



Landforms Assessment Technical Report

Karara Iron Ore Project Mine Life Extension

Final

September 2025



KARARA

MINING LTD

Landforms Assessment Technical Report

Karara Iron Ore Project Mine Life Extension

Final

Prepared by
Umwelt (Australia) Pty Limited

On behalf of
Karara Mining Limited

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Acknowledgement of Country

Umwelt acknowledges the Traditional Owners of Country throughout Australia and their continuing values, culture and connection to the land, waters and sky.

We pay our respects to Elders past and present.

The below image is from the artwork *Yapung Maryiyang* (Pathway Forward) by Saretta Fielding.



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Executive Summary

The Karara Iron Ore Project (KIOP) mine area is in the Banded Iron Formation (BIF) Blue Hills Range System, which comprises five separate ranges: Mt Karara, Blue Hills, Windaning Hill, Mungada Ridge, and Jasper Hill. KIOP is in the Mt Karara range and MIOP is distributed across the Mt Karara range, Blue Hills range and Mungada ridge.

BIF ranges across the Midwest region are recognised as having very significant biodiversity value and supporting endemic flora and fauna species (DEC 2007). The *Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields* (DEC 2007) was prepared to facilitate a strategic approach in environmental impact assessments to consider biodiversity conservation and resource utilisation. The conservation principles and guiding items in the strategic review have been applied in the landforms impact assessment for the KIOP mine life extension (MLE) Proposal.

Based on an evaluation of the significance considerations of landforms, described in *Environmental Factor Guideline – Landforms* (EPA 2018), Mt Karara is not considered a significant example of a BIF landform.

The already approved KIOP (Ministerial Statement (MS) 805) and MIOP (MS 806) have a combined residual (permanent) impact to the Blue Hills Range System of approximately 427 ha, which represents 22% of the BIF ranges local assessment unit (LAU). Of this permanent impact, 357 ha is to Mt Karara.

The proposed KIOP MLE has been designed to avoid impacts to BIF landforms outside of Mt Karara and to minimise impacts to Mt Karara where possible. The KIOP MLE will add an additional permanent impact to Mt Karara of 8% (39 ha). The cumulative residual impact to Mt Karara including the approved extent of KIOP and MIOP is 396 ha (78% of the landform).

Temporary impacts to landforms, such as infrastructure, will be reshaped during mine closure to blend to the natural surface, restoring landform values as much as possible. Re-establishment of vegetation in rehabilitation will achieve at least 70% species composition comparable with the pre-mining vegetation within five years of cessation of productive mining.

The KIOP MLE is unlikely to result in a change in International Union for the Conservation of Nature and Natural Resources (IUCN) threat category for significant flora, terrestrial fauna and ecological communities that are reliant on the BIF landform. While the Blue Hills PEC and *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (WA P1) flora taxa appear to meet criteria for Endangered and Vulnerable status respectively, the predicted impacts of the KIOP MLE do not elevate their threat levels. The Long-tailed Dunnart (*Antechinomys (Sminthopsis) longicaudata*) (WA P4) and Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*) (WA Vulnerable) do not meet thresholds for listing under IUCN criteria, and the predicted impacts of the KIOP MLE do not alter this status. The proposed impact to Mt Karara landform is not considered significant as it will not increase the threat (as per the IUCN threat categories) for any ecological values that are reliant on the BIF ranges landform.

Abbreviations

Abbreviation	Definition
AHD	Australian Height Datum
AOO	Area of Occupancy
BC Act	<i>Biodiversity Conservation Act 2016</i>
BCE	Bamford Consulting Ecologists
BIF	Banded Iron Formation
CMSR	Centre for Mine Site Restoration
CS	Conservation Significance
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Environment and Conservation (now the DBCA)
DEM	Digital Elevation Model
DPaW	Department of Parks and Wildlife
DPIRD	Department of Primary Industry and Regional Development
DSO	Direct Shipping Ore
DWER	Department of Water and Environmental Regulation
EN	Endangered
EFG	Environmental Factor Guideline
EOO	Extent of Occurrence
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
GoWA	Government of Western Australia
HIOP	Hinge Iron Ore Project (MS 968)
IUCN	International Union for the Conservation of Nature and Natural Resources
KIOP	Karara Iron Ore Project (MS 805)
KIOP MLE	Karara Iron Ore Project Mine Life Extension
KML	Karara Mining Limited
LAU	Local Assessment Unit
LIC	Linear Infrastructure Corridor
MIOP	Mungada Iron Ore Project (MS 806)
MOU	Memorandum of Understanding
MS	Ministerial Statement
NVCP	Native Vegetation Clearing Permit
OS	Other specially protected species
P	Priority
PCA	Principal Components Analysis
PEC	Priority Ecological Community

Abbreviation	Definition
PER	Public Environmental Review
SMC	Sinosteel Midwest Corporation Limited
Sp.	Species
T	Threatened
TEC	Threatened Ecological Community
TSF	Tailings Storage Facility
UPGMA	Unweighted Pair Group Method with Arithmetic Mean
VSA	Vegetation and Substrate Association
VU	Vulnerable
WA	Western Australia
WRD	Waste Rock Dump

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1.0 Purpose

This technical report assesses the impact to landforms from the proposed Karara Iron Ore Project Mine Life Extension (KIOP MLE/the Proposal). The report has been prepared by Umwelt on behalf of Karara Mining Limited (KML), to support the Environmental Protection Authority (EPA) assessment of the Proposal.

The EPA Notice Requiring Information for Assessment issued on the 16 October 2023 requested information relevant to landforms, as detailed in **Table 1.1**. Further clarification obtained from EPA Services via email is provided in **Table 1.1**, which also outlines the response and where it is included in this report.

Table 1.1 EPA Request for Information – Items Relevant to Landforms

EPA Requirement	Response
Landforms	
<p>Provide an assessment of the impacts to landforms consistent with current EPA guidance to provide information on the statement in the <i>KIOP MLE Environmental Protection Act s38 Referral – Supporting Information</i> (CORP-EN-REP-1161) 2022 that ‘the proposal will increase the total indicative disturbance on the Karara Ridge by approximately 10 per cent’. Provide spatial data to indicate the area/s of impact.</p> <p>EPA Services Clarification: The Karara Range, classified as a Banded Iron Formation (BIF), was identified as a significant landform in previous assessments. The landforms impact assessment should take account of the <i>EPA Environmental Factor Guideline – Landforms</i>, including information requirements.</p>	<p>Section 7.2 provides a calculation of impacts to the spatial extent of the landform (with the landform defined in Sections 2.0 and Section 3.2).</p> <p>Section 5.2 describes how the spatial extent of the landform was generated and the reasoning behind the methods.</p> <p>Spatial data to indicate the areas of impact from the Proposal includes:</p> <ul style="list-style-type: none"> • Karara Range and Blue Hills Local Assessment Unit (LAU) generated by Umwelt. • KIOP MLE site layout provided by KML (April 2024). <p>Table 1.2 demonstrates how the requirements of the <i>EPA Environmental Factor Guideline – Landforms</i> (EPA 2018) have been addressed.</p>
<p>Provide an updated cumulative impact assessment that considers the context of the ‘<i>Strategic Review of the Conservation and Resource Values of the Banded Iron Formation (BIF) of the Yilgarn Craton</i>’. The assessment should delineate impacts from the proposal as well as the combined effect (i.e. the impacts from the proposal plus the approved proposals under MS 805 and 806). Provide spatial data to indicate the area of impact from the proposal and the combined effect.</p>	<p>Section 7.2 provides the calculation of cumulative impacts to the spatial extent of the landform, including the combined effects with approved proposals under Ministerial Statements (MS) 805 and MS 806.</p> <p>Table 1.3 demonstrates how the requirements of the <i>Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields</i> (in the Yilgarn Craton) (DEC 2007) have been addressed.</p>
<p>Provide an evaluation of significant residual impacts and offsets, including the implementation of previously proposed offsets to help protect the landscape. Include relevant information from the section of this document, ‘4-Mitigation hierarchy and offsets’.</p>	<p>Section 8.0 provides an evaluation of the implementation of previously proposed offsets.</p> <p>Section 10.0 evaluates the significance of residual impacts to landforms.</p>
Mitigation Hierarchy (including rehabilitation) and Offsets	
<p>Demonstrate that the proposal has been designed to avoid and minimise impacts, and that the mitigation hierarchy has been addressed.</p>	<p>Section 9.0 describes how the mitigation hierarchy has been applied to the Proposal.</p>
<p>With respect to rehabilitation, provide a summary of the works completed to date and a detailed assessment of how that rehabilitation has/will restore significant flora and vegetation and terrestrial fauna values. Outline any proposed changes to rehabilitation going forward to be mitigate the impacts of the proposal.</p>	<p>Section 8.0 provides an evaluation of the rehabilitation completed to date including an assessment of whether significant flora, vegetation and terrestrial fauna values have been restored.</p>

EPA Requirement	Response
Where significant residual impacts remain, propose an appropriate offsets package that is consistent with the <i>WA Environmental Offsets Policy and Guidelines</i> and the <i>EPBC Act Environmental Offsets Policy</i> . Spatial data defining the area of significant residual impacts should also be provided.	Section 10.0 evaluates the significance of residual impacts to landforms and identifies if offsets are likely to be required. Development of an offsets package is not part of the scope of work for this report.

Table 1.2 Information Required for Environmental Impact Assessment – EPA Landforms Factor Guideline

Item	Where it is Addressed
Identify spatial extent of the landform in the local and regional context.	Section 6.0 defines the specific areas used to assess the landform and potential impacts.
Describe geology, morphology and associated processes of the landform.	Section 6.0 describes the physical composition of the assessed landform as well as the landforms in the surrounding area.
Analyse whether the landform is significant in a local, regional or national context. Consider variety, integrity, ecological importance, scientific importance, rarity and social importance.	Section 6.0 analyses the impacted landform against the assessment criteria.
Identify environmental values supported by the landform.	Section 6.0 discusses associated environmental values.
Describe how the proposal will affect the landform in maintaining environmental values.	Section 7.3 evaluates the impact to ecological values that rely on the Blue Hills Range System BIF landforms.
Predict direct, indirect and cumulative impacts from the proposal.	Section 7.0 predicts the direct and cumulative (permanent and temporary) impacts from the proposal.
Analyse robustness or sensitivity of the landform to damage. Evaluate the significance of the impacts in the local, regional or national context.	Section 10.0 describes the sensitivity of the landform to damage and the significance of the impacts at a regional scale.
Describe how the mitigation hierarchy has been applied.	Section 9.0 describes how the mitigation hierarchy has been applied to the Proposal.
Discuss whether there is likely to be a significant residual impact.	Section 10.0 evaluates the significance of residual impacts to landforms.
Identify mitigation, management and contingency plans and how these will be assured.	Development of management and contingency plans is not part of the scope of work for this report.

