ferruginous gravel over hardpan and deep red earths and juvenile alluvial deposits occur on the gravely plains and narrow drainage tracts of the land system.

Figure 5 - Topography

Figure 6 - Land Systems



Legend

- Proposal layout
- Layout of approved project

Land system

- Cunyu Land System
- Pindar Land System
- Tallering Land System
- Tealtoo Land System
- Yowie Land System

0 0.25 0.5 1

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

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3.3 Surface water and groundwater

There are few, if any, defined creeks or drainage lines within the Proposal area, indicating that the bulk of runoff, when it occurs, is by overland sheetflow.

Surface water drains from the surrounding Blue Hills discharges southwards to a low-lying wetland basin that represents the headwaters of a surface water drainage pathway. This is a 60 ha area that is that is approximately 700 m due south of the existing Mungada East pit. The area was previously referred to as a potential Gilgai formation (ecologia 2008a) but is now considered a seasonal surface water dependant wetland.

3.4 Vegetation and flora

In 2007, the DEC (now DPaW) and Department of Industry and Resources (DOIR) prepared a Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields (DEC & DOIR 2007). The Review indicated that the value of the ranges related to the presence of endemic plant species, rare and restricted plant species and highly restricted and distinct plant communities and ecological communities.

3.4.1 Survey history

Flora and vegetation surveys have been conducted at Blue Hills to support various stages of environmental approval of the Approved Project, most of which have included the Proposal area. Flora and vegetation surveys of Blue Hills include:

- Flora and vegetation survey of the SMC Blue Hills tenements conducted by Bennett Consulting Ecologists (for ATA) in October 2003 (Bennett 2004)
- Flora and vegetation survey of the SMC Blue Hills tenements conducted in July, September and October 2006 and February, June and August 2007 by ecologia (2007a)
- Flora and vegetation survey of the Tallering Land System (Markey & Dillon 2008), as part of a series on the flora and vegetation of the banded iron formations of the Yilgarn Craton conducted by DEC (five of the FCTs described occur in the Mungada Ridge area)
- Level 2 flora and vegetation survey for the Karara Iron Ore Project between June and August 2006 (Woodman 2008), conducted by Woodman Environmental Consulting, including vegetation mapping of 16,152 ha including the SMC tenements
- Targeted flora surveys of the SMC Blue Hills tenements conducted in June to September 2011 (Maia 2011)
- Desktop study of the potential impacts to flora and vegetation from implementation of the Proposal (original design) conducted by Maia (Maia 2012)
- Comprehensive desktop analysis of all available biological survey information for Mungada Ridge to determine the likely endemism of significant flora populations and ecological communities known to occur on Mungada Ridge (including Proposal area) (ecologia 2013).
- Regional flora and vegetation survey conducted by Woodman (2012) of the Karara to Minjar Block which covered the Proposal area

The survey reports listed above that were prepared for SMC are contained in **Appendix A**. Further details of the scope and intensity of these previous flora and vegetation surveys are summarised in Maia (2012). Numerous other flora and vegetation surveys have been undertaken in the region to support the environmental approvals of other iron ore projects.

3.4.2 Vegetation

The Proposal area is located within the Yalgoo Sub-region of the Austin Botanic District of the Eremaean Province of WA. The Austin Botanical District is dominated by low Mulga (*Acacia aneura*) woodland on the plains reduced to *Acacia* scrub on the hills. The vegetation of the hills is dominated by shrublands of *Acacia aneura*, *A. quadrimarginea*, *A. ramulosa* and *A. grasbyi* over *Senna* and *Eremophila* shrubs (Beard 1976).

Vegetation mapping by Beard (1976) shows the Proposal area as supporting two vegetation associations:

- **Vegetation Association Code 358.5** - *Acacia ramulosa*, *A. quadrimarginea*, *A. acuminata*, *Hakea preissii* and *Dodonaea inaequifolia* tall open shrubland; and
- **Vegetation Association Code 355.2** - *Eucalyptus loxophleba* and/or *E. oleosa* isolated low trees with *Acacia aneura* and *A. ramulosa* tall open shrubland.

The Government of Western Australia (2011) found that more than 99% and 94% (respectively) of pre-European extent of Beard's units 358.5 and 355.2 were remaining in February 2012. The current extents in all Department of Parks and Wildlife (DPaW) managed lands for Beard's units 358.5 and 355.2 are 35% and 46% respectively. These vegetation associations are not considered of regional significance or under threat.

3.4.3 Flora

Multiple flora and vegetation surveys have been carried out for the Approved Project which have included the Proposal area, but are not specific to the Proposal area. In the absence of this, the most recent survey which was conducted for the infrastructure areas of the Approved Project (Maia 2011) summarised the number of taxa recorded from within and in the vicinity of these areas. Maia (2011) reported 179 taxa from 104 genera and 46 families were recorded from the areas surveyed both within and outside the infrastructure areas of the Approved Project. The families with the highest number of taxa were Fabaceae (29), Asteraceae (24) and Myrtaceae (17). The genera with the highest number of taxa were Acacia (21), Eremophila (6), Eucalyptus and Melaleuca (5 each) (Maia 2011).

No flora species protected under the EPBC Act have been recorded in the Proposal area. A total of three flora species protected under the EPBC Act, have the potential to occur in the Proposal area and surrounds: *Eremophila viscida* (Endangered), *Hybanthus cymulosus* (Critically Endangered) and *Pityrodia axillaris* (Critically Endangered). The flora species *Eucalyptus synandra* (Vulnerable) was not returned in the database search, however it is known from the local area (ecologia 2008a).

One Threatened Flora species (Declared Rare Flora – Extant) listed under the WA *Wildlife Conservation Act 1950* (WC Act) is known to occur within the Proposal area; *Acacia woodmaniorum* (Vulnerable). Two additional Threatened Flora species are known to occur in the vicinity; *Eucalyptus synandra* (Vulnerable – WC Act and EPBC Act) and *Stylidium scintillans* (Vulnerable). *Stylidium scintillans* was targeted within SMC tenements by Maia during September 2011 (Maia 2011), however no individuals of the species, or the preferred habitat, were located.

Thirty-three Priority flora taxa are known from the vicinity of the Proposal area. Four of these have been recorded in the Proposal area:

- *Lepidosperma* sp. Blue Hills - Priority 1 (P1) (previously un-described)
- *Drummondita fulva* (P3)
- *Micromyrtus trudgenii* (P3)
- *Persoonia pentasticha* (P3)

Vegetation and flora values specific to the Proposal area are discussed in further detail in Section 6.1.

3.5 Vertebrate fauna

3.5.1 Survey history

Numerous vertebrate fauna surveys have been conducted at Blue Hills to support various stages of environmental approval of the Approved Project, most of which have included the Proposal area. Vertebrate fauna surveys of Blue Hills include:

- Bamford Consulting Ecologists (Bamford) conducted a single phase Level 2 fauna survey of the Approved Project area in February 2004 (at five trapping locations) (Bamford and Wilcox 2004)
- Bamford also conducted a three-phase Level 2 fauna survey in April, August, and October 2006, including trapping sites in Karara ridge, Blue Hills ridge, Terrapod (north-western region of the Mungada ridge), Mungada ridge and Jasper ridge (Bancroft and Bamford 2006)
- Ecologia Environment conducted a Level 1 Vertebrate Fauna Survey of the Blue Hills area in 2011. The survey involved trapping at 17 survey sites including four that fall within the Proposal area (ecologia 2011a).

The survey reports listed above that were prepared for SMC are contained in **Appendix A**.

3.5.2 Vertebrate fauna species

The faunal assemblages recorded by Bancroft and Bamford (2006) reflect the location of Blue Hills with biogeographic elements from the south-west, overlapping with elements from the Murchison and the interior. Bancroft and Bamford (2006) concluded the Approved Project area, containing the Proposal area, to support a rich faunal assemblage and diverse fauna habitats linked to the presence of ironstone ridges.

A total of six conservation significant fauna species listed under the EPBC Act and/or the WC Act have been identified as having a high likelihood of occurring in the vicinity of the Proposal area (ecologia 2011a);

- *Egernia stokesii badia* (Western Spiny-tailed Skink) (EPBC Act: EN, WC Act: S1, VU)
- *Leipoa ocellata* (Malleefowl) (EPBC Act: VU, Migratory, WC Act: S1, VU)
- *Falco peregrinus* (Peregrine Falcon) (WC Act: S4)
- *Merops ornatus* (Rainbow bee-eater) (EPBC Act: Migratory)
- *Lophochroa leadbeateri* (Major Mitchell's Cockatoo) (WC Act: S4)
- *Cyclodomorphus branchialis* (Gilled Slender Blue-tongue) (WC Act: S1)

The Gilled Slender Blue-tongue is the only one of these species to have been recorded in the Proposal area.

3.6 Invertebrate fauna

3.6.1 Survey history

Numerous invertebrate fauna surveys have been conducted at Blue Hills to support various stages of environmental approval of the Approved Project, most of which have included the Proposal area. Invertebrate fauna surveys of Blue Hills include:

- Bamford & Wilcox (2004) Blue Hills Fauna Assessment
- Bancroft & Bamford (2006) Fauna Values of Gindalbie Metals' Karara and Mungada Haematite/Magnetite Projects
- ecologia (2007b) Koolanooka/Blue Hills DSO Mining Project Short Range Endemic Biological assessment
- ecologia (2008b) Koolanooka - Blue Hills DSO Mining Project Short Range Endemic Literature Review and Risk Assessment
- ecologia (2010) Targeted SRE Survey of Blue Hills to support original approval
- ecologia (2011b) Blue Hills Additional Short-Range Endemic Invertebrate Survey Report
- ecologia (2012a) SMC Blue Hills *Idiosoma nigrum* targeted survey

The survey reports listed above that were prepared for SMC are contained in **Appendix A**.

3.6.2 Invertebrate fauna species

One of the invertebrate species recorded from the Proposal area has been confirmed as a Short range endemic (SRE) species; *Idiosoma* 'MYG018'. It was determined by the then Department of Environment and Conservation (DEC) (now DPaW) in 2011 that in the absence of additional information the records of this species at Blue Hills will be treated as the conservation significant *Idiosoma nigrum* (Shield-backed Trapdoor Spider) (EPBC Act: Vulnerable, WC Act: S1), until or unless determined otherwise (ecologia 2012b).

A further three species have been recorded in the Proposal area that have unknown, or potential, SRE status:

- Beierolpium 'sp. 8/2' (2011)
- Beierolpium 'sp. 8/3' (2011)
- Beierolpium 'sp. 8/4' (2010)

3.7 Subterranean fauna

Subterranean fauna surveys have been conducted at Blue Hills to support various stages of environmental approval of the Approved Project. Vertebrate fauna surveys of Blue Hills include:

- ecologia (2008c) Koolanooka/Blue Hills DSO Mining Project Stygofauna Assessment Survey
- ecologia (2008d) Koolanooka/Blue Hills DSO Mining Project Troglofauna Assessment Survey

No stygofauna or troglofauna species have been recorded from Blue Hills during these surveys.

3.8 Heritage

Several archaeological sites are known from Blue Hills. One registered Aboriginal 'Other Heritage Place' ID 24148 - Midwest Artefact Scatter 2, and one potential ethnographic site (BH11-14 Rockholes 2), occur within the Proposal area. These were recorded/confirmed during the archaeological Heritage and ethnographic surveys undertaken at Blue Hills in 2011 (Terra Rosa 2011a, 2011b). A Section 18

approval will be applied for under the WA *Aboriginal Heritage Act 1972* before undertaking works requiring disturbance to these sites. Works will also be undertaken in consultation with the relevant Traditional Owner groups.

SMC has consulted with three Native Title Claimants groups: Widi Mob, Binyardi and West Badimia regarding the cultural heritage values of the area, as part of ongoing consultation for the DSO Project. Information gathered as a result of this consultation included the following requests:

- That every effort be made to avoid site disturbance, especially a Man-Made Structure (Rockhole with Cap) including consideration of alternative locations for the works
- All project personnel be aware of their obligations under the WA *Aboriginal Heritage Act 1972*
- Where sites are to be disturbed, a nominal 30 m buffer be observed in addition to the site boundaries for all archaeological sites, until Section 18 consent is granted, to ensure that no accidental damage to the sites occur should ground disturbance activities be undertaken nearby, such as through down-slope movement of material.

These and other recommendations have been adopted in the Cultural Heritage Management Plan relevant to the Approved Project that is currently in preparation.

5 Key environmental management issues

This ER document and the identification of environmental management issues has been prepared by considering the Approved Project environmental approvals history (Section 1.1), including a review of information provided in the following documents relating to the DSO Project:

- Environmental Scoping Document (ESD)
- PER document (ecologia 2008a)
- Technical appendices to the PER
- EPA's Report and Recommendations, No. 1328 (EPA 2009a)
- Blue Hills s45C document (ecologia 2012b)
- Additional surveys undertaken to support the Proposal and s45C application

Key environmental factors relevant to the Proposal include:

- Vegetation and flora
- Terrestrial vertebrate fauna
- SRE fauna

Potential impacts to these factors that may result from implementation of the Proposal, and proposed management measures to avoid and/or minimise these impacts are discussed in Section 6. Other environmental factors relevant to the Proposal are discussed in less detail in Section 7. These factors are expected to be managed in accordance with standard management practices as described for the Approved Project, which are discussed in Section 8.

6 Potential environmental impacts and management

6.1 Vegetation and flora

6.1.1 Description

As Maia (2012) is the most relevant to the Proposal area, and summarises the relevant findings of all previous surveys, the information provided in the following sections has been adapted from this report unless otherwise stated.

Vegetation

Multiple sets of vegetation mapping have been prepared in the local area containing Blue Hills. Bennett Consulting Ecologists (2004) carried out a flora and vegetation survey of SMC's Blue Hills tenements for ATA in October 2003. Bennett mapped 15 vegetation associations over the two tenements. Subsequently, more detailed survey effort, in combination with statistical analysis, has resulted in the determination of Floristic Community Types (FCTs) which are pertinent to the assessment of vegetation conservation values in the Proposal area.

A total of five main groups and eight FCTs were described by Markey and Dillon (2008) as occurring across several ironstone ranges and outcrops on the central Tallering Land System, as part of a series of surveys on the flora and vegetation of the BIFs of the Yilgarn Craton undertaken by the (then) DEC. Woodman (2008) undertook additional vegetation survey and mapping which describes the vegetation of the Blue Hills tenements in detail. The FCT's mapped by Woodman are discussed further below.

Vegetation and flora endemism

Gibson et al. (2010) [(a subsequent report to the Strategic Review of BIF ranges of the Midwest and Goldfields (DEC & DOIR 2007)], found that the plant communities of the BIF ranges of the Midwest and Goldfields occur as islands of xeric shrub lands structurally and compositionally different from the surrounding woodland and shrubland matrix below. It was indicated these plant communities exhibit high levels of endemism and species turnover that cannot be ascribed to geology or current climatic gradients. The pattern of the vegetation and flora on these ranges appears to be related to local topographical factors and the long period of time these landscapes have remained un-glaciated and above sea level.

A subsequent Gibson et al (2011) publication examining patterns of plant diversity across these BIF ranges found those along the boundary of the Arid Zone (adjacent to the Transitional Rainfall Zone) appear to have acted as refugia during the climatic cycles of the Tertiary period with several hotspots of species endemism (one of which is the Koolanooka Hills approximately 60 kms to the east Blue Hills). The Gibson et al (2011) report appears to indicate that since vegetation composition on each range is unique (noting this work is prior to Floristic Community Type (FCT) analysis undertaken by Woodman (2012) indicating that FCTs occur on multiple ranges across the region) the occurrence and need to maintain sufficient representation of these ironstone specialists should be used as the key determinant for conservation focus. Regardless, both FCTs and conservation significant flora have been focussed on in this environmental review.

ecologia (2013) has conducted a desktop review of flora and vegetation endemism on the Mungada Ridge, which has been referred to in this Environmental Review.

Floristic Community Types

The original environmental impact assessments undertaken for the Approved Project were based on FCT mapping developed by Woodman (2008). This mapping was recently revised and extended to a regional level, through a regional flora and vegetation survey of the Karara to Minjar Block for the adjacent Karara Iron Ore Project (Woodman 2012). The assessment was undertaken to map vegetation communities associated with BIF within the regional survey area and to incorporate previous DEC and Woodman assessments from the area, additional quadrat-based survey and statistical analysis (Woodman 2012).

Woodman (2012) mapped thirty-two FCTs for the Karara to Minjar Block region, and of these eight occur in the Proposal area (**Figure 7**, **Table 3**).

Table 3: FCTs occurring in the Proposal area (Woodman 2012)

Code	Floristic Community Type
1	Tall shrubland to tall open shrubland of mixed *Acacia* species, including *Acacia aneura*, *A. assimilis* subsp. *assimilis*, *A. ramulosa* var. *ramulosa* and occasional *Allocasuarina acutivalvis* subsp. *prinsepiana* over mid sparse shrubland of mixed species including *Eremophila clarkei*, *E. latrobei* subsp. *latrobei*, *Mirbelia bursarioides* ms, *Philotheca brucei* subsp. *brucei* and *Philotheca sericea* over low isolated clumps of shrubs of *Xanthosia bungei* on red-brown silty clay loams on lowerslopes to crests with ironstone (BIF) or granite outcropping
2	Tall shrubland to tall open shrubland of mixed *Acacia* species, including *Acacia ramulosa* var. *ramulosa*, *A. exocarpoides*, *A. aneura* and *A. tetragonophylla* over mid open shrubland to mid sparse shrubland of mixed species including *Eremophila clarkei*, *E. latrobei* subsp. *latrobei*, *Hibbertia arcuata*, *Philotheca brucei* subsp. *brucei* and *Philotheca sericea* on redbrown silty loams or clay loams on flats to upperslopes with ironstone (BIF)
7	Tall closed shrubland to tall open shrubland of mixed *Acacia* species including *Acacia latior* and *A. sibina* with low isolated clumps of trees of mixed *Eucalyptus* spp. over low sparse shrubland of mixed species including *Dianella revoluta* over low isolated clumps of grasses of *Monachather paradoxus* and *Amphipogon caricinus* subsp. *caricinus* on red-brown silty clay loam with ironstone gravel on flats to lowerslopes
10	Tall closed shrubland to tall open shrubland of mixed *Acacia* species dominated by *Acacia assimilis* subsp. *assimilis* over mid open shrubland to mid sparse shrubland of mixed species including *Aluta aspera* subsp. *hesperia*, *Eremophila latrobei* subsp. *latrobei* and *Philotheca sericea* on red or red-brown silty clay loam or clay loam with ironstone gravel on flats to crests (primarily midslopes)
13	Tall shrubland of mixed species including *Acacia sibina, A. latior, A. ramulosa* var. *ramulosa* and *Melaleuca leiocarpa* with low isolated clumps of trees of mixed *Eucalyptus* spp. over low isolated clumps of grasses of *Monachather paradoxus* on red or red-brown silty clay loam or clay loam on flats to midslopes
19a	Low woodland to low open woodland of *Eucalyptus loxophleba* subsp. *supralaevis* over tall open shrubland of mixed species including *Acacia tetragonophylla* over mid sparse shrubland of mixed species including *Senna artemisioides* subsp. *filifolia* and *Rhagodia drummondii* over low sparse chenopod shrubland of mixed species including *Enchylaena tomentosa* var. *tomentosa*, *Sclerolaena diacantha*, *S. fusiformis* and *Maireana carnosa* over low isolated clumps of grasses of *Austrostipa elegantissima* on red to redbrown clay loam or silty clay with ironstone gravel on drainage lines, flats to midslopes

Code	Floristic Community Type
26	Tall shrubland to tall open shrubland of mixed species including *Acacia ramulosa* var. *ramulosa, A. tetragonophylla, A. assimilis* subsp. *Assimilis* and *Hakea recurva* subsp. *recurva* with low isolated clumps of trees of *Eucalyptus* spp. over low sparse shrubland of *Senna artemisioides* subsp. *filifolia* and *Rhagodia drummondii* over low isolated clumps of grasses of *Austrostipa elegantissima* on red or red-brown clay loam or sandy clay loam on flats to midslopes
27	Tall shrubland to tall open shrubland of *Acacia* species including *Acacia acuminata*, *A. tetragonophylla,* and *A. obtecta* with low isolated clumps of trees of *Callitris columellaris* and/or *Eucalyptus loxophleba* subsp. *supralaevis* over low sparse shrubland of *Rhagodia drummondii* and *Ptilotus obovatus* over low isolated clumps of grasses of *Austrostipa elegantissima* and *Monachather paradoxus* on red or red-brown clay loam or sandy clay loam on flats

During the environmental approvals process for the Approved Project, FCTs 12 and 13, as defined by Woodman (2008), were considered as being the FCTs with the highest conservation significance (rated 5 on a scale of 1 to 5), based on restricted habitat and greater occurrences of Threatened and Priority flora species (Woodman 2008, EPA 2009a). Since then, the Woodman (2008) mapping has been updated (Woodman 2012), these FCTs have been re-defined. FCT 13 is now defined as FCT 1, and FCT 12 as it occurs within and to the north of the Proposal area, has been divided into several FCTs; with FCT 10 and FCT 7 covering the majority of the original mapped area of FCT 12.

Due to the FCT mapping now being analysed and assessed on a more regional scale by Woodman (2012) this has allowed for consideration of conservation significance of the FCTs based on regional distribution, as well as FCT affiliation with the PEC. Woodman concluded that within the regional survey area FCTs 1, 2, 3, 4, 5, 6 10 and 12 were of conservation significance as they occur on BIF formations or occur high in the landscape on restricted landforms. These FCTs were assessed as potentially representing the PEC.

In the Proposal area, FCTs 1, 2 and 10 occur and are considered to be representative of the PEC. None of these FCTs are restricted to Mungada Ridge (ecologia 2013).

ecologia (2013) conducted an analysis of the Woodman (2012) mapping to determine which FCTs are considered to be of conservation significance based on restricted regional distribution and their representation of the PEC relative to Mungada Ridge. The areas that these FCTs occupy on Mungada Ridge, and more broadly in the region itself were calculated. Of FCTs 1, 2 and 10, FCT 1 was found to be of the highest conservation significance; having greater than 15% of its known distribution on Mungada Ridge as well as being associated with the PEC. The extent of FCT 10 (associated with the originally mapped FCT 12 that was considered of conservation significance) is not considered by ecologia to be of regional conservation significance as only 4.10 % of its regional distribution occurs on Mungada Ridge (ecologia 2013).

Further analysis of the regional conservation significance of the FCTs occurring within the Proposal area (i.e. those not considered in the ecologia assessment as they do not occur on Mungada Ridge) will be undertaken during the preparation of future approvals documentation for the Proposal.

Threatened and Priority Ecological Communities

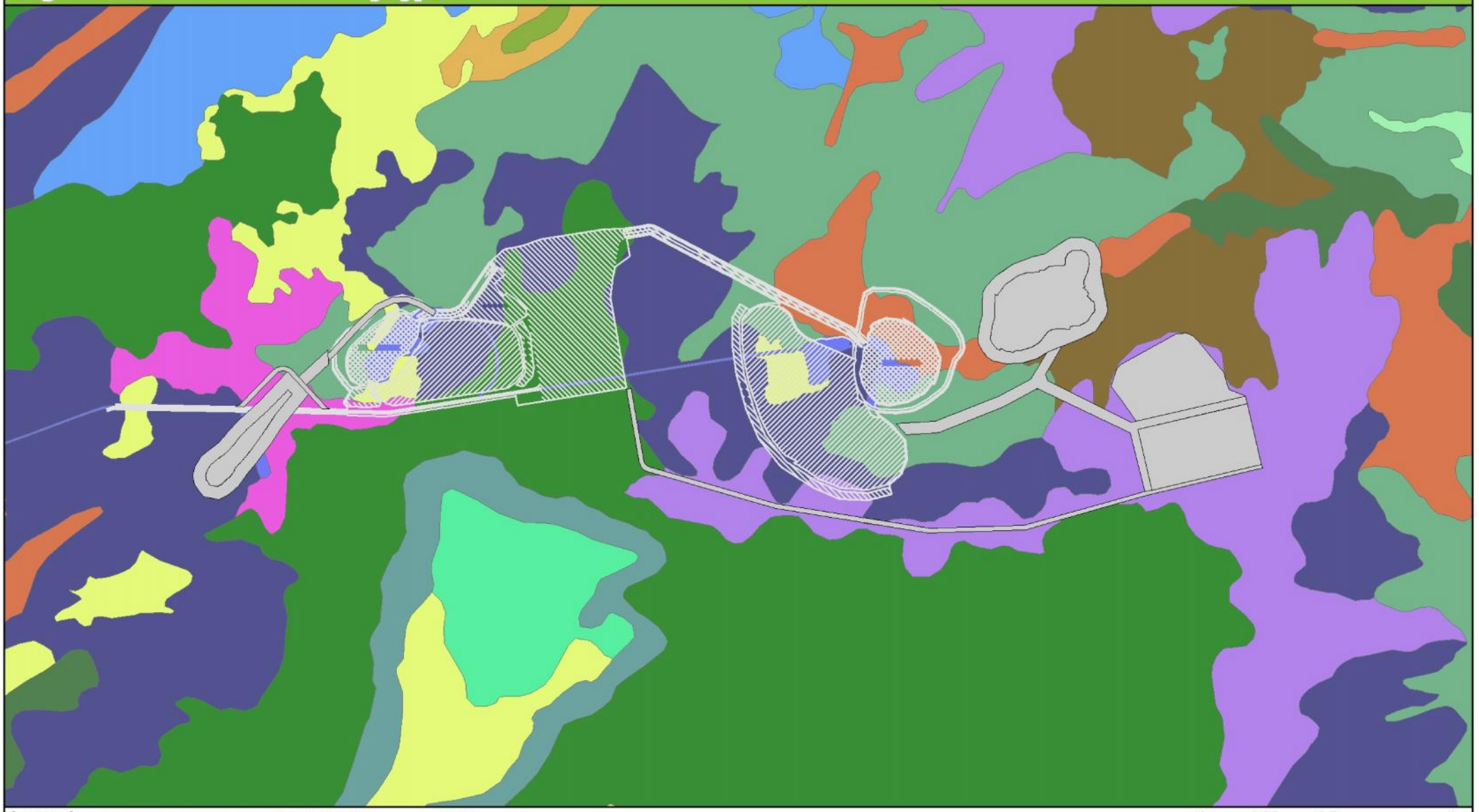
The Proposal area is not within or adjacent to a listed TEC (Maia 2012) but as indicated is partially located within the mapped extent of the Priority 1 PEC: Blue Hills (Mount Karara/Mungada Ridge/Blue

Hills) vegetation complexes (banded ironstone formation) (herein referred to as 'the PEC') (DEC 2013a). The DPaW describes Priority 1 PEC's as those with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

ecologia (2013) identified Mungada Ridge as being located entirely within the known extent of the PEC. However, the PEC was determined not to be endemic to the Ridge with the mapped buffers of the PEC extending up 20 km to the north and the south of Mungada ridge, 7 km to the east and 16 km to the west (ecologia 2013 is contained in **Appendix A**). Mungada Ridge occupies 1.2% of the area of the Blue Hills vegetation complexes PEC resulting from the DPaW search. However, this area also includes buffers and the actual area of the extent of the PEC area is likely to be less.

The Proposal area intersects the PEC, according to the mapping of the PEC without buffers provided to ecologia by DPaW (**Figure 8)**. The majority of the PEC mapped within the Proposal area occurs at Mungada East; specifically the proposed Mungada East pit and associated haul road. The Mungada West component of the Proposal only intersects a small portion of the PEC where the existing haul road is located. A total of approximately 23.07 ha of the Proposal areas lies within the PEC, which represents 0.09% of the current mapped extent of the PEC.

Figure 7 - Floristic community types



Legend

- Proposal layout
- Layout of approved project

Floristic Community Type

1	19c	27
10	2	4
12	20	7
13	21b	C
14	23	
19a	26	

0 0.25 0.5 1

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

ecological AUSTRALIA

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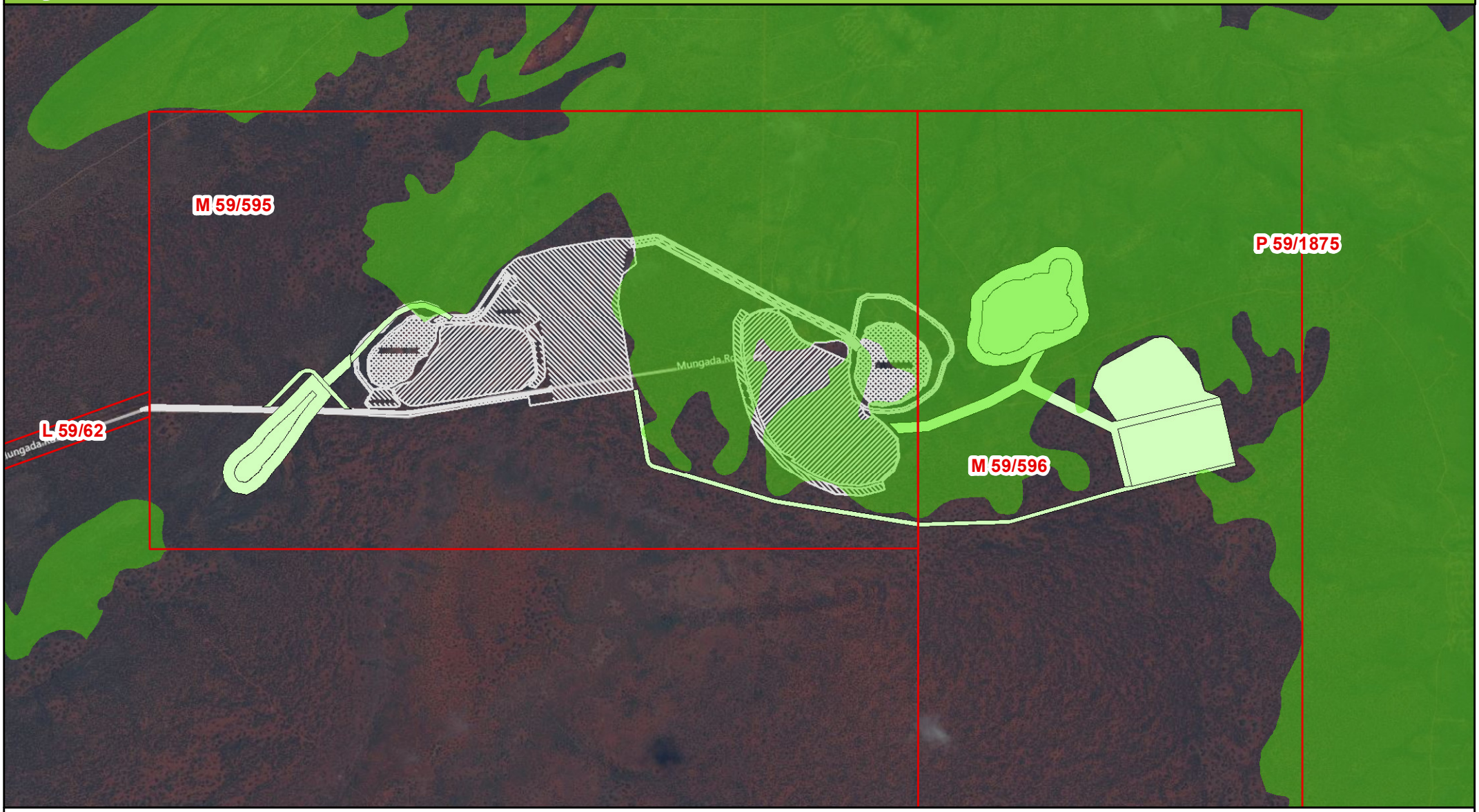
Figure 8 - Blue Hills PEC



Legend

- Proposal layout
- Layout of approved project
- Blue Hills (Mount Karara/Mungada Ridge/Blue Hills) vegetation complexes (banded ironstone formation)

0 0.25 0.5 1

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

ecological AUSTRALIA

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Conservation significant flora

Extensive and targeted flora survey has occurred over the Blue Hills tenements and Mungada Ridge, including the Proposal area.