Table 1.3 Strategic Review of the BIF Ranges of the Midwest and Goldfields

Principles and Guidance Points	Response
No development activity should proceed if it would result in the increase of an International Union for the Conservation of Nature and Natural Resources (IUCN) Threat Category of any plant or animal taxon.	Section 7.3 presents the evaluation of potential changes in IUCN Threat Category for significant flora and terrestrial fauna that may be affected by the proposed increase to disturbance of Mt Karara.
No development activity should proceed if it would result in the increase of an IUCN Threat Category of any ecological community.	Section 7.3 presents the evaluation of potential changes in IUCN Threat Category for significant ecological communities that may be affected by the proposed increase to disturbance of Mt Karara.
15 – 30% of the total number of ranges should be reserved in their entirety so complete examples of landform and ecosystem are protected.	Section 6.5 evaluates the number of ranges within the LAU that are reserved.
Conservation reserves should include at least 60% of largely contiguous ecosystem/habitat for each of the key BIF species and communities restricted to the BIF ranges.	Section 7.3 evaluates the proportion of ecosystem / habitat for significant Blue Hills Range System BIF species that is within conservation reserves.
An objective of detailed mine site planning should be to maximise protection of any flora species or ecological community identified as being restricted to the BIF or dependent on the BIF for its conservation.	Section 9.0 describes how the mine planning has aimed to maximise protection of significant flora and ecological communities restricted to the LAU.
Landscape, geodiversity, Aboriginal heritage values and the potential for nature-based tourism should be considered in developing a reserve system.	Development of a reserve system is not part of the scope of work for this report.

2.0 Background

The KIOP is a magnetite mining and processing operation located in the Shire of Perenjori, approximately 210 km east-southeast of Geraldton, Western Australia (WA). This region is situated on the Yilgarn Craton and is known to have several landforms (**Figure 2.1**) that are classed as Banded Iron Formations (BIF). The scope for Regional BIF Landforms, as presented on **Figure 2.1**, is based upon the cluster of landforms identified in the *Strategic Review of the Banded Iron Formations Ranges of the Midwest and Goldfields* and Mungada East Public Environmental Review (PER) (DEC 2007; Sinosteel 2016). This cluster sits within WA's Midwest Region and is regionally grouped due to similarities in their significant biodiversity and mineral resource values (DEC 2007; Sinosteel 2016).

The focus of this report is on the Blue Hills Range System, comprising five separate ranges: Mt Karara, Blue Hills, Windaning Hill, Mungada Ridge, and Jasper Hill. In the context of this report, this range system is primarily referred to as the Blue Hills Local Assessment Unit (LAU) (**Figure 2.2**). While KML has had previous mining ventures throughout the LAU, the KIOP MLE's main impacts to the LAU will be to Mt Karara (the immediate landform).

Existing KIOP facilities include an open-cut mining pit, a beneficiation processing plant, waste rock dump (WRD), tailings storage facility (TSF), rail loading areas, on-site accommodation, an airport and a linear infrastructure corridor (LIC), which contains a water pipeline and access road (KML 2022). The Proposal will have an estimated ore production of approximately 21 million tonnes per annum.

The sections below summarise existing KML projects and other existing projects in the Blue Hills area, and the proposed KIOP MLE project.

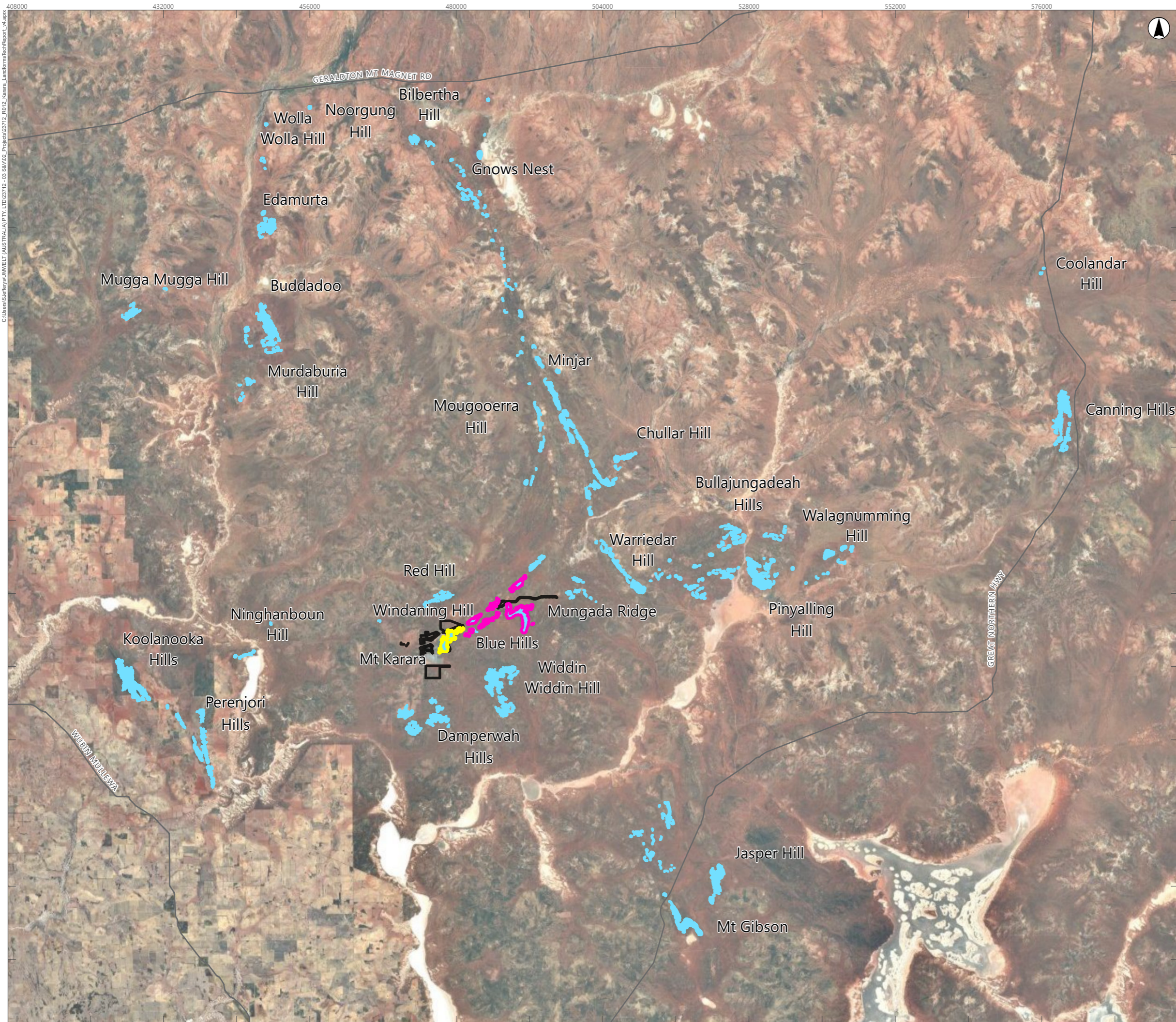
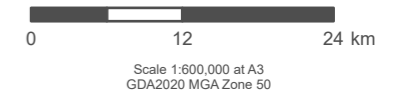
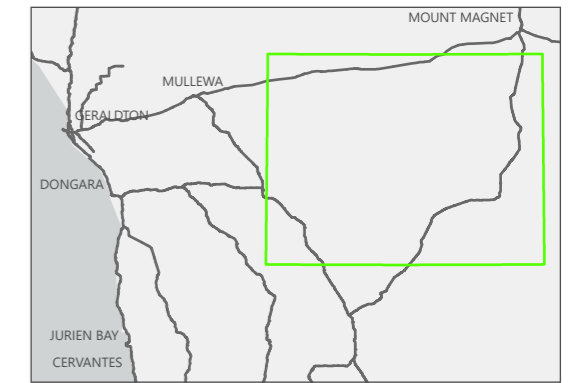


FIGURE 2.1
Regional BIF Landforms

- Legend**
- Mt Karara (included as part of the LAU)
 - Blue Hills Local Assessment Unit (LAU)
 - Indicative BIF Landforms
 - KIOP MLE Disturbance Footprint
 - Road



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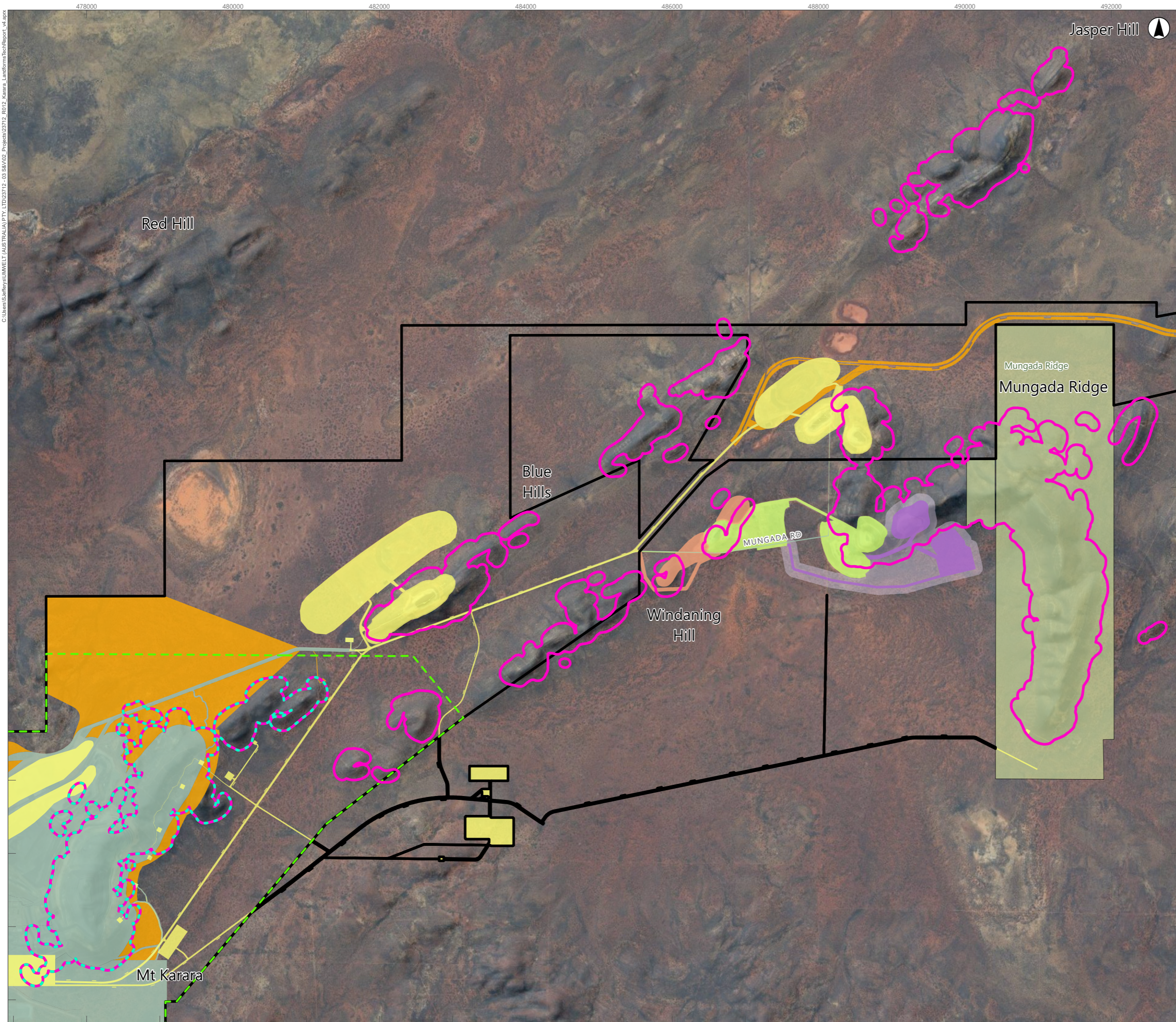
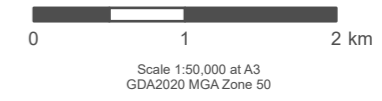
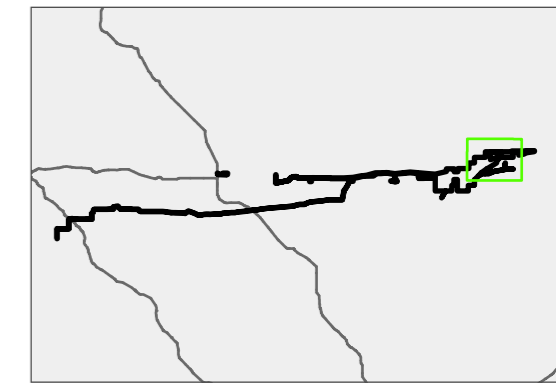


FIGURE 2.2
Blue Hills Local Assessment Unit (LAU)

- Legend**
- Mt Karara (included as part of the LAU)
 - Blue Hills Local Assessment Unit (LAU)
 - MIOP MS 806 Disturbance Footprint
 - KIOP MS 805 Disturbance Footprint
 - KIOP MS 805 Development Envelope
 - KIOP MLE Development Envelope
 - KIOP MLE Disturbance Footprint
 - East Mungada Proposed Disturbance Footprint
 - East Mungada Approved DSO Expansion
 - East Mungada Approved West Expansion
 - East Mungada Development Envelope



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2.1 KML Projects

The existing KIOP (Ministerial Statement (MS) 805) was referred under section 38 of the *Environmental Protection Act 1986* (EP Act) and approved by the Western Australian Environment Minister in 2009. Since the project's inception, there have been a total of five post-assessment variations to MS 805, approved under section 45C of the EP Act.

Other KML activities in the LAU area include the Karara Rail Loop (Native Vegetation Clearing Permit (NVCP) 3399), Hinge Iron Ore Project (HIOP, MS 968), part of the Eneabba to Koolanooka via Three Springs Transmission Lines (project no. 3961/4) and the Mungada Iron Ore Project (MIOP, MS 806). MIOP was approved for operation in 2009 and comprised hematite and magnetite iron ore mining from the Blue Hills North and Terapod satellite pits. The Blue Hills North, Terapod and Hinge satellite pits included open pits, WRDs, ore stockpiles, crushing facilities and workshops at each satellite pit. MIOP also included a 330 kilovolt (kV) powerline running from Karara to Eneabba. In 2011, a single post-assessment change of MIOP was approved under Section 45C of the EP Act, and by 2017 all mining operations within MIOP were ceased. WRDs and infrastructure footprints have since been partially rehabilitated with open pits still being used as water sources/disposal areas for MS 805 (KML 2022).

2.2 Other Projects

The Blue Hills Mungada East Expansion Project (Mungada East, MS 1071) is the other dominant mining operation in the Blue Hills area and is owned by Sinosteel Midwest Corporation Limited (SMC). Approved in late 2017, the project is an extension of the existing Koolanooka/Blue Hills Mungada Direct Shipping Ore Project (DSO Project, MS 811) and is located northeast of the main KIOP site. The expansion is expected to produce an additional 4.4 million tonnes of haematite iron ore over a period of three years and will extend the total life of the DSO (production originally commencing in 2013) from five to eight years. Infrastructure/activities associated with SMC's operations in the region includes:

- Mining, crushing and screening of iron ore from two pits (two existing pits at the Blue Hills mine, Mungada East and Mungada West pits)
- WRDs
- Access/haul roads
- Office, workshop, warehouse and magazine buildings
- Power and water supplies
- Communications infrastructure.

2.3 The Proposed Karara Iron Ore Project Mine Life Extension

The KIOP MLE will expand existing operations at the KIOP and includes additional ground disturbance to support the operational life of the mine. The development envelope is approximately 13,557 hectares (ha) and has a new disturbance footprint of 1,522 ha. As KML now have a significantly better understanding of the orebody than when the project commenced in 2009, changes in operation are required to better facilitate the management of water, waste ore and tailings.

Key changes to operations include:

- Increase in WRD footprint to allow for additional storage

- South and east extensions to the TSF footprint
- Minor extension of the mine pit boundary to accommodate a revised abandonment bund area
- Repurposing infrastructure approved under MIOP to support KIOP activities
- Incorporating infrastructure footprints previously approved under Part V of the EP Act (clearing permits) to simplify ongoing compliance management
- Increasing the development envelope footprint to incorporate the above changes.

The KIOP MLE would increase the life of the mine from around 25 years to 45 years.

3.0 EPA Objectives and Terminology

3.1 Environmental Factor Objective

The EPA objective for the landforms environmental factor is to “maintain the variety and integrity of significant physical landforms so that environmental values are protected” (EPA 2018).

3.2 Terminology

Landform

For this document, the term ‘landform’ has been used as per the definition given by the EPA:

‘The distinctive, recognisable physical features of the earth’s surface having a characteristic shape produced by natural processes. A landform is defined by the combination of its geology (composition) and morphology (form)’ (EPA 2018).

Landscapes

Furthermore, the EPA’s definition for ‘landscapes’ have been adopted, for the sake of clarity:

‘All the features of an area that can be seen in a single view, which distinguish one part of the earth’s surface from another part. Landscapes can be either natural (largely unaffected by human activity) or anthropogenic (created or largely modified by human activity)’ (EPA 2018).

Landform Areas

The landform associated with the KIOP MLE is Mt Karara, which is one of many BIF ranges in the Yilgarn Craton (**Section 2.0**). The Blue Hills Range System is comprised of many individual ranges, each containing their own unique geographical features. Throughout the literature, the naming of these ranges is used synonymously with the names of these features. In this way, Mt Karara is the name commonly given to the range that is located in the southwestern part of the Blue Hills Range System (DEC 2007).

In this document, impacts to landforms have been categorised into immediate and LAU, with immediate referring to Mt Karara, and LAU to the Blue Hills Range System. Mt Karara lies within the Blue Hills Range System and is considered part of the LAU.

4.0 Policy, Legislation and Guidance

Key policies and guidance for this Landform Technical Report include:

EPA Policy and Guidance

- Statement of Environmental Principles, Factors and Objectives (EPA 2023)
- Environmental Factor Guideline: Landforms (EPA 2018).

Other Policy and Guidance

- Strategic Review of the Banded Iron Formations of the Midwest and Goldfields (DEC 2007)
- Environmental Offsets Guidelines (GoWA 2014)
- WA Environmental Offsets Policy (GoWA 2011).

5.0 Methodology

5.1 Supporting Landforms Technical Documents

At present, there are few examples of comprehensive technical reports that have solely addressed the EPA factor landforms in the Yilgarn region. Consequently, this report will primarily draw reference from several relevant documents that have included the environmental factor landforms in the Yilgarn or Blue Hills region (**Table 5.1**); along with the policy and guidance documents listed in **Section 4.0**.

Table 5.1 Reference Reports

Reference	Summary	Relevance To This Report
Sinosteel Midwest Corporation Limited Blue Hills Mungada East Expansion – Public Environmental Review (Sinosteel 2016)	Presents an environmental review of the Mungada East Expansion Proposal, a detailed impact assessment and description of proposed environmental management measures	<ul style="list-style-type: none"> Context for LAU/neighbouring mining operations GIS Methodology for Landform Factor
Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields (DEC 2007)	Provides a review of BIF ranges in the Midwest and Goldfields regions	<ul style="list-style-type: none"> Summarises biodiversity values Strategic review of an iron ore industry in the Yilgarn region, specifically the Midwest
Report and recommendations of the Environmental Protection Authority – Blue Hills Mungada East Expansion, Report 1598 (EPA 2017)	The EPA’s report to the Minister for Environment with the outcomes of the environmental impact assessment for the Blue Hills Mungada East Expansion	<ul style="list-style-type: none"> Provides outcomes to the EPA’s environmental impact assessment for, among other things, the environmental factor landforms
Appeals in Objection to the Content of, and Recommendations in, and Environmental Protection Authority Report (Report 1598) (Appeals Convenor 2017)	Addresses the appeals lodged in objection to the content of, and recommendations in, the report of the EPA in relation to the Blue Hills Mungada East Expansion	<ul style="list-style-type: none"> Provides clarity on: <ul style="list-style-type: none"> permanent and temporary impacts to landforms basis for conclusions of the significance of landforms basis for conclusions of the significance of impacts to landforms

5.2 Generating BIF Landform Local Assessment Unit

The *Sinosteel Midwest Corporation Limited Blue Hills Mungada East Expansion Public Environmental Review* (Mungada East PER) (Sinosteel 2016) was considered a useful resource during the preparation of this technical report due to geographical proximity to the assessed area. The Mungada East project is located approximately 10 km northeast of the KIOP MLE and is one of the most recent proposals in the region that has been assessed by the EPA for impacts on landforms.

The Mungada East PER includes a comprehensive section on landform assessment and impacts in a local and regional context. It also provides guidance for producing spatial layers that represent landforms. As there is no government spatial data available that represents the BIF landforms, the Mungada East PER was used as guidance to generate the spatial layer used for this technical report.

To create the LAU boundary, regional contour line data was acquired from Landgate (10 m intervals) and converted into a digital elevation model (DEM) layer (5 m resolution) using ArcGIS Pro. A contour slope analysis on the surface was conducted, selecting for any slope ≥ 5 degrees, and a 50 m buffer was applied to smooth, fill and join smaller polygons into larger groups to better represent formations for regional visualisation. The layer produced for the LAU was similar in overall area to that of the Mungada East PER (3.6% smaller due to the smoothing process). The area for Mt Karara and the LAU were 506 ha and 1,939 ha, respectively.

5.3 Rehabilitation Assessment Methods

Records of KML's rehabilitation schedule, retrieved from annual compliance reports, were reviewed to create a summary of rehabilitation works completed to date. This includes over 650 ha of rehabilitated land across MS 805, MS 806 and MS 968, and other areas covered by NVCPs. The assessment on KML's rehabilitation schedule can be found in **Section 8.1**.

A review of KML's rehabilitation data was undertaken to determine if significant flora and vegetation, as well as terrestrial fauna values, are being restored. The assessment criteria included:

- reviewing success in meeting rehabilitation criteria as defined in MS 805 and MS 806. Prior to undertaking this analysis, the floristic data was reviewed by a Principal Botanist for nomenclatural and taxonomic currency, and introduced taxa and indeterminate records (e.g. *Acacia* sp.) were removed.
- undertaking agglomerative hierarchical clustering analyses to assess whether the floristic composition of rehabilitation is similar to vegetation representative of the 'Blue Hills (Mount Karara/Mungada Ridge/Blue Hills) vegetation assemblages (banded ironstone formation' Priority Ecological Community (PEC) (methods outlined in **Section 5.3.1**).
- determining whether significant flora species have been restored in rehabilitation areas.
- determining if habitat suitable for significant terrestrial fauna has been established.
- evaluating the effectiveness of the rehabilitation methods and any recommendations for improvement.

5.3.1 Blue Hills PEC Floristic Composition Analysis

Statistical analysis using R Statistical Software (R Core Team 2025) was undertaken to assess the floristic similarity between control quadrats and rehabilitation quadrats using monitoring data supplied by KML. Data from a quadrat's most recent sampling period was used in the analysis when a quadrat had been sampled over multiple years.

Introduced taxa and indeterminate records (e.g. *Acacia* sp.) were removed from the analysis dataset, and the floristic data was reviewed by a Principal Botanist for nomenclatural and taxonomic currency prior to undertaking the analysis. Two initial analyses were then undertaken, one including and one excluding singletons (i.e. flora taxa that occur only once in the dataset) to determine whether the inclusion of singletons in the dataset would impact the grouping and classification of quadrats in a meaningful way. The outcome was that there was no significant change in quadrat grouping with the removal of singletons, so they were retained in the dataset.