One Threatened Flora species (Declared Rare Flora – Extant) listed under the WC Act is known to occur within the Proposal area, as well as four Priority flora species (**Table 4**).

Table 4: Conservation significant flora recorded within the Proposal area

Species	Conservation Significance
Acacia woodmaniorum	Threatened (Declared Rare Flora – Extant) (Vulnerable)
Lepidosperma sp Blue Hills	P1 (previously un-described)
Drummondita fulva	P3
Micromyrtus trudgenii	P3
Persoonia pentasticha	P3

Acacia woodmaniorum has 9,544 known localities and 30,108 individual plants in the local region (ecologia 2013) (**Figure 9**). Of all known individuals of this species, approximately 55% occur within SMC's Blue Hills tenements (ecologia 2013). A total of 3,680 individuals of *Acacia woodmaniorum* have been recorded in the Proposal area, the majority occurring on the south facing slopes of the Mungada East ridge, and in lower numbers around the existing Mungada West pit. It is acknowledged as a Threatened (Vulnerable) species *Acacia woodmaniorum* is considered to be facing a high risk of extinction in the wild (ecologia 2013).

In the local region, *Lepidosperma* sp. Blue Hills has 754 known localities and 4,975 individual plants in the local region (**Figure 10**), approximately 34% of which occur within SMC's Blue Hills tenements and approximately 98% of which occur on Mungada Ridge (ecologia 2013). There are additional locations for this species at Mt Singleton and Charles Darwin Reserve (FloraBase 2013 as cited in ecologia 2013) but numbers at these locations were unavailable at the time of reporting. A total of 534 individuals of *Lepidosperma* sp. Blue Hills have been recorded in the Proposal area, the majority occurring on the south facing slopes of the Mungada East ridge. As a Priority 1 taxa, *Lepidosperma* sp. Blue Hills is 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 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 (DEC 2013).

Both *Acacia woodmaniorum* and *Lepidosperma* sp. Blue Hills are also known to be restricted to rocky hills/crests and slopes. Desktop analysis undertaken by ecologia (2013) recognised *A. woodmaniorum* and *Lepidosperma* sp. Blue Hills as having significant proportions of known individuals on Mungada Ridge. FloraBase (2013) also identifies that the known distribution of *A. woodmaniorum* is limited to the Blue Hills Range. *Acacia woodmaniorum* was considered by ecologia (2013) to potentially be endemic to Mungada Ridge although it was acknowledged that further targeted regional surveys in predetermined areas (deemed to be of suitable habitat and that have not previously been searched) are recommended to determine if additional populations occur beyond Mungada Ridge.

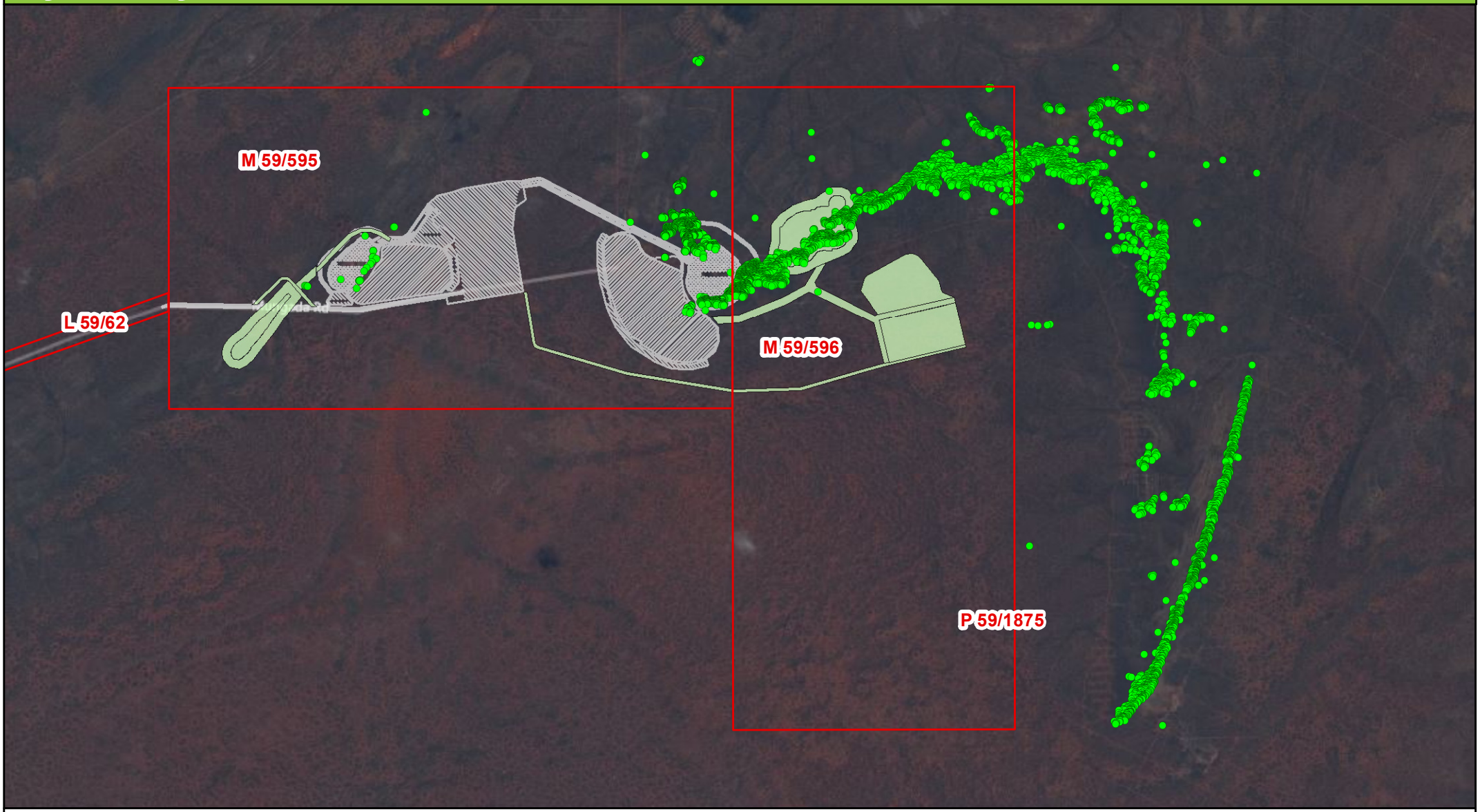
The locations of records of Priority flora species in the local region are shown on **Figure 10**. Priority 3 species are taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat (DEC 2013).

Weeds

No weeds of national environmental significance have been recorded within the Proposal area. Ten environmental weeds have been recorded in the wider Blue Hills area (Maia 2012):

- *Arctotheca calendula*
- *Brassica tournefortii*
- *Cleretum papulosum subsp. papulosum*
- *Cuscuta planiflora*
- *Erodium cicutarium,*
- *Lamarckia aurea,*
- *Lysimachia arvensis,*
- *Pentaschistis airoides subsp. airoides,*
- *Rostraria pumila*
- *Sonchus oleraceus.*

Figure 9 - Regional *Acacia woodmaniorum* records



Legend

- Proposal layout
- SMCL Tenements
- Layout of approved project
- *Acacia woodmaniorum* (T)

0 0.25 0.5 1
Kilometres
Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

ecological AUSTRALIA
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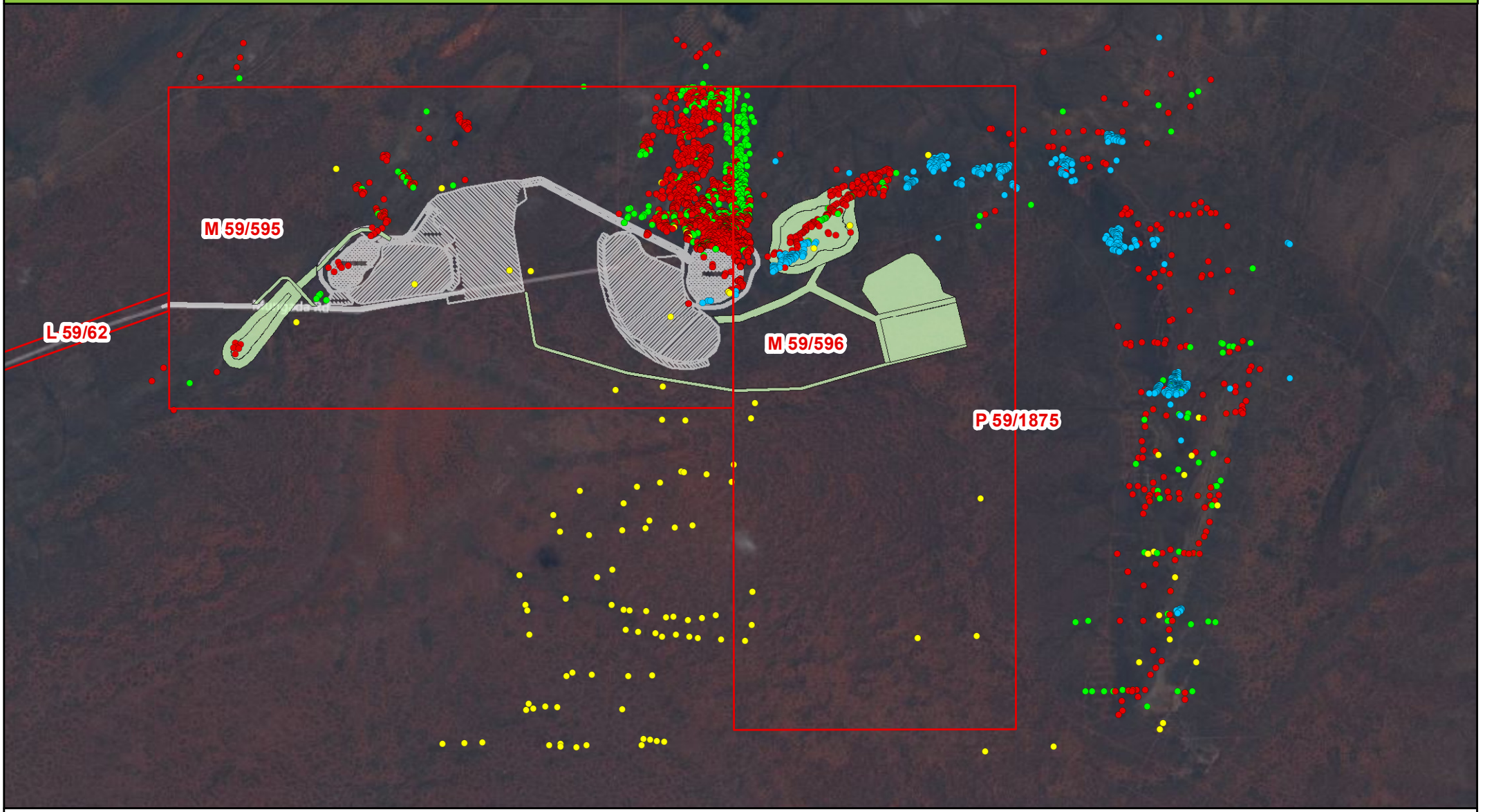
Figure 10 - Priority Flora records



Legend

- Proposal layout
- SMCL Tenements
- Layout of approved project

Species

- Drummondita fulva (P3)
- Lepidosperma sp. Blue Hills (P1)
- Micromyrtus trudgenii (P3)
- Persoonia pentasticha (P3)

0 0.25 0.5 1
Kilometres
Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

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6.1.2 Assessment of potential impacts

Overview

The Proposal will have a direct impact from 63.9 ha of clearing (**Table 5**). Indirect impacts to vegetation may also occur via changes in fire regime and intensity, increased dust emissions, saline water use for dust suppression and weed control. These potential indirect impacts would be considered in further detail as part of the formal environmental assessment process relevant to the Proposal (if applicable). In particular, weed and fire management would be discussed in detail.

Table 5: Ground disturbance requirements for the Proposal

Aspect	Impact Footprint	Vegetation Clearing Required
Approved Project	116.7 ha	106.7 ha
Proposal	63.9 ha	63.9 ha
Total	**180.6 ha**	**170.6 ha**

Based on the impact assessment conducted by Maia (2012) the main impacts to conservation significant flora, FCTs and the PEC will result from the Mungada East component of the Proposal. The Mungada East component is located on lower and upper southern facing slopes of the Mungada Ridge, which supports populations of the Threatened species *Acacia woodmaniorum,* Priority 1 flora species *Lepidosperma* sp. Blue Hills and contains the conservation significant FCTs 1, 2 and 10.

Impacts to regional vegetation

Estimated regional-scale impacts to Beard's vegetation associations of the Expansion area are expected to be low (Maia 2012) and are presented in **Table 6**. These have been calculated using the extent of Beard's vegetation associations mapped within the Proposal area, in comparison with the known extent of each vegetation association within WA.

Table 6: Ground disturbance requirements for the Expansion

Beard's Vegetation Association	Extent (ha)		Regional Impact of Proposal (%)
	WA Current	Proposal Area	
358.5	59,627.9	31.37	0.05
355.2	58,066.6	33.84	0.06

Impacts to the PEC

Avoidance and minimization measures applied through modifying the optimum mine plan to shift the new waste dump off the Mungada Ridge has substantially reduced the impact to the PEC.

Development of the Proposal will result in approximately 23.07 ha disturbance to the mapped extent of the PEC; or approximately 0.09 % of its known extent. The majority of disturbance will result from the development of the Mungada East component of the Proposal; the Mungada West component will only impact minimally on the PEC from the existing haul road (**Figure 11**). The anticipated impacts to the PEC as a proportion of its known extent (2,194.5 ha) are reported in **Table 7**.

Table 7: Impacts to the PEC

Aspect	Footprint (ha)	% of Known Extent
Approved Project	45.43	0.18
Proposal	23.07	0.09
Total	**68.5**	**0.27**

Impacts to FCTs

Avoidance and minimization measures applied through modifying the optimum mine plan to shift the new waste dump off the Mungada Ridge has substantially reduced the impact to conservation significant FCTs.

Local scale impacts to FCTs mapped in the Proposal area have been calculated using the vegetation mapping of Blue Hills and surrounds completed by Woodman (2012).

The Proposal will result in impacts to three conservation significant FCTs (1, 2 and 10) (see Section 6.1.1). The extent of impacts to FCTs occurring in the Proposal area is shown in

Table 8 and impacts to conservation significant FCTs from the Proposal are summarised as follows:

- **FCT 1:** approximately 6.4 ha (or 0.62%) of the mapped extent
- **FCT 2:** approximately 6.1 ha (or 0.17%) of the mapped extent
- **FCT 10:** approximately 11.9 ha (or 0.39%) of the mapped extent

These impacts are expected to result mostly from construction of the Mungada East component of the Proposal; the only conservation significant FCT impacted by the Mungada West component will be FCT 10 (**Figure 8**). The expected impacts of the Proposal on the regional extent of FCTs 1, 2 and 10 is <1% for each (**Table 8**).

Table 8: Predicted impacts to FCTs

FCT	Regional Extent (ha)	Extent within Approved Project (ha)	Extent Within Proposal Area (ha)	Impact* from Proposal (%)
1	1,035.5	9.3	6.4	0.62
2	3,671.3		6.1	0.17
7	9,458.8	35.3	4.8	0.05
10	3,033.9	21.5	11.9	0.39
13	2,612.9	1.8	1.4	0.05
26	5,283.2	1.5	29.9	0.57
27	4,207.7	27.4	0.8	0.02
19a	16,009.4	7.9	0.15	0.0009

* Percentage of mapped regional extent of each FCT
Grey shaded rows indicate conservation significant FCTs

Impacts to Acacia woodmaniorum

Avoidance and minimization measures applied through modifying the optimum mine plan to shift the new waste dump off the Mungada Ridge has substantially reduced the impact to *Acacia woodmaniorum*.

The expected direct impact from the Proposal on individuals of *Acacia woodmaniorum* is presented in **Table 9**. Approximately 3,680 individuals will be impacted as a result of the Proposal (**Figure 12**). The Proposal is likely to impact on 12.2% of the *Acacia woodmaniorum* known distribution (**Figure 9**). This impact is unlikely to affect the conservation status of this species.

Impacts to Lepidosperma sp. Blue Hills

The expected direct impact from the Proposal on individuals of *Lepidosperma* sp. Blue Hills is presented in **Table 9**. Approximately 534 individuals of *Lepidosperma* sp. Blue Hills have been recorded in the Proposal area and are likely to be disturbed (**Figure 13**). The total number of *Lepidosperma* sp. Blue Hills affected by the Proposal represents 10.9% of the known individuals recorded from the local region. This impact is unlikely to affect the conservation status of this species.

Other Priority flora species

The Proposal is likely to have a direct impact of no more than 7% of recorded occurrences of each of the P3 species *Drummondita fulva, Micromyrtus trudgenii* and *Persoonia pentasticha* in the local region (ecologia 2013).

Table 9: Predicted impact to *Acacia woodmaniorum* and *Lepidosperma* sp Blue Hills (using results of ecologia 2013)

Species	Individuals Known in Local Region	Individuals in Approved Project Area	Individuals Within Proposal Area	Impact from Proposal (%)*
Acacia woodmaniorum (T)	30,108	4,219	3,680	12.2
Lepidosperma sp Blue Hills (P1)	4,975	14	534	10.9

*Percentage of number of plants known in local region

Figure 11 - Potential impacts to PEC

Legend

- Proposal layout
- SMCL Tenements
- Layout of approved project
- Area of PEC impacted by Proposal layout

0 0.25 0.5 1

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

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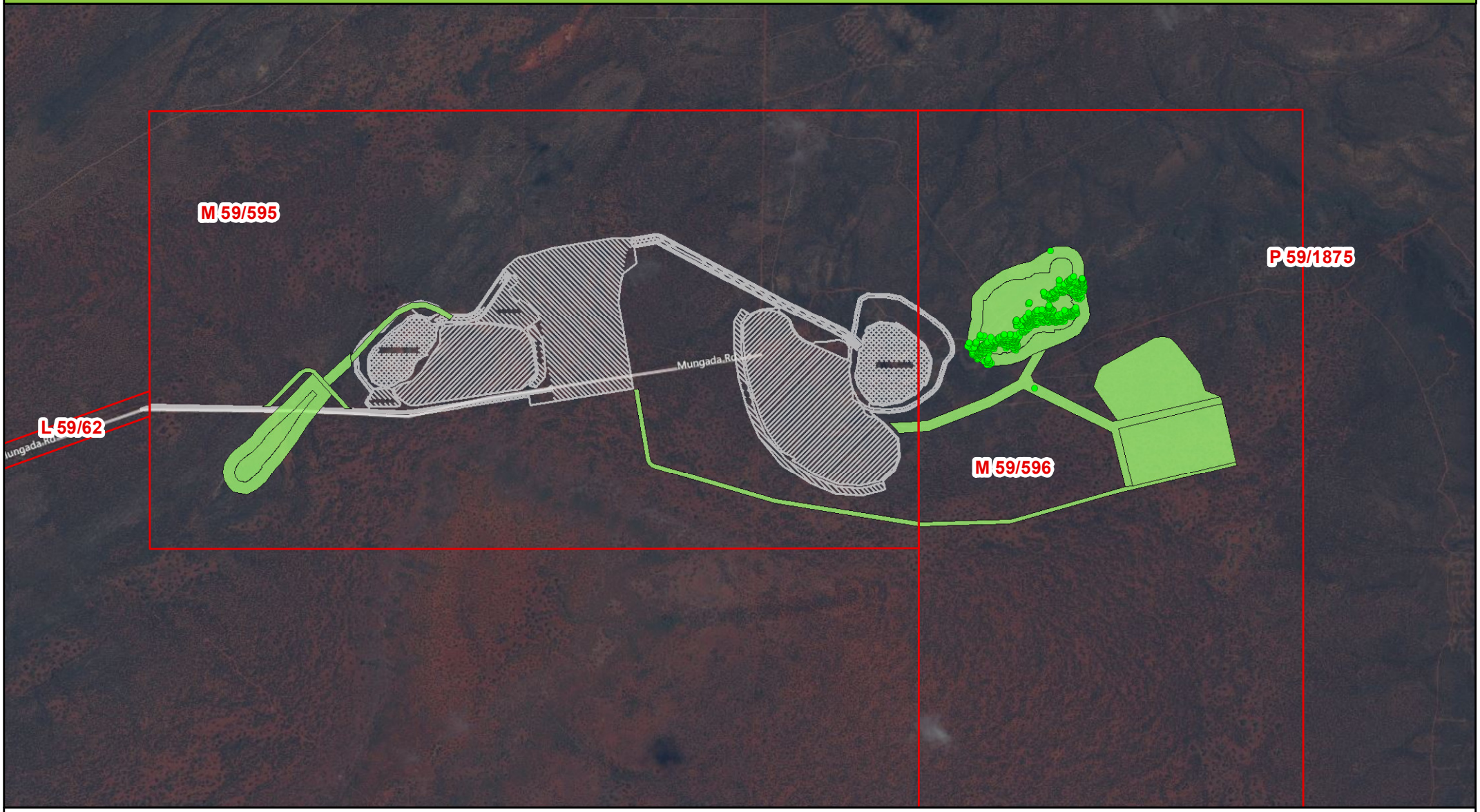
Figure 12 - Potential impacts to *Acacia woodmaniorum*



Legend

- Proposal layout
- SMCL Tenements
- Layout of approved project
- *Acacia woodmaniorum* records within Proposal layout

0 0.25 0.5 1
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

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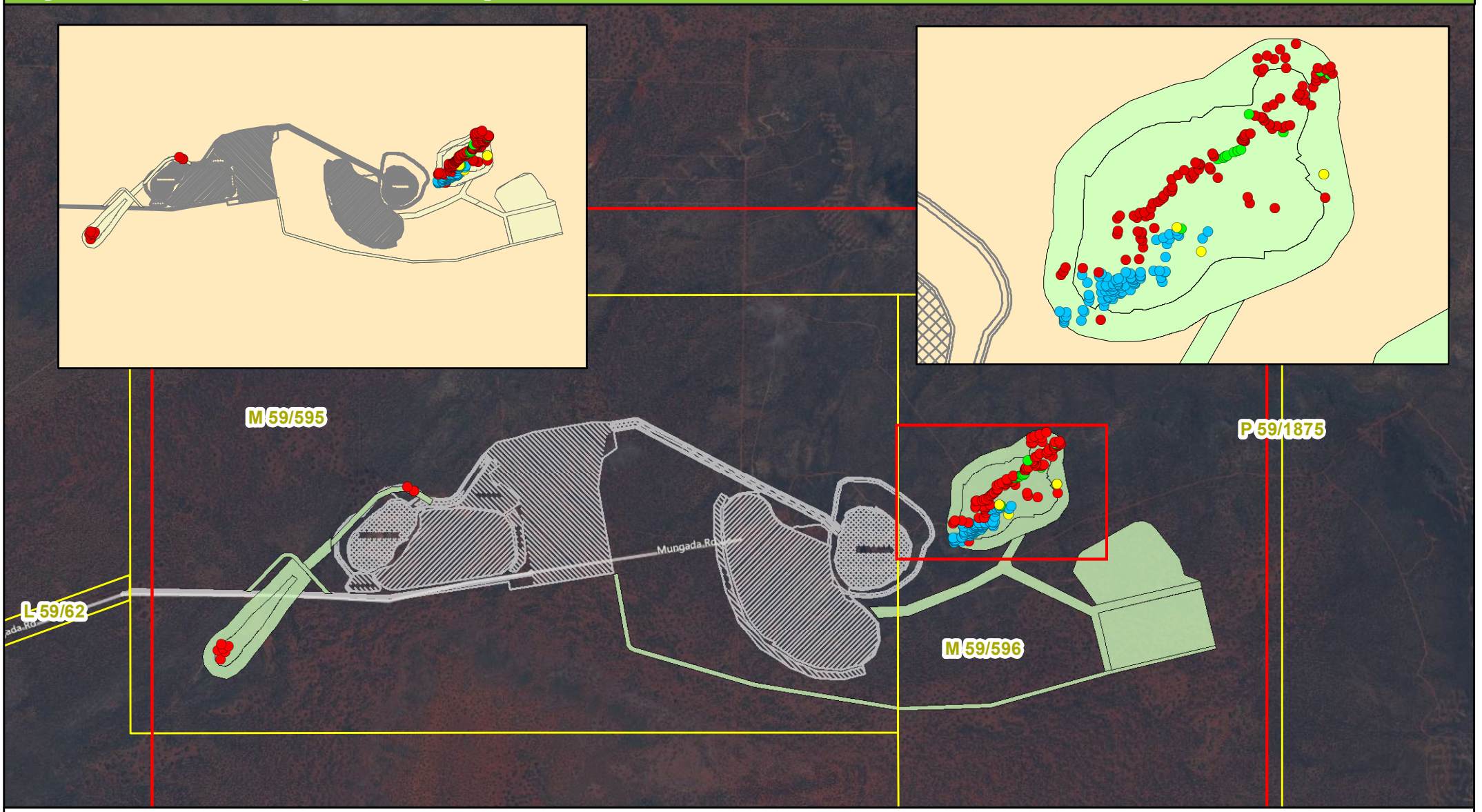
Figure 13 - Potential impacts to Priority Flora



Legend

- Proposal layout
- SMCL Tenements
- Layout of approved project

Priority Flora

- Drummondita fulva (P3)
- Lepidosperma sp. Blue Hills (P1)
- Micromyrtus trudgenii (P3)
- Persoonia pentasticha (P3)

0 0.225 0.45 0.9
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

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6.1.3 Key management actions

SMC's management objectives for vegetation and flora, based on EPA objectives, are:

- Minimise the loss of and adverse impacts to native vegetation and plant habitats.
- Protect Rare and Priority flora species that occur within the Proposal area.
- Maintain the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and the improvement in knowledge, consistent with relevant EPA's objectives

As a component of the PER for the DSO Project, SMC provided a list of management and mitigation commitments that will be implemented to achieve the objectives stipulated above. These management actions will remain applicable to construction and operational works of the Proposal, as listed below. These actions, as set out in the PER (ecologia 2008a) include:

- Preparation of a Threatened Flora Management and Conservation Plan
    - Liaison with the DEC [now DPaW] regarding the management of conservation significant flora
    - No-entry sites for protection of conservation significant flora, with clear demarcation to prevent accidental disturbance
    - Training and induction measures for site personnel, to raise awareness of conservation significant flora and vegetation
- Demarcation of disturbance areas prior to site works commencing
- Clearance controls concerning topsoil and vegetation removal and stockpiling
- Training and tools provided to personnel to assist in general awareness of conservation significant flora and to aid in minimising vegetation clearing and disturbance
- Vehicles and machinery restricted to designated tracks/roads
- Rehabilitation to be undertaken as soon as practicable.

SMC considers that further management actions may be required in addition to those set out in the PER for the DSO Project given the important vegetation and flora values of the Mungada Ridge. In particular, these values include:

- The WC Act listed Threatened flora species *Acacia woodmaniorum*, which is thought to potentially be endemic to the Mungada Ridge
- The Blue Hills PEC (P1)
- FCT 1, which is thought to be representative of the PEC and also range restricted.

Measures to minimise and mitigate impacts on conservation significant vegetation and flora will be achieved by:

- Ensuring that all disturbance areas are inspected to record the location of specimens/populations of conservation significant flora prior to the completion of mine planning
- Clearly demarcating the presence of restricted access areas including areas of conservation significant flora and vegetation that are to be retained

- Identifying further opportunities to minimise the direct disturbance of recorded specimens of *Acacia woodmaniorum* and the mapped extent of the PEC and FCTs 1, 2 and 10 by:
    - Refining required extent of the Mungada East mine pit and alignment of the new haul road to minimise the ground disturbance footprint and, therefore, impacts on conservation significant vegetation and flora.
- Undertaking field trials examining topsoil and overburden placement design and embankment/stockpile slopes for simulation of the natural soil substrate and physical conditions on the Mungada Ridge, to optimise potential for return of similar species composition and richness to that of the FCTs impacted in the Proposal area
- Restoring vegetation in disturbed areas of FCTs 1, 2 and 10 and the larger PEC on completion of mining activities, using revegetation with completion criteria including the successful restoration of at least 70% of the species known for these FCTs
- Conducting field and nursery trials to examine revegetation success of *Acacia woodmaniorum*, including the identification of factors that promote revegetation success
- Conducting research into the ecology of the conservation significant species and the PEC, including the influence of fire and surface water hydrology
- Identifying methods to protect conservation significant flora and vegetation of the Mungada Ridge in areas outside the Proposal area, such as:
    - Managing edge effects by ensuring the number and extent of weed species occurring in the area is not increased as a result of the development of new mine pits, waste dumps and haul road
    - Monitoring edge effects and health/condition of vegetation adjacent to, and further afield from, the Proposal area
    - Monitoring of *Acacia woodmaniorum* population outside of the Proposal area within SMC tenements
- Designating areas outside the Proposal area as 'conservation management areas' for protection of conservation significant flora and the PEC, and manage accordingly during mining.