Prior to undertaking agglomerative hierarchical clustering, a principal components analysis (PCA) using base R was undertaken on a single-layer data matrix consisting of presence/absence species data. Three analyses were then undertaken to determine the optimal number of clusters, with the minimum of these three metrics being considered to capture the majority of variation in the plot data:

- Determining the “elbow” of the curve of a PCA scree plot and retaining all components before this point.
- The point where the principal components contribute 5% of the standard deviation and the principal components cumulatively contribute 90% of the standard deviation.
- The point where the percent change in variation between consecutive principal components is less than 0.1%.

The same presence-absence data matrix was then used in the classification analysis, with the classification and ordination analysis of the data matrix undertaken using the ‘vegan’ (Oksanen et al. 2025) and ‘cluster’ (Maechler et al. 2025) R packages. The Bray-Curtis coefficient was used to generate an association matrix for the classification analysis. This association matrix consisted of pairwise coefficients of dissimilarities between plots based on floristic data. Agglomerative hierarchical clustering, using flexible Unweighted Pair Group Method with Arithmetic Mean (UPGMA) ($\beta = -0.1$), was used to generate a plot classification dendrogram using the ‘factoextra’ R package (Kassambara & Mundt 2020).

In addition to the dendrogram, a cluster plot was generated using the ‘factoextra’ R package. Prior to generating the cluster plot, PCA was performed to reduce the number of dimensions such that the data can be represented by clusters in a two-dimensional space. The data was then plotted according to the first two principal components that explain the majority of the variance in the dataset.

5.4 IUCN Assessment Approach

The IUCN Red List Categories and Criteria (IUCN Standards and Petitions Committee 2024) provide a consistent framework for assessing and monitoring the status of species and ecosystems. While none of the conservation significant vegetation communities and species potentially at risk of significant impact from the Proposal have been formally assessed for inclusion in the IUCN Red List, the assessment process provides a structured methodology for evaluating risk and supports informed decision-making regarding potential environmental impacts. IUCN criteria assessment outcomes for the estimated current state were compared with those incorporating the predicted additional impacts from the Proposal to provide an indication of whether the Proposal would be likely to result in an increase of IUCN Threat Category of a community or plant or animal taxon.

The following sections explain the selection of communities and taxa for assessment under the IUCN criteria, and the methods that were followed.

5.4.1 Selection of Vegetation Communities and Species for Assessment

The purpose of the IUCN criteria assessment was to determine whether the Proposal may result in a change in IUCN Threat Category for any ecological community or flora and fauna species associated with the BIF landform. Therefore, the assessment was only undertaken for the following conservation significant ecological communities and plant and animal taxa that are either restricted to, or have preferred habitat associated with, the BIF landform:

- Ecological communities:
 - PEC 'Blue Hills (Mount Karara/Mungada Ridge/Blue Hills) vegetation assemblages (banded ironstone formation)' ('Blue Hills PEC') (WA Priority (P) 1).
- Flora species:
 - *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (WA P1).
- Fauna species:
 - Long-tailed Dunnart (*Antechinomys (Sminthopsis) longicaudata*) (WA P4)
 - Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*) (WA Vulnerable).

Section 6.3 provides further details of ecological values associated with the BIF landform.

5.4.2 Application of IUCN Criteria

Assessment of communities and species against the IUCN Criteria was undertaken using the methods outlined in the following guidance documents:

- Guidelines for Using the IUCN Red List Categories and Criteria (IUCN Standards and Petitions Committee 2024).
- Guidelines for nominating and assessing the eligibility for listing of ecological communities as threatened under national environment law (DCCEE 2024b).
- Guidelines for assessing the conservation status of native species according to the *Environment Protection and Biodiversity Conservation Act 1999* and Environment Protection and Biodiversity Conservation Regulations 2000 (DCCEE 2024a).

The assessment reviewed the ecological status of the Blue Hills PEC across five main criteria as outlined in the guidance:

- decline in geographic distribution
- limited geographic distribution
- loss or decline of functionally important species
- reduction in community integrity
- rate of continuing change.

For terrestrial fauna and flora species the assessment included four main criteria:

- population size
- population decline
- geographic range
- number of mature individuals.

An initial assessment was undertaken against the IUCN criteria using available information on the estimated current state of the community or species across its known range. An additional assessment against the criteria was completed to account for the Proposal impacts to determine the likelihood of there being a change in IUCN Threat Category.

6.0 Receiving Environment

This section describes the morphological characteristics of the Blue Hills Range System LAU and Mt Karara; the ecological values of the LAU and Mt Karara; and the significance of the Mt Karara landform.

6.1 Morphological Characteristics of the Blue Hills Range System LAU

This section describes the geology, morphology and land systems of the LAU. The landform areas generated for this report and described in this section are based upon historical Landgate DEMs (**Section 5.2**) which predate mining operations in the area and do not reflect the current state of the landforms (immediate, local or regional). It is acknowledged that these impacts are irreversible and will continue to be affected by approved mining activities in the future. While some findings and figures may incorporate this historic data, it has been taken into consideration throughout the assessment.

6.1.1 Geology

The assessed region (including the LUA) is situated on the Yilgarn Craton, which consists of metavolcanic and metasedimentary rocks, granites, and granitic gneiss that formed over two billion years ago. This specific region of the Yilgarn Craton is known as the Youanmi Terrane and has areas of lower succession categorised by mafic and ultramafic volcanic rocks and BIF formations, along with minor felsic volcanic rocks and local basal quartzite (Cassidy et al. 2006). As a result of their age, they have been exposed to prolonged weathering and sit relatively low in the landscape. As the area is dominated by undulating plains of Cainozoic sediments overlying Archaean bedrock, the BIF range formations are a visually dominant part of the landscape (Markey & Dillon 2010).

The main geology types in the LAU (**Figure 6.1**), as per Geoscience Australia's Surface Geology spatial data (2012), includes:

- **Asy (Archean):** Conglomerate, chert, small amounts felsic volcanoclastic rocks, sandstone, quartzite, siltstone, phyllite, schist, pelite, shale. Includes the former Hatfield Formation.
- **Qrc (Quarternary):** Colluvium and/or residual deposits, sheetwash, talus, scree; boulder, gravel, sand; may include minor alluvial or sand plain deposits, local calcrete and reworked laterite.

BIF landforms within the LAU occur predominantly on the Asy geological type, with the proposed KIOF MLE spread equally across the Asy and Qrc geological types (the Qrc geological type is predominately representative of the outwash slopes of the BIF landform, rather than the hill itself).

These geology types are not restricted to Mt Karara, or indeed the LAU, and are found in various locations throughout the region. Approximately 1,461 ha of the LAU is categorised as Asy and 467 ha as Qrc (with the remaining 11 ha categorised as Czl, **Figure 6.1**), while 2,035 ha of the landforms within the region are categorised as Asy and 1,160 ha are Qrc. The area categorised as Asy and Qrc within the LAU accounts for 30% and 10% (respectively) of the total areas mapped as these geology types within the region.

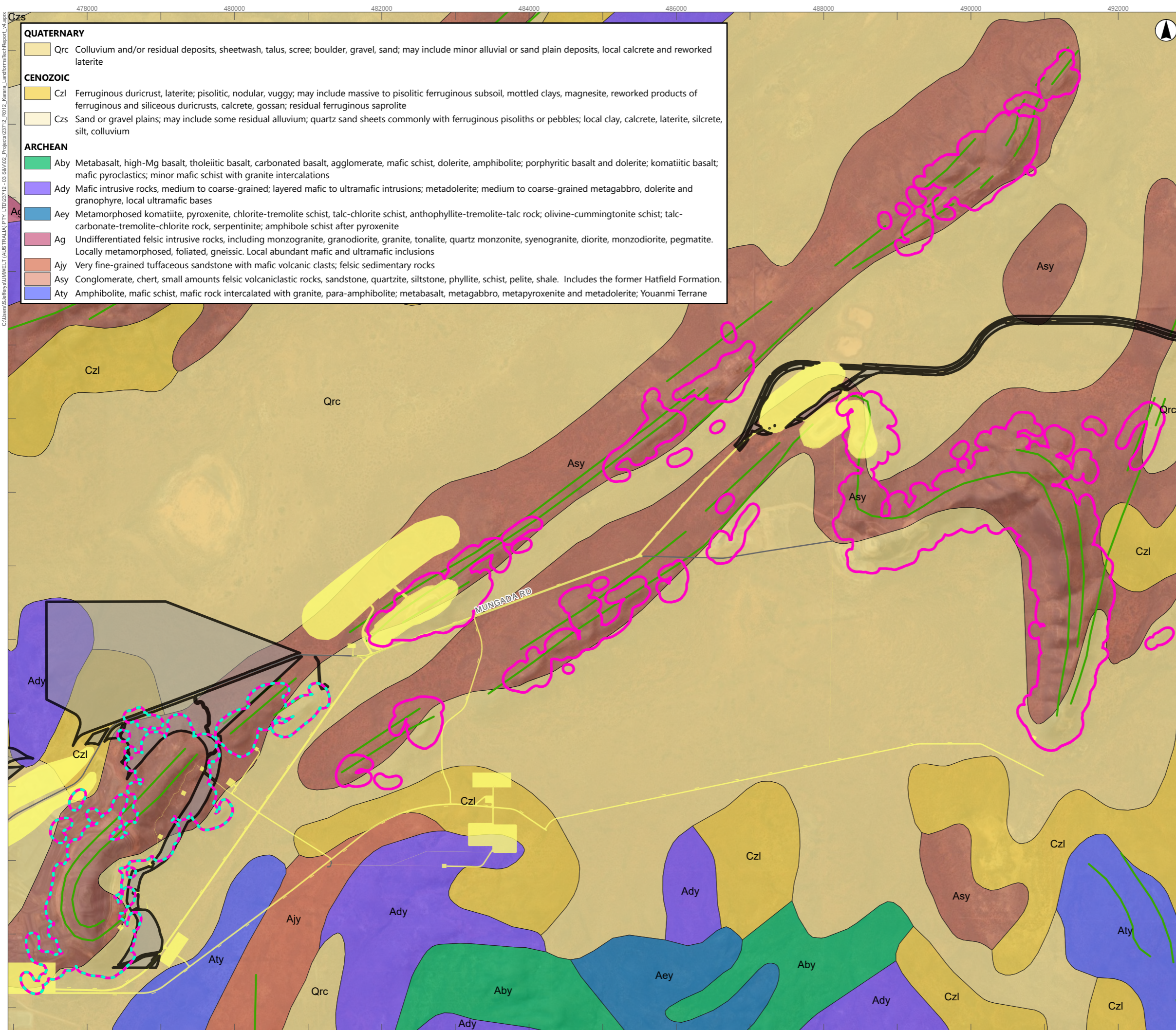
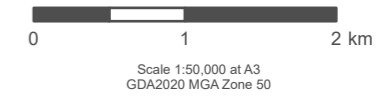


FIGURE 6.1
Geology of the LAU

- Legend**
- Mt Karara (included as part of the LAU)
 - Blue Hills Local Assessment Unit (LAU)
 - KIOP MLE Disturbance Footprint
 - MIOP MS 806 Disturbance Footprint
 - Road
 - Indicative BIF (A-h - Hematite, Magnetite-Quartz)



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6.1.2 Morphology

The BIF landforms in the region make up a total estimated area of 20,889 ha (calculated using the methods described in **Section 5.2**). The region's highest peak is located at Warriardar Hill Range, with an elevation of 537 m Australian Height Datum (AHD) (with a relative elevation of 187 m, assuming the surrounding area is approximately 350 mAHD). The LAU has an estimated total area of 1,939 ha and is orientated in a south-westly by north-easterly direction. Peak elevation throughout the LAU is 510 mAHD on Mungada Ridge, with a relative height of 160 m (assuming the surrounding area is approximately 350 mAHD) (**Figure 6.2**).

Within the region, the steepest slope is located approximately 12 km northeast of Perenjori (Ninghanboun Hill) at 36%. Throughout the LAU, the steepest slopes occur on Mungada Ridge at 27% (**Figure 6.3**).

6.1.3 Land Systems

Soil landscape mapping has been prepared across WA as a compilation of the results of a variety of soil and soil landscape surveys, considering general ecological information, vegetation physiognomy and composition, patterns of variation, conservation status, gradational association and land system representation. Soil landscape mapping information for the LAU originates from surveys undertaken within the Sandstone–Yalgoo–Paynes Find area (Payne et al. 1998).

There are seven land systems found within the LAU (**Figure 6.4** and **Table 6.1**). As seen on a regional scale, the dominant system in the LAU is the Tallering Land System. Ninety-three percent of the LAU is mapped as Tallering Land System (representing 5.5% of the total area currently mapped as this particular land system type). The Tallering Land System is a broad classification which is known to include BIF ranges, and extends from Mt Karara to Yalgoo in the north. It is characterised by ridges/hills of sedimentary rock, dolerite and banded ironstone which support acacia shrublands (DPIRD 2022). It is documented that 20% of this particular system is composed of hills and ridges, with a further 58% comprising hillslopes that are covered in scattered to moderately dense acacia shrublands (Meissner & Caruso 2008).

Table 6.1 Land Systems in the LAU

Land System	Description	Cover within the LAU (%)
Campsite	Alluvial plains supporting eucalypt woodlands with halophytic understoreys and acacia shrublands.	0.3
Doney	Calcareous alluvial plains with eucalypt woodlands adjacent to salt lake systems.	< 0.01
Tealtoo	Level to gently undulating loamy plains with fine ironstone gravel mantles supporting dense acacia shrublands.	0.8
Pindar	Loamy plains surrounded by sandplain supporting York gum woodlands and acacia shrublands.	3
Moriarty	Low greenstone rises and stony plains supporting chenopod shrublands with patchy eucalypt overstoreys.	2
Tallering	Prominent ridges and hills of banded ironstone, dolerite and sedimentary rocks supporting bowgada and other acacia shrublands.	93
Yowie	Sandy plains supporting tall shrublands of mulga and bowgada with patchy wanderrie grasses.	0.9

Source: DPIRD (2022).

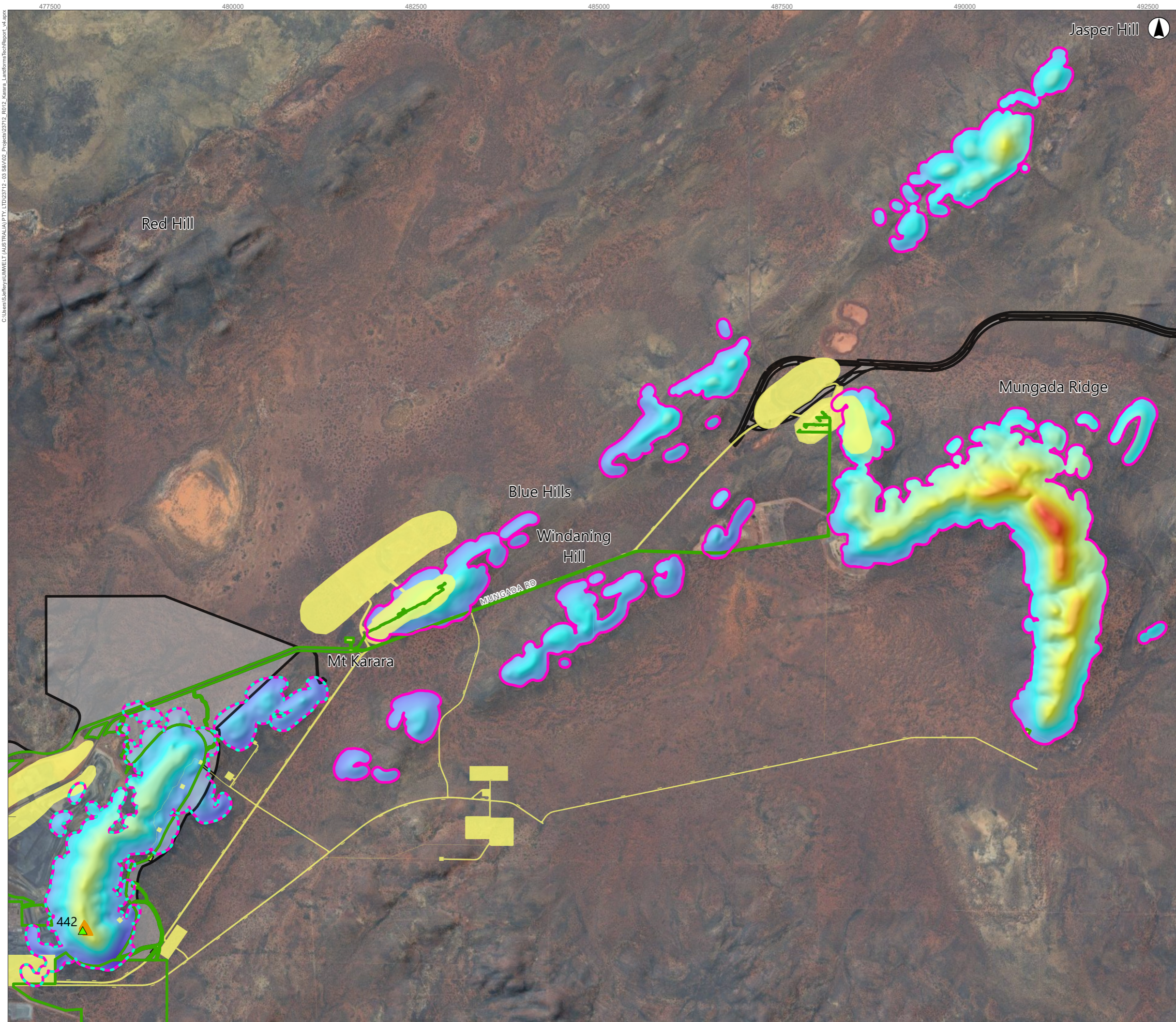


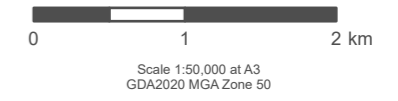
FIGURE 6.2
Elevation of the LAU

Legend

- Mt Karara (included as part of the LAU)
- Blue Hills Local Assessment Unit (LAU)
- KIOP MLE Disturbance Footprint
- KIOP MS 805 Disturbance Footprint
- Road
- Sinosteel Midwest Corporation Limited
- ▲ Survey Point - Mt Karara BA11
- ▲ Highest Points of Elevation in Mt Karara

Elevation

High : 512m
 Low : 330m



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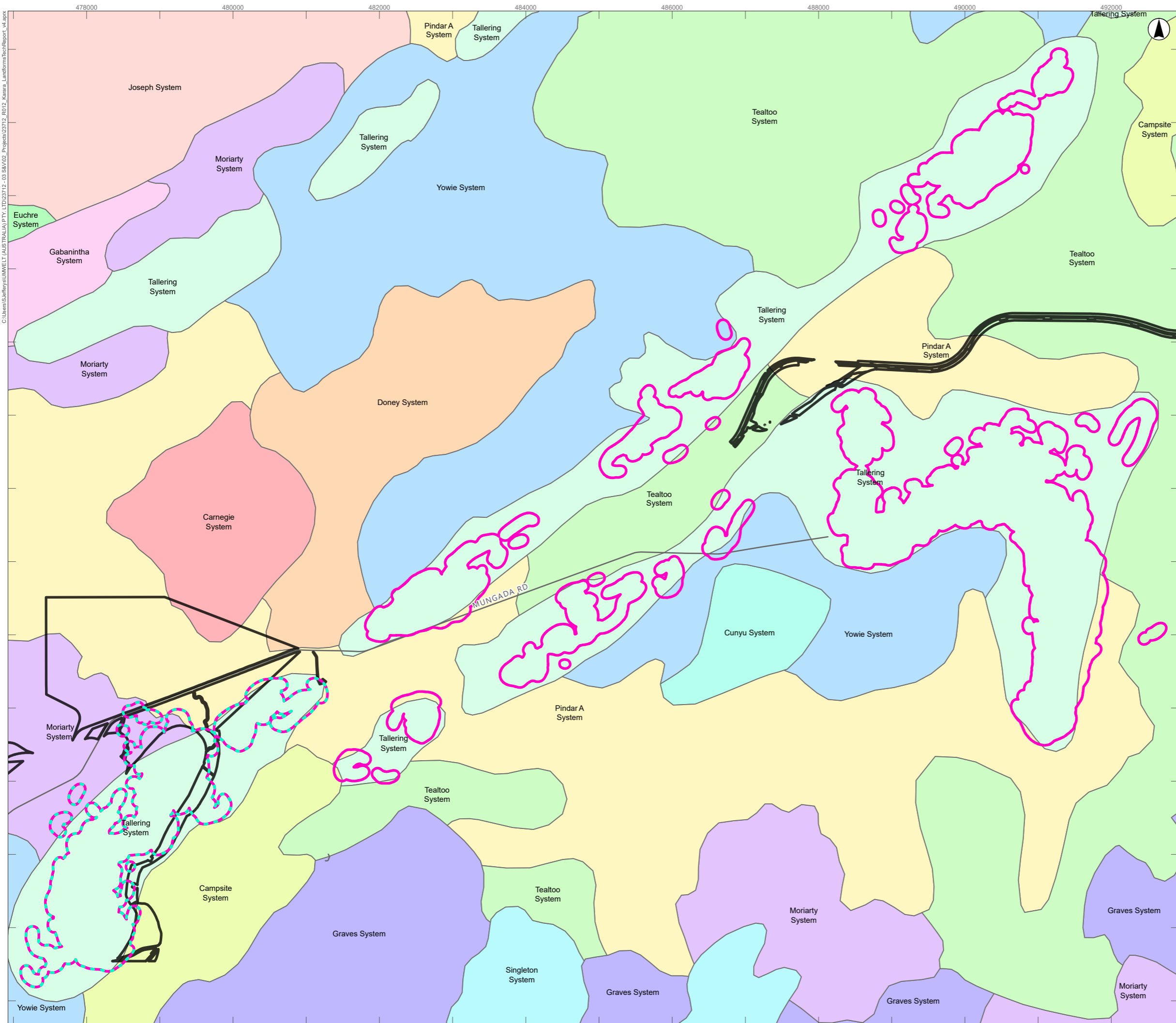


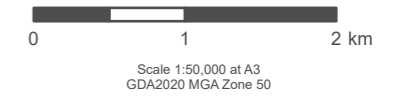
FIGURE 6.4
Land Systems of the LAU

Legend

- Mt Karara (included as part of the LAU)
- Blue Hills Local Assessment Unit (LAU)
- KIOP MLE Disturbance Footprint
- Road

Land System

- Campsite System
- Carnegie System
- Cunyu System
- Doney System
- Euchre System
- Gabanintha System
- Graves System
- Joseph System
- Moriarty System
- Pindar A System
- Singleton System
- Tallering System
- Tealtoo System
- Yowie System



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6.2 Morphological Characteristics of Mt Karara Landform

6.2.1 Spatial Extent of the Landform

The LAU (**Figure 2.2**) is comprised of five ranges, including Mt Karara (**Figure 6.5**). This section describes the geology, morphology, land system and extent of the Mt Karara landform.