6.2 Vertebrate fauna

6.2.1 Description

Habitats

Four main habitat types occur in the Approved Project area and surrounds were identified by ecologia (2011a), on the basis of geology, soil types, and existing vegetation (**Figure 14**). Of these, three occur in the Proposal area:

- **Low slopes with dense Acacia shrub**: found at the foot slopes of rocky ridges and steep slopes, this habitat type is dominated by dense *Acacia* spp. shrubs and scattered trees, and is distinguished by its low sloping landform and dense shrub vegetation. This habitat type is restricted to the Tallering Land System.
- **Eucalypt woodland plain**: characterised by a flat plain landscape with stands of mature *Eucalyptus* spp. trees with *Acacia* spp. shrubs and trees elsewhere. The Eucalypts provide an important feature to this habitat type and the surrounding landscape, occurring in small groups and resulting in abundant leaf and wood litter at the base of the stand. This litter provides an important microhabitat for a number of species, particularly reptiles, while tree hollows provide nesting habitat for birds. This habitat type is associated with the land systems of Yowie, Pindar and Tealtoo.

- **Rocky ridge with steep slopes**: the substrate of this habitat type consists of a surface layer of banded ironstone consisting of numerous solid outcrops interspersed with loose rocky stones and pebbles; and vegetation dominated by a dense layer of small leaf Myrtaceae species, with sparse trees consisting of *Melaleuca* sp., *Acacia* spp. and *Eucalyptus* spp. This habitat type is restricted to the Tallering land system.

Components of the Proposal area are predominantly located within the Low slopes with dense Acacia shrub and Rocky ridge with steep slopes habitat types. The three habitats types in the Proposal area are likely to be represented in the surrounding region, as they are considered to be linked to land systems that occur outside the Proposal area. Therefore, none are considered unique or restricted to Blue Hills (ecologia 2011a).

Fauna assemblages

Extensive and targeted fauna survey has occurred over the Blue Hills tenements and Mungada Ridge, including the Proposal area. Bancroft and Bamford (2006) concluded the Approved Project area, containing the Proposal area, to support a rich faunal assemblage and diverse fauna habitats linked to the presence of ironstone ridges.

Species of conservation significance

One vertebrate fauna species of conservation significance has been recorded in the Proposal area; Gilled Slender Blue-tongue (WC Act: S1). A further five vertebrate fauna species of conservation significance have been recorded in the vicinity of the Proposal area and so are considered likely to occur (ecologia 2011a):

- Western Spiny-tailed Skink (EPBC Act: EN, WC Act: S1, VU)
- Malleefowl (EPBC Act: VU, Migratory, WC Act: S1, VU)
- Peregrine Falcon (WC Act: S4)
- Rainbow bee-eater (EPBC Act: Migratory)
- Major Mitchell's Cockatoo (WC Act: S4)

ecologia (2011a) conducted an assessment of potentially occurring conservation significant fauna species for a portion of the Approved Project area; those recorded or considered of high likelihood of occurring in the vicinity of the Proposal area (as per the list above) are discussed herein. A description of these species and the likelihood of their occurrence in the Proposal area are presented below. Records from Blue Hills and surrounds are shown on **Figure 14**.

Gilled Slender Blue-tongue

The Gilled Slender Blue-tongue is known only from the semi-arid coast and inland of south-western Australia. The species inhabits semi-arid acacia woodlands and shrublands. This species is crepuscular and nocturnal, sheltering in the day in spinifex, leaf litter and under fallen timber.

The species has been recorded on three occasions from the Blue Hills area and vicinity; all within the rocky ridges with steep slopes habitat type (ecologia 2011a). Approximately 17.1 ha of this habitat type occurs within the Proposal area.

Western Spiny-tailed Skink

The Western Spiny-tailed Skink occurs in the south-west interior of WA. The species uses hollow timber logs for habitat and is reliant upon Eucalypt woodlands; and may therefore be associated with the Eucalypt woodland plain habitat type in the Proposal area. Large patches of Eucalyptus trees exist

within this habitat type, which may provide suitable habitat in the form of large hollow tree branches and logs. Approximately 30.7 ha of this habitat type occurs within the Proposal area.

Seventeen records of the Western Spiny-tailed Skink are known from the DPaW Threatened fauna database. This species has been recorded in the local area from at least four locations, the closest of which is located within 5 km of the Proposal area (EPA 2009a). This species is therefore considered as having a high likelihood of occurring in the Proposal area.

Malleefowl

Malleefowl prefer habitat consisting of thickets of Mallee, Mulga or other dense litter-forming shrublands as well as dry forest dominated by other Eucalypts, Mulga and Acacia species. They require sandy substrates with leaf litter in order to build their nesting mounds, hence the highest breeding densities occur in vegetation that is at least 40 years post-fire (ecologia 2011a).

Two active mounds have been recorded within the Approved Project area (**Figure 15**). Recorded mounds occur in the largest concentrations on the slopes of the ironstone ridges with gravelly loam soils and associated dense vegetation (EPA 2009a). These habitats are associated with the 'Low slopes with dense Acacia shrub' habitat type, of which 17.4 ha occurs within the Proposal area (Mungada East and West) (ecologia 2011a). Given the amount of suitable habitat and nearby records, Malleefowl are considered to have a high likelihood of occurring in the Proposal area.

Major Mitchell's Cockatoo

Major Mitchell's Cockatoo occupies habitats of lightly wooded country near water and tall Eucalypts, though it is also found on beaches and coastal dunes. It is likely to be associated with the 'Eucalypt woodland plain' habitat type. This species is widespread, but records in the arid and semi-arid interior of the State are patchy.

Major Mitchell's Cockatoo has been recorded within the Approved Project area. In 2010 ecologia recorded two individuals perched in a Eucalypt tree, while in 2006 individuals and pairs were recorded daily, often in large numbers during the survey near Mungada ridge (Bancroft and Bamford 2006). Regular sightings of this species in 2006 suggested that this species was likely to be breeding in the Eucalypt woodland plain habitat type at Blue Hills (Bancroft & Bamford 2006). One nearby survey also recorded the species in high numbers near the Old Karara Homestead, approximately 17 km south-west of Blue Hills (Bancroft & Bamford 2006). The closest record of this species to the Proposal area is approximately 250 m east of the proposed processing facility at Mungada East.

Peregrine Falcon

The Peregrine Falcon is considered nomadic or sedentary and is widespread in many parts of Australia, but is absent from most deserts and the Nullarbor plain. This species is typically associated with cliffs near coasts, rivers and ranges and around wooded watercourses and lakes (ecologia 2011a).

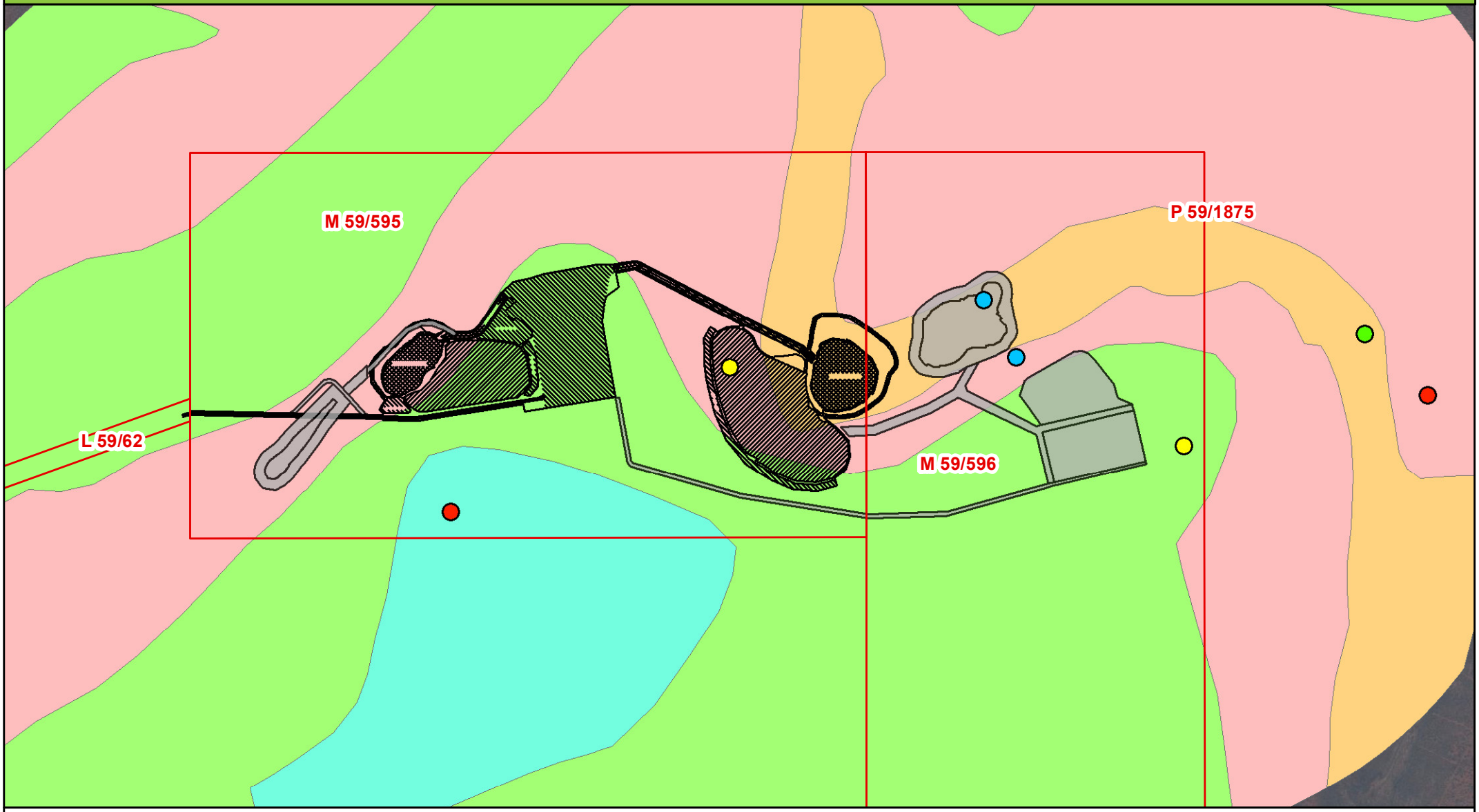
Mungada Ridge is considered typical nesting habitat for the species, which primarily nests on ledges of cliffs, granite outcrops and in quarries, but may also nest in tree hollows and around wetlands. Surrounding habitats may be utilised as hunting grounds for this species (ecologia 2011a).

This species has been recorded nesting approximately 1 km east of the Proposal area (Bancroft and Bamford 2006) (**Figure 14**) within the 'Rocky ridge with steep slopes' habitat type. Approximately 17.1 ha of this habitat type occurs within the Proposal area.

Rainbow Bee-eater

The Rainbow Bee-eater prefers lightly wooded, preferably sandy country near water. This species has been recorded during two surveys of the Approved Project area (Bamford and Wilcox 2004, Bancroft and Bamford 2006) and is likely to occur within the Proposal area during its regular migrations through the area (ecologia 2011a). This species is unlikely to breed in the Proposal area, due to a lack of suitable breeding habitat in the form of sandy banks (ecologia 2011a). While the species is known to occur at Blue Hills, its presence is expected to be transient in nature.

Figure 14 - Fauna habitats and significant fauna records



Legend

- Proposal layout
- SMCL Tenements
- Layout of approved project

Fauna habitats

- Rocky ridge with steep slopes
- Low slopes with dense *Acacia* scrub
- Eucalyptus woodland plain
- Alluvial Plain

Significant Species

- Gilled Slender Blue-tongue
- Major Mitchell's Cockatoo
- Peregrine Falcon
- Rainbow Bee-eater

0 0.25 0.5 1
Kilometres
Datum/Projection:
GDA 1994 MGA Zone 50

N

Data Sources: Microsoft Virtual Earth

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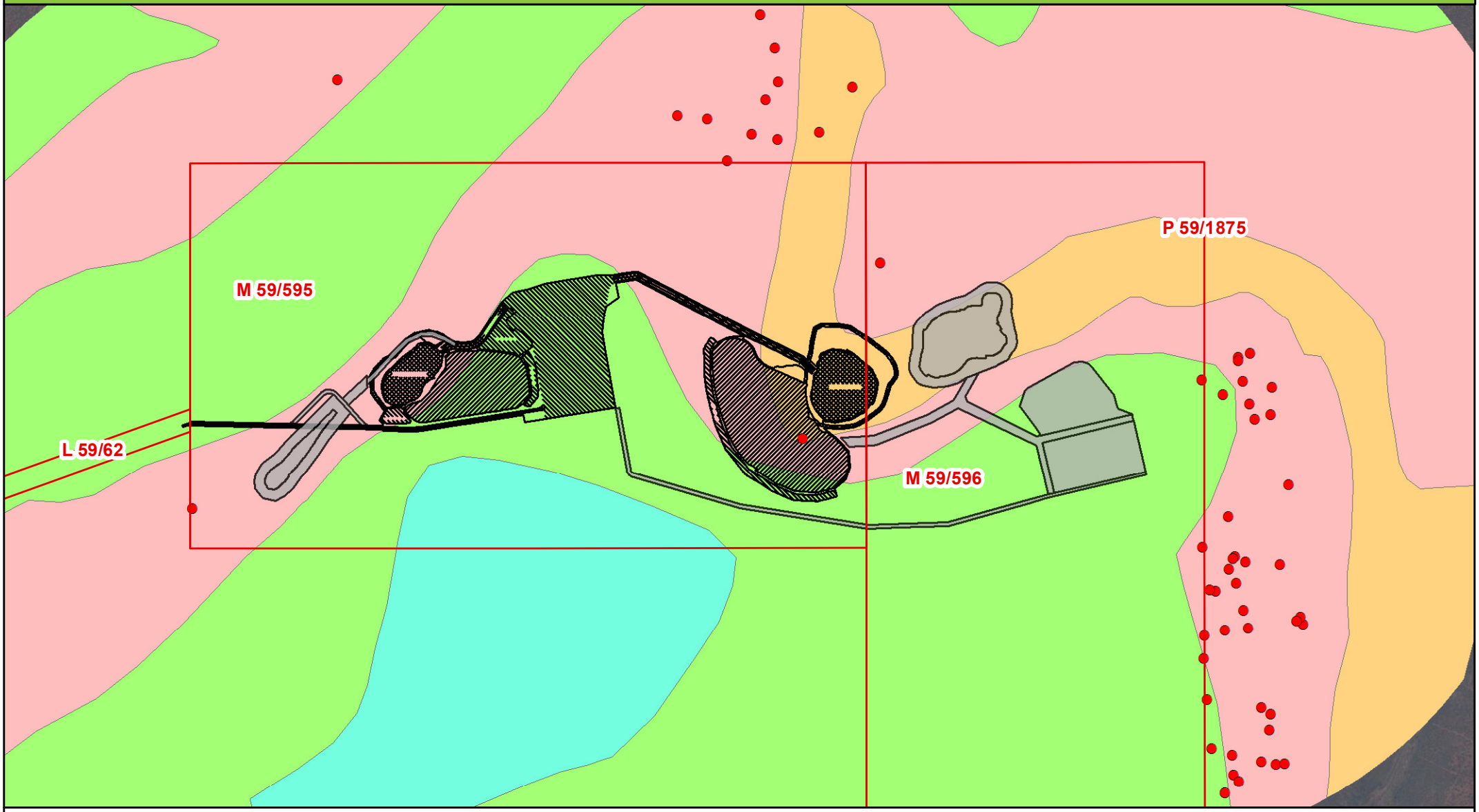
Figure 15 - Malleefowl Mound records



Legend

- Proposal layout
- SMCL Tenements
- Layout of approved project

Fauna habitats

- Rocky ridge with steep slopes
- Low slopes with dense *Acacia* scrub
- Eucalyptus woodland plain
- Alluvial Plain

- Malleefowl Mounds

0 0.25 0.5 1

Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

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Data Sources: Microsoft Virtual Earth

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6.2.2 Assessment of potential impacts

Potential direct impacts to vertebrate fauna as a result of implementation of the Proposal are expected to be associated with the mortality of individuals from clearing of fauna habitat.