Mt Karara's geology is comprised mainly of the Asy geological type with minor areas of Qrc geological type; this is consistent with the geology of the other landforms within the LAU (**Section 6.1.1**).

Mt Karara extends over 506 ha, with its highest recorded elevation from a historic survey mark (BA11) at 452 mAHD. The highest point of relative elevation is 102 m, assuming the surrounding area is approximately 350 mAHD. However, the data collected at survey mark BA11 predates mining activities and is no longer part of the landform. **Figure 6.2** indicates that the highest remaining elevation for Mt Karara, outside the approved MS 805 disturbance footprint, will be in the northeastern ridges at 382 mAHD (with a relative height of 37 m, assuming the surrounding area is approximately 345 m AHD). These ridges fall outside the approved KML operations, as well as the proposed MLE.

While currently approved mining activities (MS 805) have changed the overall morphology of the Mt Karara range, historical DEMs indicate that the landform runs in a northerly direction for approximately 2 km, before curving in a north-northeasterly direction for approximately 4 km. The landform ranges in width from 300 m to almost 2 km at its widest point, with an average width of 1 km (**Figure 6.5**).

Mt Karara's steepest recorded slopes are also from the historic survey mark BA11, at 26%. As with elevation, the data collected at this survey mark predates mining activities and is no longer part of the landform. **Figure 6.3** indicates that the steepest remaining slopes for Mt Karara, outside of the approved MS 805 disturbance footprint, will be in the northeastern ridges at 15%. These ridges fall outside currently approved KML operations, as well as the proposed MLE.

The landform intersects four land systems (Campsite, Moriarty, Pindar and Tallering), with 444 ha (88%) of the landform being categorised as Tallering (**Figure 6.4**).

6.2.2 Approved Impact to Landform

Mt Karara is the only landform within the LAU that will be permanently impacted as a result of the KIOP MLE. Currently approved disturbance areas (MS 805 and MS 806) are known to have both temporary (e.g. bores, access roads and/or general infrastructure) and permanent impacts (mine pits, WRDs and/or abandonment bunds) on Mt Karara. Other mining operations in the area (MS 811 and MS 1071), while impacting the greater LAU, do not have a direct impact on the Mt Karara landform.

Permanent impacts to Mt Karara from KML's existing approvals are estimated to be 357 ha (71% of Mt Karara), and temporary impacts are estimated to be 13 ha (3% of Mt Karara). Most of the permanent impact to Mt Karara is from the current and approved open pit area under MS 805.

Landform impacts are further detailed in **Section 7.0**.

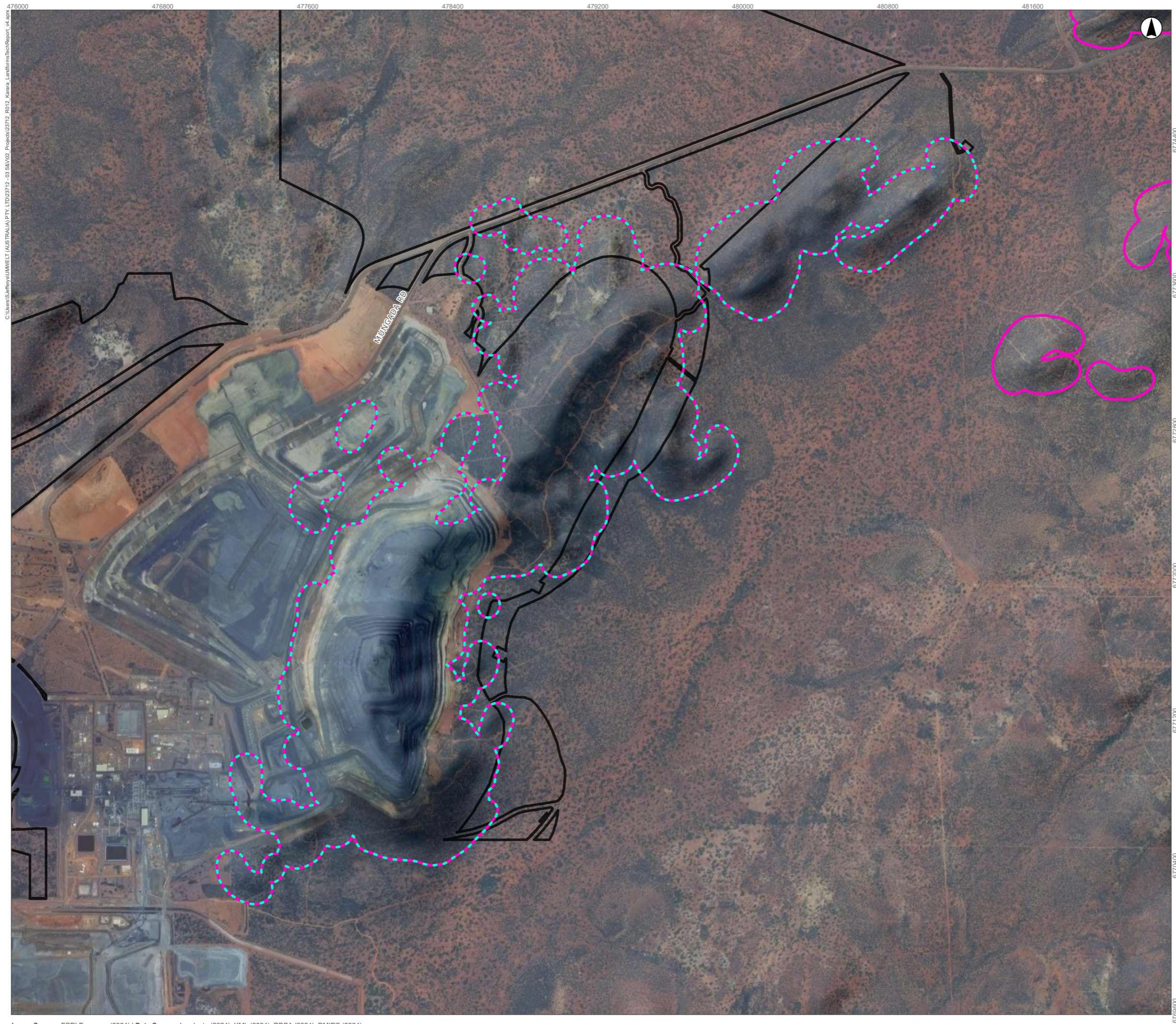
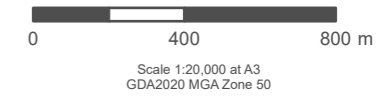


FIGURE 6.5
Immediate Landform (Mt Karara)

- Legend**
- Mt Karara (included as part of the LAU)
 - Blue Hills Local Assessment Unit (LAU)
 - KIOP MLE Disturbance Footprint
 - Road



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6.3 Ecological Values

Based on the recent ecological survey reports undertaken for the KIOP MLE by Umwelt (2025a) and Bamford (2025), one conservation significant ecological community and several significant flora and fauna are known to occur on Mt Karara. These values are described in the following sections (where they are known from areas outside those defined as currently cleared or approved to be cleared in the *Flora and Vegetation Impact Assessment: Karara Iron Ore Project Mine Life Extension* (Umwelt 2025b)).

6.3.1 Significant Vegetation

A total of 109 ha (22% of the entire Mt Karara area) has been mapped by Umwelt (2025a) as the WA PEC 'Blue Hills (Mount Karara/Mungada Ridge/Blue Hills) vegetation assemblages (banded ironstone formation)' (P1). This PEC will be impacted by the KIOP MLE (Umwelt 2025b).

6.3.2 Significant Flora

The LAU is situated between the arid Eremaean botanical province and the South West botanical province, and has been well surveyed for mining developments operating out of the area. The Blue Hills LAU has high diversity and endemism of plant taxa, including *Acacia woodmaniorum*, which is listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the WA *Biodiversity Conservation Act 2016* (BC Act). Several other conservation significant flora occur in the Blue Hills LAU, including *Prostanthera* sp. Karara (D. Coultas & K. Greenacre Opp 8) (P1) and *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (P1).

Conservation significant flora taxa that are known from the LAU and that may be impacted by the KIOP MLE include the below (presented in **Figure 6.6**):

- *Acacia karinae* (P3)
- *Caesia* sp. Koolanooka Hills (R. Meissner & Y. Caruso 78) (P1)
- *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3)
- *Gunniopsis divisa* (P3)
- *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (P1)
- *Rhodanthe collina* (P3).

6.3.3 Significant Terrestrial Fauna

Table 6.2 lists conservation significant terrestrial fauna species that may be considered residents of or regular visitors to the remaining portions of Mt Karara (based on the mapped presence of suitable fauna habitat vegetation and substrate associations (VSAs 1, 3, 4, 5 and 7) (Bamford 2025)).

Table 6.2 Conservation Significant Fauna Species with Habitat on Mt Karara

Scientific Name	Common Name	BCE Conservation Significance*	Status (WA)	Status (EPBC)
Frogs				
<i>Neobatrachus centralis</i>	Desert Trilling Frog	CS3	-	-
Reptiles				
<i>Caimanops (Diporiphora) amphibolurooides</i>	Mulga Dragon	CS3	-	-
<i>Hesperoedura reticulata</i>	Reticulated Velvet Gecko	CS3	-	-
<i>Cyclodomorphus branchialis</i>	Gilled Slender Blue-tongue	CS1	VU	-
<i>Egernia stokesii badia</i>	Western Spiny-tailed Skink	CS1	VU	EN
Birds				
<i>Burhinus grallarius</i>	Bush Stone-curlew	CS3	-	-
<i>Cacatua leadbeateri</i>	Major Mitchell's Cockatoo	CS3	-	-
<i>Climacteris affinis</i>	White-browed Treecreeper	CS3	-	-
<i>Climacteris rufus</i>	Rufous Treecreeper	CS3	-	-
<i>Falco peregrinus</i>	Peregrine Falcon	CS1	OS	
<i>Leipoa ocellata</i>	Malleefowl	CS1	VU	VU
<i>Oreoica gutturalis</i>	Crested Bellbird	CS3	-	-
<i>Pyrrholaemus brunneus</i>	Redthroat	CS3	-	-
<i>Aphelocephala leucopsis</i>	Southern Whiteface	CS1	VU	VU
<i>Eopsaltria griseogularis</i>	Western Yellow Robin	CS3	-	-
<i>Pomatostomus superciliosus</i>	White-browed Babbler	CS3	-	-
<i>Polytelis anthopeplus</i>	Regent Parrot	CS3	-	-
<i>Neophema splendida</i>	Scarlet-chested Parrot	CS3	-	-
Mammals				
<i>Antechinomys laniger</i>	Kultarr	CS3	-	-
<i>Nyctophilus major tor</i>	Inland Long-eared Bat	CS2	P4	-
Invertebrates				
<i>Idiosoma clypeatum</i>	Northern Shield-backed Trapdoor Spider	CS2	P3	-
<i>Idiosoma formosum</i>	Ornate Trapdoor Spider	CS1	EN	-
<i>Antichiropus</i> sp. nov. 'Karara'	Karara Millipede	CS3	-	-
<i>Millipede</i> sp. nov. 'PM1'	Millipede PM1	CS3	-	-
<i>Urodacus</i> sp. nov. 'Mt Gairdner'	Mt Gairdner Scorpion	CS3	-	-

* Conservation significance rank assigned by Bamford Consulting Ecologists (BCE):

conservation significance 1 (CS 1) – species listed under the BC Act and/or the EPBC Act.

conservation significance 2 (CS 2) – species listed as Priority species by DBCA.

conservation significance 3 (CS 3) – species with at least local significance due to their pattern of distribution.