One species of conservation significant vertebrate fauna is known to occur in the Proposal area; Gilled Slender Blue-tongue. A further five are considered highly likely to occur within the Proposal area; Western Spiny-tailed Skink, Malleefowl, Peregrine Falcon, Rainbow Bee-eater and Major Mitchell's Cockatoo. Of these species, the Western Spiny-tailed Skink and Gilled Slender Blue-tongue are considered to be at the greatest risk of impact from the Proposal due to their habitat preferences, limited mobility and limited capacity to disperse in response to disturbance.

Ground disturbance, including the clearing of vegetation, is required in order to facilitate the construction of mine pits and associated infrastructure relevant to the proposed Expansion. Direct impacts to three habitat types are expected as a result:

- Low slopes with dense Acacia shrubs (17.4 ha)
- Eucalypt woodland plain (30.7 ha)
- Rocky ridge with steep slopes (17.1 ha)

While the Proposal area contains suitable habitat for six fauna species of conservation significance that are considered highly likely to occur; these habitats are not considered to be unique to Blue Hills and are adequately represented in the surrounding region (ecologia 2011a).

Key features of habitats occurring in the Proposal area include (Bancroft and Bamford 2006; as cited in EPA 2009b):

- Ironstone ridges, particularly where the rock formations are well developed to create micro-habitats for roosting bats, *Pseudantechinus woolleyae* (Woolley's Pseudantechinus) and the Peregrine Falcon (the latter of which has been recorded at Blue Hills. The EPA (2009a) Report noted that the Mungada Ridge stands out in this respect. The Gilled Slender Blue-tongue may also be restricted to rocky habitats along ridges.
- Lower slopes of ironstone hills where water is concentrated, creating dense vegetation. Such areas are important for a number of significant bird species, the Shield-backed Trapdoor Spider, and also seem to be linked to general patterns of biodiversity. Dense vegetation is particularly well-developed on the western slopes of Mungada Ridge, where the boomerang shape of the ridge has probably concentrated runoff and facilitated the growth of dense vegetation.
- Temporary wetlands.
- Well-developed eucalypt woodlands.

The majority of ground disturbance associated with the Mungada West component of the Proposal will occur only within the Low slopes with dense Acacia shrubs habitat type. The Mungada East component will impact all three habitat types; Low slopes with dense Acacia shrubs, Eucalypt woodland plain and Rocky ridge with steep slopes. As the habitats of the Proposal area were considered typical of the surrounding region, with no unique fauna habitats restricted to the Proposal area by ecologia (2011a), it is considered that impacts to fauna habitats as a result of the Proposal will be minimal at a local and regional scale.

Gilled Slender Blue-tongue

This species has been recorded within the Proposal area at one location inside the new Mungada East pit. A second record of this species is known from Blue Hills approximately 60 m south-east of the new Mungada East pit. One individual of the species has also been recorded from the adjacent Karara ridge, approximately nine kilometres from the Proposal area (Bancroft and Bamford 2006).

This species is associated with the Rocky ridge with steep slopes habitat type (ecologia 2011a), 17.1 ha of which will be impacted as a result of the Proposal. Avoidance and minimization measures applied through modifying the optimum mine plan to shift the new waste dump off the Mungada Ridge has substantially reduced the impact to the habitat type. It is estimated 17.1 ha of ironstone ridges, which are a key habitat feature for this species, will be now disturbed for the Proposal; this habitat type is represented outside of the Proposal area. .Direct mortality of some individuals may also occur from vehicle strike.

Western Spiny-tailed Skink

Although this species has not been recorded in the Proposal area, it is known to occur nearby, and the Proposal area contains suitable habitat. For these reasons, the species is considered to have a high likelihood of occurring in the Proposal area. This species is associated with the Eucalypt woodland plain habitat type (approximately 30.7 ha of which is to be cleared for the Proposal) found surrounding the Mungada Ridge landform and, if present, may rely on patches of Eucalypt trees where key habitat features are present in the form of large hollow branches and logs.

If present, this species may be impacted temporarily by the Proposal through clearing of the Eucalypt woodland plain habitat, however these impacts will be minimised as habitat for the species is considered to occur outside of the Proposal area. The species may also be impacted (if present) through direct mortality resulting from vehicle strike. Prior to construction, further inspections will be undertaken to confirm whether the Western Spiny-tailed Skink is present in the Proposal area through the inspection of any present hollows in Eucalypt trees or logs.

Malleefowl

Malleefowl mounds have been recorded at numerous locations on the Mungada Ridge and surrounds, however none have been recorded in the Proposal area. At Blue Hills and on the Mungada Ridge, mounds have been found to occur in the highest concentrations on the slopes of ironstone ridges with gravelly loam soils and associated dense vegetation (EPA 2009a). These habitats are associated with the Low slopes with dense acacia shrubs habitat type found in the Proposal area (17.4 ha of which is to be disturbed by the Proposal). The characteristics of this habitat type, with dense shrubs, abundant leaf and wood litter and suitable soil substrate result in Malleefowl mounds being concentrated in these areas.

Due to the many records occurring in similar habitat close by, it can be expected that Malleefowl mounds may occur within the Proposal area. Impacts to this species (if present) may result from direct mortality from vehicle strike or destruction of mounds, and disturbance of potential habitat for the species in the Proposal area.

Major Mitchell's Cockatoo

This species has been recorded in the Approved Project area, and also approximately 250 m east of the proposed processing facility at Mungada West. Impacts to this species are likely to be minimal given the species' mobility and availability of habitat outside the Proposal area, and areas of potential breeding habitat for the species such as stands of large Eucalypt trees with hollows will be avoided where possible.

Peregrine Falcon

The species has been observed nesting in the vicinity of the Proposal area, approximately 1 km east of the Proposal area (Bancroft and Bamford 2006). Approximately 17.1 ha of Rocky ridges and steep slopes habitat which provides habitat for this species, will be disturbed as part of the Proposal.

Although suitable habitat is present within the Proposal area for this species in the form of ironstone ridges, impacts to this species from the Proposal are expected to be minor. Habitat for the Peregrine Falcon is present in the surrounding area and this species has the ability to move away from disturbance (if present).

Rainbow Bee-eater

The Rainbow Bee-eater occurs in open country across a variety of vegetation types across Western Australia. This species has been recorded during two surveys of Blue Hills (none have been recorded in the Proposal area). While the species is known to occur in the general area, it is highly mobile and therefore less likely to be impacted than other species that are more limited in range. The species is unlikely to breed in the Proposal area (ecologia 2011a), and is unlikely to be impacted as a result of the Proposal given its highly mobile nature and availability of habitat regionally.

Indirect impacts

Other threatening processes that may impact on the terrestrial fauna values of Blue Hills surround habitat modification as a result of potential altered surface hydrology, erosion, modified fire regimes, and the introduction of weeds and feral animals. Modified surface drainage also has the potential to impact dense vegetation and associated habitats.

Maintenance of surface drainage patterns will be required in order to avoid impacts in areas adjacent to the Proposal area.

Fire, weeds, and feral animals will be managed in accordance with management approaches as prescribed for the Approved Project.

6.2.3 Key management actions

SMC's objectives for management of terrestrial fauna are to:

- Maintain the abundance, diversity, geographic distribution, and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge; and
- Minimise the impact to fauna.

As a component of the PER for the DSO Project, SMC provided a list of actions that are being implemented towards mitigating the impacts of the DSO Project on fauna and fauna habitats. These include:

- Minimising impacts to fauna as a result of vegetation clearing, by reducing the clearing footprint where possible, and through conducting a staged approach to clearing
- Measures to limit the extent of vegetation clearing (e.g. demarcating clearing limits)
- Uploading the recorded locations of conservation significant fauna into the site Environmental Geographic Information System (GIS) and plotting onto maps for consideration in mine planning
- Liaising with the DEC [DPaW] regarding the management of conservation significant fauna

- Implementing operational control procedures, site inductions and employee training programs to protect native fauna from intentional harm, and to appropriately manage injured fauna, if found
- Avoiding accidental ignition sources
- Installing high-pitched whistles on the front of road trains working the Blue Hills haul road, in an effort to scare fauna and thereby reduce fauna road kills
- Protecting dead trees as valuable habitat by prohibiting the collection of firewood
- Covering, fencing, bunding and capping foundation holes, drill holes and trenches to prevent fauna entrapment and, where appropriate, installing fauna egress matting
- Regularly inspecting holes and excavations for trapped fauna. Uninjured trapped fauna will be released by a competent person with appropriate DPaW permits
- Reporting of any deaths of fauna of conservation significance to the DPaW
- Initiating rehabilitation as soon as possible, with ongoing rehabilitation throughout the mine-life to facilitate habitat restoration.

In addition, special measures for the protection of Malleefowl were also committed to be implemented including:

- Recording sightings of nests, both active and inactive;
- Restricting vehicle speeds on haul roads;
- Installing warning signals as necessary; and
- Recording sightings of birds as time/number/location.

SMC has also become a financial member of the Malleefowl Preservation Society.

The management actions outlined above will remain applicable, and will be implemented during construction and operational works associated with the Proposal.

SMC is also committed to undertaking targeted surveys for conservation significant fauna, with the purpose of determining the abundance and distribution of conservation significant species and to assist with developing species-specific management actions. Corresponding management actions will include avoidance, relocation or captive breeding.

The Environmental Management Plan (EMP) for the DSO Project currently includes procedures specifically for the abundance, diversity, distribution, and preservation of conservation significant fauna, including specific actions for managing potential impacts on Malleefowl.

Given the important fauna values of the Mungada Ridge, SMC considers that further management actions may be required in addition to those set out in the PER and EMP for the DSO Project. In particular, these values relate to important habitats located in the area, which include:

- Eucalypt plain woodland habitat, which provides habitat for:
    - Major Mitchell's Cockatoo
    - Western Spiny-tailed Skink (particularly hollow branches and logs).
- Low slopes with dense acacia shrubs, which provides habitat for Malleefowl
- Rocky ridges and steep slopes, which provides habitat for:
    - Gilled Slender Blue-tongue
    - Peregrine Falcon (noting that this species is also likely to utilise adjacent habitat for hunting).

The management strategy focuses specifically on the management of key fauna habitats, as set out above. Features of the plan include measures to minimise and mitigate impacts on conservation significant fauna, such as:

- Conducting targeted surveys within the Proposal area for conservation significant fauna
- Minimising disturbance to the Rocky ridge with steep slopes habitat type supporting Gilled Slender Blue-tongue
- Providing a constraints layer for mine planning for avoidance, wherever practicable, of Malleefowl mounds and hollows containing Western Spiny-tailed Skinks if found, and, where unavoidable, providing for relocation or captive breeding of Malleefowl chicks and trapping and relocation of any Western Spiny-tailed Skinks
- Protecting hollow-bearing trees if found adjacent to the mining area and able to be avoided in placement of infrastructure, where practicable, for the conservation of habitat for Major Mitchell's Cockatoo
- Where practicable, avoiding the disturbance of areas where water is concentrated within areas mapped as the Low slopes with dense acacia shrub habitat type, when determining access road routes (where proposed)
- Identifying opportunities for habitat creation during progressive rehabilitation and closure. To this end, further work will be conducted in order to examine the potential for restoring physical characteristics for habitats for conservation significant species, including:
    - Rocky habitats to recreate habitat for the Gilled Slender Blue-tongue
    - Harvesting hollow-bearing woody material prior to the commencement of vegetation clearing in areas mapped as Eucalypt plain woodland habitat for use in the restoration of habitat for the Western Spiny-tailed Skink.
- Given that Malleefowl were found to occur in vegetation that is at least 40 years post-fire, the importance of managing bushfire risk has important implications for the protection of habitat for this species.

6.3 Invertebrate fauna

6.3.1 Description

Species occurring in the area

One invertebrate species has been recorded as a confirmed SRE species in the Proposal area; *Idiosoma nigrum* (Shield-backed Trapdoor Spider), with a further three invertebrate species recorded in the Proposal area that have unknown or potential SRE status (**Table 10**) (**Figure 16**).