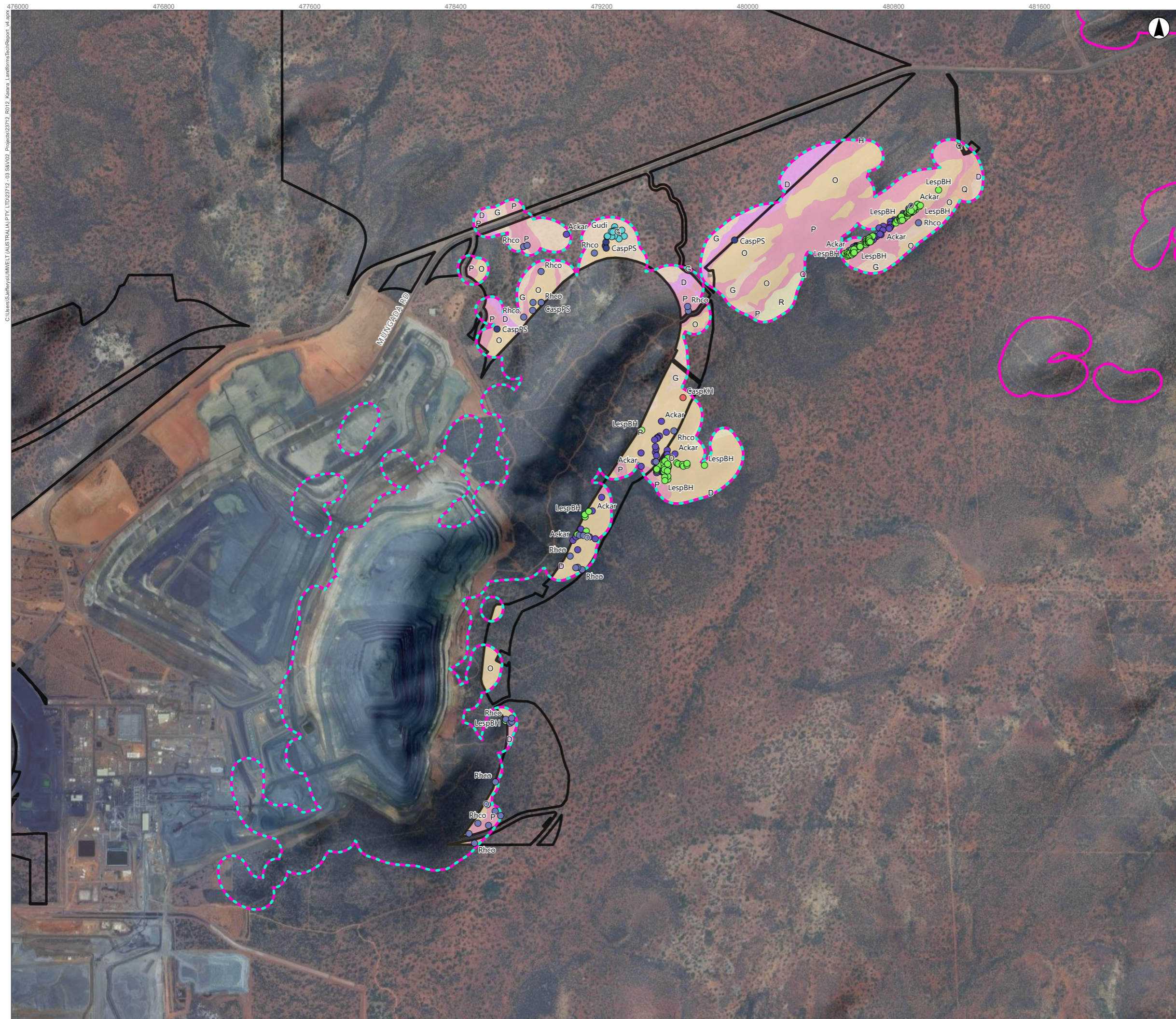


FIGURE 6.6
Ecological Importance (Mt Karara)

Legend

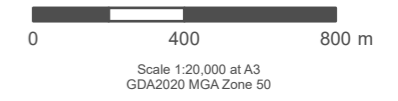
- Mt Karara (included as part of the LAU)
- Blue Hills Local Assessment Unit (LAU)
- KIOP MLE Disturbance Footprint
- Road

Significant Flora Taxa

- Ackar *Acacia karinae* (P3)
- CaspKH *Caesia* sp. Koolanooka Hills (R. Meissner & Y. Caruso 78) (P1)
- CaspPS *Calotis* sp. Perrinvale Station (R.J. Cranfield 7096) (P3)
- Gudi *Gunniopsis divisa* (P3)
- LespBH *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (P1)
- Rhco *Rhodanthe collina* (P3)

Vegetation Type

- D
- G
- H
- O
- P
- Q
- R



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Vegetation Type

	D	Occasional low woodland to open woodland of <i>Eucalyptus kochii</i> , <i>Callitris columellaris</i> , and/or <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> , over tall open shrubland of mixed species including <i>Acacia tetragonophylla</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Acacia acuminata</i> , <i>Acacia obtecta</i> and <i>Exocarpos aphyllus</i> , over mid sparse shrubland of mixed species including <i>Hakea recurva</i> subsp. <i>recurva</i> , <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Eremophila clarkei</i> and <i>Acacia assimilis</i> subsp. <i>assimilis</i> , over low sparse shrubland of mixed species including <i>Rhagodia drummondii</i> , <i>Ptilotus obovatus</i> and <i>Olearia humilis</i> , over low sparse tussock grassland of <i>Austrostipa elegantissima</i> and <i>Monachather paradoxus</i> , over low sparse formland of mixed species including <i>Erodium cygnorum</i> , <i>Cephalopterum drummondii</i> and <i>Gilruthia osbornei</i> , on red or red-brown sandy clay loam, sometimes with occasional ironstone or quartz surface stones, on flats and plains
	G	Mid to low woodland to open woodland of <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> and occasionally <i>Eucalyptus kochii</i> , over tall sparse shrubland of mixed species including <i>Acacia tetragonophylla</i> and occasionally <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Exocarpos aphyllus</i> , <i>Acacia obtecta</i> and <i>Acacia burkittii</i> , over an occasional mid sparse shrubland of <i>Senna</i> sp. Austin (A. Strid 20210), <i>Scaevola spinescens</i> and/or <i>Dodonaea inaequifolia</i> , over low isolated clumps of shrubs of mixed species including <i>Senna artemisioides</i> subsp. <i>filifolia</i> , <i>Ptilotus obovatus</i> and <i>Pimelea microcephala</i> subsp. <i>microcephala</i> , over low isolated clumps of chenopod shrubs of mixed species including <i>Rhagodia drummondii</i> , <i>Sclerolaena fusiformis</i> , <i>Maireana georgei</i> , <i>Maireana carnosus</i> and <i>Enchylaena lanata</i> , over low isolated clumps of tussock grasses of <i>Austrostipa elegantissima</i> , over low isolated clumps of forbs of mixed species including <i>Mesembryanthemum nodiflorum</i> , <i>Cephalopterum drummondii</i> , <i>Erodium cygnorum</i> and <i>Gilruthia osbornei</i> , on red or red-brown clay loam or silty clay loam, usually with ironstone and/or granite and/or quartz surface stones, on flats and plains
	H	Occasional low open woodland to isolated trees of mixed species including <i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i> , <i>Eucalyptus salubris</i> , <i>Eucalyptus clelandiorum</i> or <i>Eucalyptus kochii</i> subsp. <i>amaryssia</i> , over tall open to sparse shrubland of mixed species including <i>Acacia obtecta</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Acacia latior</i> and <i>Melaleuca leiocarpa</i> , over mid isolated shrubs of mixed species including <i>Acacia tetragonophylla</i> , <i>Exocarpos aphyllus</i> and <i>Acacia exocarpoides</i> , over occasional low isolated clumps of shrubs of <i>Ptilotus obovatus</i> , <i>Senna charlesiana</i> , <i>Persoonia pentasticha</i> (P3) and <i>Olearia pimeleoides</i> , over low isolated clumps of chenopod shrubs of mixed species dominated by <i>Rhagodia drummondii</i> and <i>Sclerolaena fusiformis</i> and occasionally <i>Maireana georgei</i> and <i>Enchylaena lanata</i> , on red-brown clay loam, with occasional ironstone surface stones, on flats and plains
	O	Occasional low isolated trees of <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , over tall sparse shrubland of mixed species including <i>Acacia assimilis</i> subsp. <i>assimilis</i> , <i>Calycopeplus paucifolius</i> , <i>Melaleuca nematophylla</i> , and/or <i>Acacia ramulosa</i> var. <i>ramulosa</i> , over mid sparse shrubland of mixed species including <i>Eremophila clarkei</i> , <i>Philotheca brucei</i> subsp. <i>brucei</i> , <i>Philotheca sericea</i> , <i>Aluta aspera</i> subsp. <i>aspera</i> and <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , over low isolated shrubs of <i>Xanthosia kochii</i> , <i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260) and <i>Hibbertia arcuata</i> , over low isolated clumps of forbs of mixed species including <i>Waitzia acuminata</i> var. <i>acuminata</i> , <i>Podolepis lessonii</i> and <i>Lawrencella rosea</i> , on red-brown silty loam or silty clay loam with ironstone, BIF or granite stones, and sometimes with ironstone, BIF or granite outcropping, on slopes and crests
	P	Occasional low isolated trees of <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> , over tall shrubland to open shrubland of mixed species including <i>Acacia assimilis</i> subsp. <i>assimilis</i> , <i>Melaleuca nematophylla</i> , <i>Acacia latior</i> , <i>Calycopeplus paucifolius</i> and <i>Acacia sibina</i> , over mid shrubland to open shrubland dominated by <i>Aluta aspera</i> subsp. <i>hesperia</i> and occasionally with <i>Philotheca sericea</i> , <i>Hibbertia arcuata</i> and/or <i>Grevillea paradoxa</i> , over occasional low open shrubland of mixed species including <i>Philotheca deserti</i> subsp. <i>deserti</i> and <i>Xanthosia kochii</i> , over low isolated clumps of tussock grasses of <i>Monachather paradoxus</i> and <i>Amphipogon caricinus</i> var. <i>caricinus</i> , over low sparse formland of mixed species including <i>Erodium cygnorum</i> , <i>Bellida graminea</i> , <i>Trachymene ornata</i> , <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> and <i>Lawrencella rosea</i> , on red or red-brown clay loam or silty loam with ironstone or BIF surface stones, and occasionally with ironstone or BIF outcropping, on lower to upper slopes
	Q	Occasional low open woodland of <i>Eucalyptus arcata</i> and/or <i>Eucalyptus kochii</i> subsp. <i>amaryssia</i> , over tall shrubland to open shrubland of mixed species dominated by <i>Acacia latior</i> , <i>Acacia sibina</i> , and occasionally <i>Melaleuca leiocarpa</i> , <i>Acacia longispinea</i> and <i>Melaleuca hamata</i> , over occasional mid isolated shrubs of mixed species including <i>Aluta aspera</i> subsp. <i>hesperia</i> and <i>Hakea recurva</i> subsp. <i>recurva</i> , over low isolated shrubs of mixed species including <i>Philotheca deserti</i> subsp. <i>deserti</i> , <i>Cryptandra imbricata</i> , <i>Prostanthera prostantheroides</i> and <i>Enekbatus stowardii</i> , over low sparse tussock grassland of <i>Monachather paradoxus</i> , <i>Amphipogon caricinus</i> var. <i>caricinus</i> and occasionally <i>Austrostipa elegantissima</i> , over low sparse formland to isolated clumps of forbs of mixed species including <i>Bellida graminea</i> , <i>Erodium cygnorum</i> , <i>Dianella revoluta</i> var. <i>divaricata</i> and <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> , on brown or red clay loam, sandy clay loam or silty loam with ironstone surface stones, on lower slopes, plains and flats
	R	Occasional low open woodland of <i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i> and/or <i>Eucalyptus kochii</i> , over tall shrubland to open shrubland of mixed species including <i>Acacia ramulosa</i> var. <i>ramulosa</i> , <i>Melaleuca hamata</i> , <i>Acacia latior</i> , <i>Acacia incognita</i> and <i>Acacia sibina</i> , over mid sparse shrubland to isolated clumps of shrubs of mixed species including <i>Eremophila clarkei</i> , <i>Acacia tetragonophylla</i> , <i>Eremophila eriocalyx</i> , <i>Aluta aspera</i> subsp. <i>hesperia</i> and <i>Eremophila latrobei</i> subsp. <i>latrobei</i> , over low sparse shrubland to isolated clumps of shrubs of mixed species including <i>Philotheca deserti</i> subsp. <i>deserti</i> , <i>Leucopogon</i> sp. Clyde Hill (M.A. Burgman 1207), <i>Hibbertia arcuata</i> , and occasionally <i>Chamelaucium pauciflorum</i> subsp. <i>Perenjori</i> (B.J. Conn 2181) and <i>Olearia humilis</i> , over low sparse tussock grassland of <i>Amphipogon caricinus</i> var. <i>caricinus</i> , over low sparse formland to isolated clumps of forbs of mixed species including <i>Erodium cygnorum</i> , <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i> , <i>Bellida graminea</i> , <i>Waitzia acuminata</i> var. <i>acuminata</i> and <i>Gilruthia osbornei</i> , on red or red-brown clay loam with ironstone and sometimes quartz surface stones, on plains and simple slopes