Table 10: Summary of SRE invertebrate species collected from the Approved Project area and surrounds

Species	SRE Status	Records
Spiders		
Idiosoma nigrum (Shield-backed Trapdoor Spider)	Confirmed (EPBC Act: Vulnerable, WC Act: S1)	A total of ten burrows of this species have been identified within the Proposal area
Pseudoscorpion		
Beierolpium 'sp. 8/2'	Unknown	Recorded from numerous sites across the Blue Hills Project area, including records within/adjacent to the Proposal area
Beierolpium 'sp. 8/3'	Unknown	Recorded at only one site, inside the Proposal area
Beierolpium 'sp.8/4'	Unknown	Recorded from numerous sites inside and outside the Approved Project area

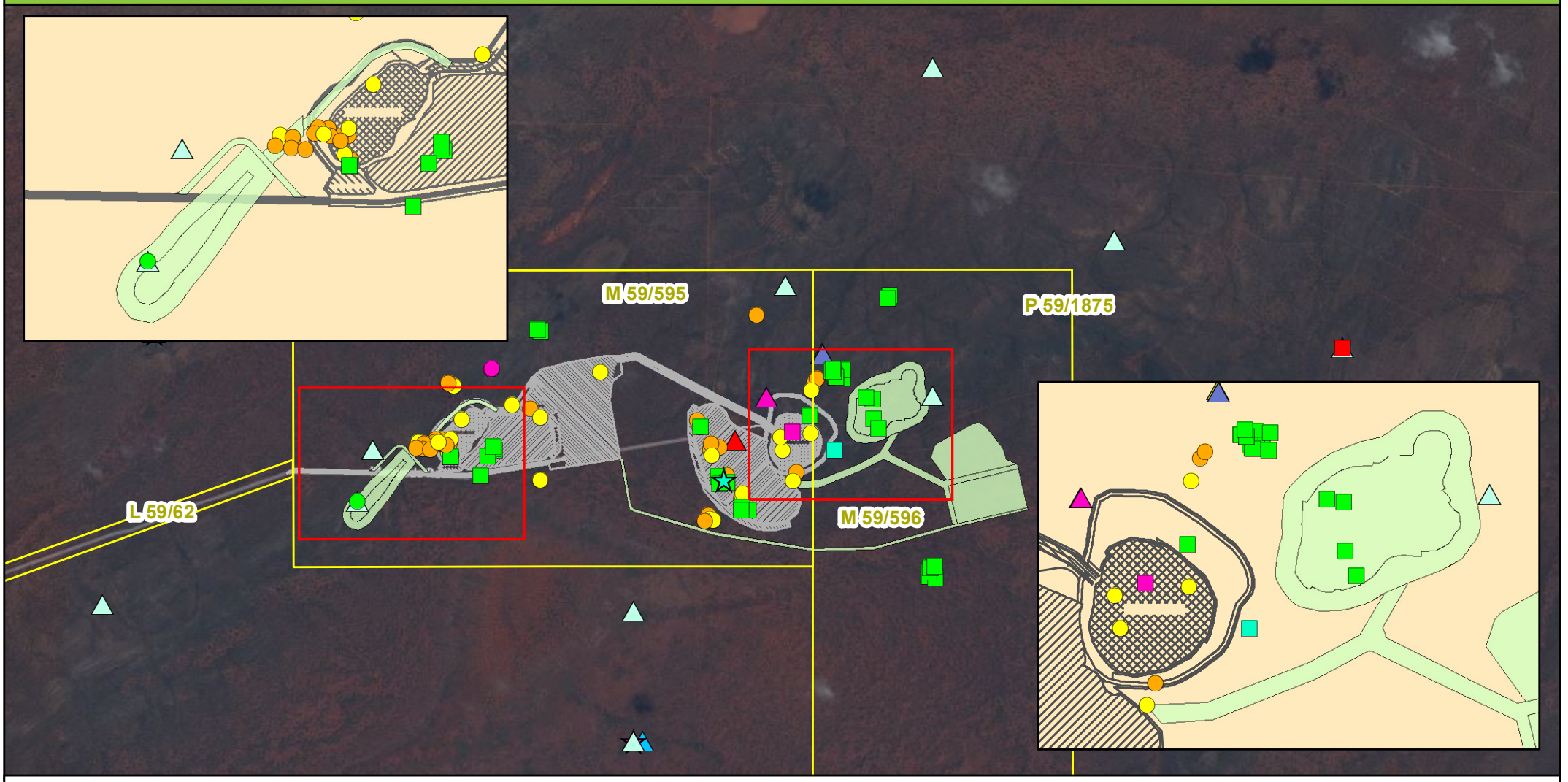
Conservation significant spiders

Desktop assessments identified two conservation significant spiders; *Aganippe castellum* (Tree-stem Trapdoor Spider) and *Teyl* sp. (Minnivale Trapdoor spider), listed under the WC Act as Schedule 1 species (Tree-stem Trapdoor has been downgraded to a Priority 4 species) with the potential to occur at Blue Hills; however, neither of these species have been recorded in surveys of the Blue Hills to date.

The targeted SRE survey by ecologia (2010) and targeted Shield-backed Trapdoor Spider survey (ecologia 2012a) undertaken at Blue Hills identified the presence of the conservation significant Shield-backed Trapdoor Spider, (EPBC Act: Vulnerable, WC Act: S1). The species is also known to occur nearby at Karara (Bamford 2007).

A total of 10 Shield-backed Trapdoor Spider burrows have been recorded in the Proposal area. Four are located within the new Mungada East pit, and six are located in the area of the proposed connection to the existing Mungada West haul road. These six records at Mungada West were originally recorded as burrows of *Idiosoma* 'MYG018' which is a confirmed SRE but not a listed species (ecologia 2010). SMC met with the then DEC (now DPaW) in September 2011 to discuss the taxonomic status of *Idiosoma* 'MYG018' and received feedback that in the absence of additional information this species will be treated as *Idiosoma nigrum* until determined otherwise (ecologia 2012b).

Figure 16 - SRE records



Legend

- Proposal layout
- SMCL Tenements
- Layout of approved project

All ecologia SRE records

- Aname 'sp. juv.'
- Aname sp. juv.
- Austrohorus sp.
- Barychelidae
- Barychelidae sp. A
- Barychelidae sp. B
- Beierolpium 'sp. 8/2'
- Beierolpium 'sp. 8/3'
- Beierolpium 'sp.8/4'
- Bothriembryon sp.
- Idiosoma 'MYG018'
- Idiosoma burrow
- Mecistocephalidae
- Sinumelon vagante
- Synsphyronus sp.
- Trichorhina
- Trichorhina sp.
- Tyrannochthonius sp.nov.Blue Hills

0 0.25 0.5 1
Kilometres

Datum/Projection:
GDA 1994 MGA Zone 50

N

ecological AUSTRALIA
www.ecoaus.com.au

Data Sources: Microsoft Virtual Earth

6.3.2 Assessment of potential impacts

Potential impacts on SREs and their habitats that may result from the Proposal include removal of habitat and mortality of individuals. Although the Proposal area contains suitable habitats for SRE species these habitats are not considered unique to the Proposal area (ecologia 2011b).

Indirect impacts may also result from implementation of the Proposal are likely to include changes in surface water regimes, fire regime and intensity, impacts from dust, and weeds (ecologia 2012b). These potential impacts are expected to be minimal, and would be considered in further detail as part of a formal environmental assessment of the Proposal.

The majority of invertebrate species recorded within the Proposal area were determined to be 'unknown' or unconfirmed SRE species. All but one of these species are known from records outside the Proposal area; *Beierolpium* 'sp. 8/3'. At Blue Hills, this species has only been recorded inside the new Mungada West pit and will therefore be impacted by the Proposal. All likely, potential, and unknown SREs are typically treated as confirmed SREs in accordance with the precautionary principle (Section 4a of the EP Act). Although only one record of this species is known from Blue Hills, the habitat in which this species was found (Low slopes with dense Acacia shrub) is not considered to be restricted to the Proposal area (**Figure 14**). This habitat type, like the other two habitat types in the Proposal area, is contiguous with adjacent similar habitat and likely to be represented in the surrounding region, as it is considered to be linked to land systems that occur outside the Proposal area (ecologia 2011a). The remaining potential or unknown SRE species recorded in the Proposal area have been recorded outside the Proposal area. Impacts to these species are therefore anticipated to be minimal.

Only one species recorded in the Proposal area was determined to be a potential/confirmed SRE; the Shield-backed Trapdoor Spider (confirmed SRE and conservation significant status under EPBC Act and WC Act). Burrows of this species in the Proposal area are located within the footprint of the new Mungada East pit and the proposed Mungada West haul road. Impacts to these burrows will be unavoidable. This species has been recorded in the vicinity of the Proposal area as well as in the broader Blue Hills area. Habitats inside the Proposal area from which the Shield-backed Trapdoor Spider was collected were found to be widespread beyond the Approved Project area boundary (ecologia 2012a).

Management measures specific to this species will be implemented to minimise impacts to Shield-backed Trapdoor Spider burrows located elsewhere in the Blue Hills tenements.

6.3.3 Key management actions

SMC's objectives for management of SRE invertebrate fauna are to:

- Maintain the abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge; and
- Minimise the impact to fauna.

As a component of the PER for the DSO Project, SMC provided a list of actions that will be implemented to achieve the objectives stipulated above. SMC also provided a more detailed approach to the management of impacts to SRE fauna in the DSO Project EMP.

The following management items will be implemented for the Proposal to mitigate impacts on SRE species, in particular *Idiosoma nigrum* within the Proposal area:

- Restricting clearing to that which is necessary and avoiding disturbance to the southern facing ridge slopes
- Clearing boundaries will be defined in the field
- A buffer of un-impacted vegetation will be maintained around known populations of *I. nigrum* identified outside the mine pit areas that are able to be retained to minimise indirect impacts
- Implementing dust suppression measures, including management of road speeds on unsealed roads in order to prevent damage to surrounding vegetation potentially supporting *I. nigrum*
- Developing a fire prevention strategy to prevent impacts to *I. nigrum* habitat
- Rehabilitating cleared areas through potential habitat as soon as practicable.

These management actions will remain applicable to construction and operational works of the Proposal.

7 Other environmental factors

7.1 Hydrology

No major rivers or creeks occur within or surrounding the Proposal area. Surface water drainage occurs predominately through overland sheet flow.

The PER for the DSO Project identified a Gilgai formation, located in the topographic depression approximately 700 m to the south of the Proposal area, as a key environmental feature of the Blue Hills area. The EPA (2009a) indicated that the Gilgai formation is likely to rely on surface and subsurface water drainage, and therefore that the quantity of surface water to the area be maintained. More recent studies commissioned by Karara Mining Limited have confirmed that the drainage depression is not groundwater dependant, confirming the drainage depression as a surface water dependant system. It is understood that this information has since been confirmed by the DEC (now DPaW).

Surface water drainage will be managed to ensure that the hydrology is not altered as a result of the Proposal. Management objectives and measures specific to management of the wetland[1] are summarised in Section 8.3 of the DSO Project PER and Section 11 of the DSO Project EMP. These measures include standard mine operation procedures to manage the risk of stormwater flows within and surrounding the mining operations. As a result of these management standards, the timing and duration of surface water flows to the nearby drainage depression wetland are not expected to change as a result of the Approved Project or Proposal.

The risk of contamination of surface and groundwater from hydrocarbons will be minimised by implementing the management measures detailed in the DSO Project PER and EMP.

Surface water diversion infrastructure will also be required to minimise the risk of flooding, erosion and sedimentation in the Proposal area and to minimise resultant impacts to mine infrastructure. The location of mine infrastructure and surface water diversions will be considered to minimise the disruption of natural drainage patterns.

It is anticipated that water requirements for the Approved Project operations will remain unchanged as a result of the inclusion of the Proposal. Should additional water supply be required to support the Proposal, this will be provided by existing water supply sources (approved as part of the DSO Project) within approved abstraction limits. All groundwater abstraction will be in accordance with licence conditions.

All water sources that are brought into operation will be monitored in accordance with an agreed water monitoring program, including (but not limited to):

- Reporting of monthly pumped volumes
- Monthly measurement of water levels from operating sources and non-operating bores
- Monthly water quality (salinity and pH) from operating sources
- An annual comprehensive chemical analysis of the groundwater from each source

[1] Discussed in the DSO Project approval documentation as a Gilgai formation

7.2 Greenhouse gases

The Proposal is expected to generate additional greenhouse gases, mainly from the consumption of electricity and diesel fuel.

Emissions of greenhouse gases will be minimised as far as practicable in accordance with relevant management measures prescribed in the DSO Project PER (Section 8.5.4). Development of measures for the management of greenhouse gases resulting from the Proposal will be designed in line with SMC's management and mitigation approach for gaseous emissions:

- Greenhouse gas emission minimisation will be incorporated into mine planning in accordance with EPA Guidance Statement for Minimising Greenhouse Gas Emissions (2002)
- Energy efficient technology will be selected where practicable and energy consumption will be considered as a criterion in equipment selection
- Vegetation clearing will be minimised where practicable, thereby assisting to minimise greenhouse gas emissions from the Project
- Progressive rehabilitation of open areas will result in partial offsets of emissions over the life of the Project
- Atmospheric emissions will not be reported to the National Pollutant Inventory as they do not meet the minimum reporting threshold values.

The original PER for the DSO project indicated annual emissions of greenhouse gases (8,632 – 13,802 t CO2-e/yr). This is not anticipated to increase significantly (i.e. to alter reporting requirements) as a result of the Proposal.

It is anticipated that dust emissions from the Proposal will not result in any additional impacts to conservation significant flora, vegetation, fauna or ecological communities to that described and assessed for the Approved Project. Any such impacts are expected to be of a similar extent and nature to that described, assessed, and approved for the DSO Project.

In addition, dust emissions from the Approved Project and Proposal are not considered to represent a risk to any other sensitive receptors given the remote location of Blue Hills from such receptors.

The Management of dust for the Proposal will be in accordance with measures outlined in Section 8.4.4 of the DSO Project PER.

7.3 Noise and vibration

No noise modelling was required of the Approved Project due to its remote location relative to residential areas. For this reason, noise and vibration emissions from the Proposal are not expected to result in any new or additional adverse impacts beyond those considered for the Approved Project.

All practicable measures will be implemented to minimise noise emissions generated by mining and processing activities. Further details of these measures are provided in Section 8.6.4 of the DSO Project PER.

7.4 Acid mine drainage

Given the low sulphur content of the ore and the lack of any observable issues at existing waste rock stockpiles generated from historic mining in the 1960s, acid generation is considered highly unlikely to occur during construction and operation of the Approved Project and the Proposal.

7.5 Waste

Where the material is fit for purpose, waste rock produced from the Proposal will be used for construction and borrow material purposes (e.g. road base material and construction of bunds). The remaining waste will be either used in backfilling of existing pits, or disposed of at the new waste dump proposed at Mungada East (Section 2.2.3).

Solid, hazardous and liquid waste storage and disposal will be managed as per the measures outlined in Section 8.9.4.1 of the DSO Project PER, relevant to general waste management, storage of hazardous materials and hydrocarbons, procedures for spill response and bioremediation. Waste management for the Proposal will adhere to the previously established environmental management commitments, as set out in the PER.

7.6 Aboriginal heritage

Several archaeological sites are known from Blue Hills. One registered Aboriginal 'Other Heritage Place' ID 24148 - Midwest Artefact Scatter 2, and one potential ethnographic site (BH11-14 Rockholes 2), occur within the Proposal area. These were recorded/confirmed during the archaeological Heritage and ethnographic surveys undertaken at Blue Hills in 2011 (Terra Rosa 2011a, 2011b). A Section 18 approval will be applied for under the WA *Aboriginal Heritage Act 1972* before undertaking works requiring disturbance to these sites. Works will also be undertaken in consultation with the relevant Traditional Owner groups.

Management of cultural heritage related relevant to both the Approved Project and Proposal will be in accordance with the management measures prescribed in the DSO Project PER, which includes consultation with Traditional Owner/s as per SMC's Management Commitment 13 stated in the PER:

> *Midwest will consult with traditional owners and obtain their consent to disturb any new Aboriginal Heritage sites discovered in the Project disturbance area. Midwest will obtain approvals relevant to the* Aboriginal Heritage Act 1972 *for disturbance to heritage sites.*

7.7 Landscape and recreation

Historic mining operations at Blue Hills have already contributed to the alteration of visual and landscape values of the area. The development of the Proposal will contribute to additional changes to the visual and landscape values of the area. As part of closure procedures, SMC will aim to ensure final landform contours are compatible with the surrounding landscape are restored post-mining, as far as practicable. It is recognised that the Mungada Ridge has high landscape value and rehabilitation efforts will focus on maintenance of this value.

Recreational values, previously identified as relevant to the Old Karara Homestead (the original location for the mine camp associated with the Approved Project) are no longer relevant, given that workers will now be housed at the neighbouring Karara operations. SMC no longer proposes to develop the Old Karara Homestead for recreational purposes.

7.8 Rehabilitation and mine closure

At the completion of mining, both the new mine pits at Mungada East and West will be rehabilitated to the standards detailed in the DSO Project EMP. A full Closure Plan (Ecologia Environment 2008e) has also been developed to comply with relevant guidelines. A summary of the approach is provided below.

At the completion of mining the new waste dump at Mungada East will be stabilised and rehabilitated in accordance with the standards prescribed for the DSO Project. Rehabilitation will occur progressively

as disturbed areas will no longer be utilised. Upon the completion of mining activities, rehabilitation will involve:

- Re-establishment of stable landform with erosion protection for long term stability
- Ripping of compacted areas and on contours of slopes
- Spreading of vegetation debris to return organic matter to the area and provide supplementary seeding with appropriate species. Seed stock will be gathered as close to the pre-clearance of the area of impact as possible, to provide an effective provenance seed-set for use in rehabilitation.

The rehabilitation program will include development of completion criteria to indicate the stage when rehabilitation can be considered self-sustaining. Closure considerations will include assessment and remediation of contaminated sites, ongoing placement of waste materials to improve the form of existing waste dump areas, and the rehabilitation of all disturbed areas, including exploration drill pads and tracks.

Additionally a suitable pit abandonment strategy will be developed and detailed in the Closure Plan.

Rehabilitation and closure will also take into account the commitments for protection of conservation significant flora, vegetation and fauna relevant to the Proposal, including the potential for:

- Rehabilitation of conservation significant vegetation types, including those which make up the Blue Hills PEC
- Recruitment of populations of conservation significant flora, including the listed Threatened species *Acacia woodmaniorum*
- Creation of habitat characteristics for conservation significant terrestrial fauna

SMC has engaged the Botanic Parks and Garden Authority to undertake research aimed at ensuring effective restoration of vegetation communities at SMC's mining projects at Koolanooka, Blue Hills and Weld Range. The project commenced in 2011 and will continue until 2016 at a total cost of $1.7 million. The aims of the restoration program are:

- Final rehabilitation of all disturbed areas (including post mining sites at Koolanooka and Blue hills, and exploration lines informing future restoration practices at Weld range) with vegetation communities that:
    - are composed of original native plant species, with a minimum of 70% of initial richness
    - represent original vegetation communities, including sub-communities of the Koolanooka TEC and Blue Hills PEC
    - Minimize disturbance to the TEC and PEC.
- The production of a restoration practitioner's manual for SMC environmental staff to assist with the implementation of scientific findings for on-ground restoration.
- To explore Midwest and State capacity building opportunities including program development with Midwest mining companies, indigenous and community engagement with SMC and Kings Park Science.

A copy of the restoration plan is attached as **Appendix B**.

8 Environmental management framework

8.1 Overview

SMC has previously made environmental commitments for the DSO project, which will be expanded where necessary to incorporate the Proposal. SMC will manage environmental impacts through:

- Complying with environmental approval conditions;
- Implementing the EMP for the DSO Project;
- Preparing and implementing the Mine Closure Plan for the DSO Project that will be updated to take into account the environmental management closure needs for the Proposal;
- Regularly reviewing the performance of the above mentioned plans;
- Measuring energy use and greenhouse gas emissions, and continually seeking opportunities to reduce emissions;
- Continually updating plans for ground disturbance and closure ;
- Progressively rehabilitating disturbed land and measuring success;
- Training staff and contractors in environmental requirements and considerations of their work;
- Seeking stakeholder views and ensuring that they are respected and considered; and
- Reporting regularly to stakeholders on performance.

8.2 Environmental policy

SMC has an overarching Environmental Policy which promotes the company's objective to develop resources while also protecting and preserving the environment. All SMC activities will meet statutory requirements as a minimum standard and be planned and performed so that adverse effects on the environment are either avoided or appropriately managed.

To achieve the objective of the policy, SMC will ensure the following actions are undertaken:

- Establish a set of policies, objectives and commitments for all activities;
- Identify SMC's legal environmental responsibilities and comply with all applicable laws and regulations;
- Develop and apply responsible environmental management where laws and regulations do not exist;
- Assess potential environmental impacts before conducting new activities;
- Institute a management system that, among other aspects, identifies environmental responsibilities for all its employees and contractors ;
- Design and implement a system of work procedures and training programs that will encourage respect for the environment and the prevention of pollution and enable employees and contractors to identify and fulfil their environmental responsibilities;
- Implement monitoring and auditing systems that will ensure the company's environmental commitments and objectives are being achieved; and
- Develop and foster a corporate culture that encourages continuous improvement in environmental performance.

8.3 Principles of environmental protection

In 2003, the EP Act was amended to include the following five core environmental principles. These guide the EPA in carrying out its role and responsibilities:

- Precautionary principle

- Principle of intergenerational equity
- Principle of the conservation of biological diversity and ecological integrity
- Principles relating to improved valuation, pricing and incentive mechanisms
- Principle of waste minimisation

These principles were considered in the development of impact mitigation and management measures for the DSO Project as set out in the PER (ecologia 2008a). Further consideration will be given to these principles in the development of the Proposal and in further stages of environmental impact assessment.

8.4 Summary of environmental control instruments

The key environmental controls relevant to the Approved Project and the Proposal include (but are not limited to):

- Environmental conditions prescribed in MS 811 (including attachments) issued by the Minister for the Environment allowing the DSO Project to be implemented
- Any additional environmental conditions that may be prescribed and attached the MS 811 relating to the Proposal
- Conditions of any Department of Environmental Regulation (DER) Vegetation Clearing Permits (if applicable)
- Conditions of DER Works Approval/s (under Part V of the EP Act) for construction of works on prescribed premises (if any)
- Conditions of DER Licence/s (under Part V of the EP Act) for the operation of activities on prescribed premises (if any)
- Conditions of Licences and Permits for activities relating to the abstraction of groundwater (under the *Rights in Water and Irrigation Act 1914*).

8.5 Site environmental management plans

A number of management plans relevant to environmental management at Blue Hills, and relevant to the management of conservation significant species, have been, or will be, developed for the Approved Project and will also be implemented for the Proposal.

8.5.1 Environmental Management Plan

An Environmental Management Plan (EMP) has been developed for the DSO Project (ecologia 2008f). The plan sets out procedures to minimise and manage the environmental impacts of construction and operation activities and provides a framework for minimising the risk of impacts. The plan will be regularly updated throughout the life of the project, including appropriate updates relevant to the Proposal.

8.5.2 Closure Plan

A Closure Plan has been developed for the DSO Project in alignment with AMEC Mine Closure Guidelines (2000) and ANZMEC/MCA Strategic Framework for Mine Closure (2000) (ecologia 2008e). During the life of mine, the plan will be reviewed and updated as required to ensure information remains current, including additional provisions associated with the Proposal. In particular, any specific rehabilitation and closure requirements relevant to the restoration of habitat for conservation significant flora and fauna will be included in this plan.

8.5.3 Implementation Strategy

Prior to ground disturbing activities, SMC will prepare a staged implementation strategy setting out management and monitoring strategies and objectives for meeting the requirements of conditions within MS 811 for each mine site location (Koolanooka and Blue Hills). The implementation strategy will assist SMC in demonstrating its compliance with the conditions of MS 811.

8.5.4 Fire Prevention Strategy

Given the conservation significant fauna values of the Mungada Ridge (including habitats for the conservation significant Malleefowl and the Shield-backed Trapdoor Spider, both of which are vulnerable to changes in fire frequency), fire risk management is particularly important. SMC will assess the risk of fire and if required, develop a fire prevention strategy.

8.5.5 Significant Flora Management Plan

A Significant Flora Management Plan has been prepared for the DSO Project (ecologia 2008g) (**Appendix C**). The objective of this plan is to maintain the abundance, diversity, geographic distribution and productivity of the significant flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge. Management measures are included to minimise the impacts to conservation significant flora from habitat removal and fragmentation, weeds, fire, dust, hydrocarbon and chemical spills and waste.

8.6 Offsetting arrangements

It should be noted that SMC negotiated offsets as part of the original approvals process for the DSO Project. SMC has followed through on all of these commitments in conjunction with DPaW.

The Approved Project, including the Proposal, will be subject to the SMC Environmental Policy. Management controls to be implemented as part of the Approved Project, to ensure key environmental factors are managed as described in the DSO Project PER, include measures and/or actions contained within the various plans relevant to environmental management. These documents provide a clear framework for the avoidance, minimisation, and mitigation of impacts resulting from the DSO Project and will be updated to include the Proposal. However, in light of the important conservation values of the Mungada Ridge, SMC recognises that some residual impacts may result, even after the application of these management measures. SMC will work with the EPA, in consultation with the DPaW, should the need for environmental offsets be identified by the EPA.

8.7 Reporting

Internal compliance assessments occur regularly throughout the year. These include regular site inspections, review of the obligations register, review of the Ministerial Conditions, and implementation of the EMP.

In accordance with MS 811, annual compliance monitoring reports are provided to the CEO of DPaW under the current approval. The compliance report:

- Is endorsed by the proponent's Managing Director or a person, approved in writing by the Department of Environment and Conservation, delegated to sign on the Managing Director's behalf
- Includes a statement as to whether the conditions of the current approval have been complied with
- Identifies all potential non-compliances that have occurred and describes the corrective and preventative actions taken

- Is made publicly available in accordance with the approved compliance assessment plan
- Indicates any proposed changes to the compliance assessment plan as required by condition 4-1 of the Ministerial statement 811 (Minister for Environment 2009).

9 Conclusion

Based on the preliminary environmental impact assessment presented in this ER, the direct environmental impacts of the Proposal on key environmental factors and anticipated environmental outcomes are summarised as follows:

Flora and vegetation

- Clearing of 63.9 ha of vegetation including:
    - Clearing of 23.07 ha of PEC
    - Clearing of 24.4 ha of conservation significant FCTs (FCTs 1, 2 and 10)
    - Impact to 3,680 individuals of Threatened flora species *Acacia woodmaniorum*
    - Impact to 534 individuals of Priority 1 species *Lepidosperma* sp Blue Hills

Vertebrate Fauna

- Clearing of fauna habitat comprising:
    - Rocky ridges with steep slopes (17.1ha)
    - Low slopes with dense Acacia shrub (17.4 ha)
    - Eucalypt woodland plain (30.7 ha)
- Clearing of areas known to contain the Gilled Slender Blue-tongue (WC Act: S1) and likely to contain:
    - Western Spiny-tailed Skink (EPBC Act: EN, WC Act: S1, VU)
    - Malleefowl (EPBC Act: VU, Migratory, WC Act: S1, VU)
    - Peregrine Falcon (WC Act: S4)
    - Rainbow bee-eater (EPBC Act: Migratory)
    - Major Mitchell's Cockatoo (WC Act: S4)

Invertebrate Fauna

- Clearing of fauna habitat (as above)
    - Impact to 10 recorded Shield-backed Trapdoor Spider burrows
    - Impact to a single record at Blue Hills of the unknown SRE species *Beierolpium* 'sp. 8/3'

The completed referral form, together with this ER document have been prepared to provide sufficient information to allow the EPA make a decision on whether to formally assess and an assessment of whether the Proposal is likely to have a significant effect on the environment as per Section 7 of the Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative procedures 2012 (Government of WA 2012) (**Table 11**).

Table 11: Key information for EPA significance test criteria (Government of WA 2012)

Criteria	Key Information Presented
a) values, sensitivity and quality of the environment which is likely to be impacted	Addressed in 'Environmental Setting' (Chapter 2) and relevant 'Descriptions' for each of the key environmental factors (Section 6.1.1 - Vegetation and flora; 6.2.1 – Vertebrate fauna; 6.3.1 – Invertebrate fauna) Section 2 refers to the 'Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields', which provides' (DEC & DOIR 2007), which provides further background information in regard to the sensitivity of the environment.
(b) extent (intensity, duration, magnitude and geographic footprint) of the likely impacts	Addressed in 'Assessment of potential impact' for each of the key environmental factors (Section 6.1.2 - Vegetation and flora; 6.2.2 – Vertebrate fauna; 6.3.2 – Invertebrate fauna). Addressed for other environmental factors in Chapter 7
c) consequence of the likely impacts (or change)	Relevant information to assist in assessment of criterion in 'Assessment of potential impact' for each of the key environmental factors (Section 6.1.2 - Vegetation and flora; 6.2.2 – Vertebrate fauna; 6.3.2 – Invertebrate fauna). Addressed for other environmental factors in Chapter 7
(d) resilience of the environment to cope with the impacts or change	Section 2 refers to the 'Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields', which provides' (DEC & DOIR 2007), which provides background information in regard to the resilience of the environment.
(e) cumulative impact with other projects	Section 6.1.2 indicates impacts of both approved and proposed mining in SML mining lease on FCTs and conservation significant flora.
(f) level of confidence in the prediction of impacts and the success of proposed mitigation	Relevant information in 'Assessment of potential impact' and 'Key management actions' for each of the key environmental factors (Section 6.1.2 & 6.1.3 - Vegetation and flora; 6.2.2 & 6.2.3 – Vertebrate fauna; 6.3.2 & 6.3.3 – Invertebrate fauna). Overall mitigation approach described in Chapter 8 (Environmental Management Framework)
(g) objects of the Act, policies, guidelines, procedures and standards against which a proposal can be assessed	Section 8.3 refers to SML's consideration of EPA Principles of Environmental Protection in the original DSO project and for it to be considered in further stages of environmental impact assessment of the current proposal.
(h) presence of strategic planning policy framework	Section 2 refers to the 'Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields' (DEC & DOIR 2007).
(i) presence of other statutory decision-making processes which regulate the mitigation of the potential effects on the	Section 8.4 provides a summary of environmental control instruments including other statutory decision making processes in regards to environmental management of the

Criteria	Key Information Presented
environment to meet the EPA's objectives and principles for EIA	Proposal.
(j) public concern about the likely effect of the proposal, if implemented, on the environment	Section 1.7 indicates SMC has previously received strong community support for the development of mining at Blue Hills.

SMC is committed to maintaining and protecting the environmental values of Blue Hills through both retention of vegetated areas and implementation of various management measures as outlined in this ER. SMC has been and is continuing to meet offset requirements for the Approved Project, in particular through their commitment to research aimed at ensuring effective restoration of vegetation communities at Blue Hills (and other of SMC's projects) in partnership with the Kings Park and Botanic Garden Science Directorate. This research has begun, and in particular is showing promising results for the revegetation of *Acacia woodmaniorum* at Blue Hills. The details of the research plan are contained in **Appendix B**.

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Appendix A: Supporting survey reports

(contained on CD)

a. Bennett (2004) Flora and vegetation survey of the SMC Blue Hills tenements
b. ecologia (2007a) Flora and vegetation survey of the SMC Blue Hills tenements
c. Markey & Dillon (2008) Flora and vegetation survey of the Tallering Land System
d. Maia (2011) Targeted flora surveys of the SMC Blue Hills tenements
e. Maia (2012) SMC Blue Hills Mungada West and East Expansion Project, Potential Impacts Study
f. ecologia (2013) Blue Hills Iron Ore Project Flora and Vegetation Endemism Desktop
g. Bamford and Wilcox (2004) Blue Hills Fauna assessment
h. ecologia (2011a) Blue Hills Project Level 1 Vertebrate Fauna Survey
i. ecologia (2007b) Koolanooka/Blue Hills DSO Mining Project Short Range Endemic Biological assessment
j. ecologia (2008b) Koolanooka - Blue Hills DSO Mining Project Short Range Endemic Literature Review and Risk Assessment
k. ecologia (2010) Targeted SRE Survey of Blue Hills
l. ecologia (2011b) Blue Hills Additional Short-Range Endemic Invertebrate Survey Report
m. ecologia (2012a) SMC Blue Hills Idiosoma nigrum targeted survey

Appendix B: Restoration Research Plan

(contained on CD)

Appendix C: Significant Flora Management Plan

(contained on CD)

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