FIGURE 6.6

**LEGEND: Ecological Importance
(Mt Karara)**



6.4 Significance of the Landform

The EPA's Environmental Factor Guideline (EFG) for Landforms assesses the significance of a landform based on the following six criteria (EPA 2018):

- Variety (**Section 6.4.1**)
- Integrity (**Section 6.4.2**)
- Ecological importance (**Section 6.4.3**)
- Scientific importance (**Section 6.4.4**)
- Rarity (**Section 6.4.5**)
- Social importance (**Section 6.4.6**).

The approved disturbance footprint for MS 805 will impact up to 71% (357 ha) of the Mt Karara landform, leaving only the lower slopes of the main landform's eastly and northeasterly facing aspects. There is a single ridge (approximately 78 ha in size) that sits to the northeast of Mt Karara's main landform mass that remains outside approved operations. However, the main landform mass itself (as well as all other minor ridges that make up Mt Karara) are likely to be impacted by approved and proposed operations. As a result, the assessment of the significance of the landform was conducted on the remaining 29% (149 ha) of Mt Karara.

6.4.1 Variety

The EPA guideline considerations for variety are:

The landform is a particularly good or important example of its type. The landform is not well represented over the local, regional or national scale or differs from other examples at these scales.

What remains of Mt Karara would not be considered 'a particularly good or important example of its type' as mining activity has irreversibly changed the morphology of the formation. Following mine closure, the remnant landform will likely resemble the smaller gently sloping ranges that are found throughout the surrounding LAU and greater region; these ranges that are not physically impacted and remain intact.

The overall size of Mt Karara is already approved to be reduced to 29% of the original landform size. The elevation remaining after approved disturbance (ranging from ~340 mAHD to ~380 mAHD) will be significantly lower than the highest peaks in the LAU (510 mAHD). The residual slopes (15%) are less steep than the historical survey mark BA11 and those in the LAU (26-27%). The geology types (Asy and Qrc), as well as the land system type (primarily Tallering) are not unique to Mt Karara, with analogous landforms of similar geological composition found in the LAU and greater region.

6.4.2 Integrity

The EPA guideline consideration for integrity is:

The landform is intact, being largely complete or whole and in good condition.

Mt Karara is currently the most disturbed landform within the LAU, with an approved permanent impact area of 357 ha (71%). This is a result of exploration, mining and/or infrastructure development including WRDs, mine pits and run of mine area associated with KIOP (MS 805). The greatest impacts coincide with the historically highest points/steepest aspects of Mt Karara, removing many of the unique identifying physical characteristics of the landform.

6.4.3 Ecological Importance

The EPA guideline considerations for ecological importance are:

The landform has a distinctive or exclusive role in maintaining existing ecological and physical processes; for example, by providing a unique microclimate, source of water flow, or shade. The landform supports endemic or highly restricted plants or animals.

The areas of greatest ecological importance (the BIF ridge crest) on Mt Karara have already been removed or are approved to be cleared. While the location of proposed impact for the KIOP MLE Proposal is comparatively less significant than previously approved clearing, the Proposal will remove part of the already heavily-impacted landform.

Few of the landform's features of ecological importance remain, therefore, any proposed activities conducted on currently uncleared land should prioritise minimal permanent ground disturbance and rehabilitation is recommended where possible.

6.4.4 Scientific Importance

The EPA guideline considerations for scientific importance are:

The landform provides evidence of past ecological processes or is an important geomorphological or geological site. The landform is of recognised scientific interest as a reference site, or an example of where important natural processes are operating.

Mt Karara, as a BIF landform, is an example of complex geological processes connected with geochemical and environmental evolution of the earth, developing independently to glacial or marine pressures for more than 250 million years.

The Mungada East PER based their assessment of scientific importance on the shape of the landform and its geoheritage status. Geoheritage focuses on rocks, minerals and fossils that offer information on broadscale geological processes, including the formation of landforms and other geomorphological features (Brocx & Semeniuk 2007). The Mungada East PER concluded that none of the BIF landforms in the LAU were likely to attain geoheritage status, noting the lack of known fossils sites or asteroid/meteorite impact structures (Sinosteel 2016). At present there are still no sites within the LAU with geoheritage status (DEMIRS 2021). Mungada Ridge, despite having a distinctly unique crescent shape, was not regarded as scientifically important based on this criteria (Sinosteel 2016). It is unlikely that Mt Karara (being of a far more degraded state) would be considered scientifically important based on landform shape.

Due to its degraded state, Mt Karara is unlikely considered to be of specific scientific importance and is not noticeably different from other BIF landforms in the LAU or surrounding region.

6.4.5 Rarity

The EPA guideline consideration for rarity is:

The landform is rare or relatively rare, being one of the few of its type at a national, regional or local level.

Mt Karara is not considered to be rare. The Mungada East Expansion Appeals Convenor Report referred to the fact that there are numerous BIF landforms both within the LAU and the surrounding region. As there are substantially more than a 'few' BIF landforms locally and regionally, by the EPA guideline considerations, it is unlikely that rarity would be triggered for Mt Karara as it is not an 'extremely limited landform type' (EPA 2018).

6.4.6 Social Importance

The EPA guideline consideration for social importance is:

The landform supports significant amenity, cultural or heritage values.

The BIF landforms within the LAU are important as they support conservation significant flora, fauna and ecosystems, as well as supporting social and cultural values. However, due to mining operations (both current and approved (MS 805 and MS 806)), it is unclear how socially significant the remaining landform is. A majority of Mt Karara has been permanently altered from mining activities, namely the main pit void and WRDs, which have impacted both the aesthetic and ecological value of the landform. At present, public access to the LAU is limited, restricting tourism and cultural uses of the area (EPA 2017). Therefore, the Mt Karara landform is not identified as supporting significant amenity, cultural or heritage values.

The EPA's principle of intergenerational equity suggests that further impacts to Mt Karara should be minimised where practicable, to prevent a decline in aesthetic and social resources for future generations. To ensure these values were upheld in the LAU, a 1,031 ha Class A National Park over Lot 500 on Plan 421082 and Lot 501 on Plan 421083 was created in late 2021, named Mungada Ridge National Park. The National Park (reserve no. 53978) is a joint vesting between the Conservation and Parks Commission and the Bundi Yamatji Aboriginal Corporation, under the conservation estate component of the Yamatji Nation Indigenous Land Use Agreement (Shire Perenjori 2022). The establishment of Mungada Ridge National Park aids amenity, cultural and heritage values related to BIF landforms within the LAU.

6.4.7 Summary of Significance of the Landform

The Mt Karara landform is not considered to be significant due to variety, integrity, ecological importance, scientific importance, rarity or social importance, as 71% of the original landform has already been approved for permanent disturbance, and the physical characteristics of the remaining landform are no more remarkable than other landforms in the Blue Hills Range system LAU.

6.5 Regional Reserves

The assessment for regional reserves was calculated by clipping¹ the Department of Biodiversity, Conservation and Attractions' (DBCAs) Legislated Lands and Waters spatial dataset (2025) to the extent of the regional landform area. The resulting spatial layer therefore only shows reserved areas within the boundaries of the landforms of the region. This was done to make the results easily comparable with the other findings presented in this report.

According to this method, approximately 23% of the regional landform area is reserved. The reserved areas include those within Thundelarra Conservation Park, Barnong Conservation Park, Karara Conservation Park, Mungada Ridge National Park and two un-named timber reserves. The largest reserved area is that within Karara Conservation Park (2,566 ha) and includes the Red Hill BIF landform, the only landform out of the 29 individually named ranges in the region (as defined by this assessment) that is reserved in its entirety. This single landform represents 3% of the total number of ranges reserved in their entirety, which is considerably less than the 15 – 30% stated in the *Strategic Review of the Banded Iron Formations Ranges of the Midwest and Goldfields* (DEC 2007).

¹ Using the geometries from one spatial layer to cut, or "clip," the geometries from another spatial layer.

7.0 Predicted Impacts

This section includes an assessment of temporary and permanent impacts to Mt Karara and the Blue Hills Range System LAU, as a result of the proposed KIOP MLE and existing approved KML projects. It also assesses cumulative impacts accounting for SMC's activity in the LAU.

7.1 Types of Impacts to Landform

Impacts to landforms can be classified as permanent or temporary impacts, and includes the removal or alteration of a landform's defining morphology, geology or abiotic processes (EPA 2018).

Permanent impacts are irreversible damages that have lasting effects on landforms and cannot be fully rehabilitated after the disturbance to the landform has ceased. Examples of permanent effects include aspects such as decommissioned pits, abandonment bunds and/or waste rock stockpiles. Temporary impacts are any superficial disturbances to a landform and can be rehabilitated after a disturbance has ceased. Examples of temporary effects can include aspects such as access tracks, drill pads and/or laydown areas (Appeals Convenor 2017).

7.2 Calculation of Impacts to Spatial Extent of Landform

7.2.1 Methods and Scope

The impact assessment used the landforms spatial area generated by Umwelt (**Section 5.2**) and the spatial layers for Project activities (provided by KML). The scope of the impacts evaluated were as follows:

1. KIOP MLE standalone proposal – operational (temporary) impacts, and residual (permanent) impacts after mine closure and rehabilitation.
2. KIOP MLE cumulative impacts with other KML projects in the Blue Hills area (KIOP, approved under MS 805, and MIOP, MS 806).
3. KML cumulative impacts with other approved projects in the Blue Hills area (Blue Hills Mungada East Extension, MS 1071).

The above impacts were assessed for Mt Karara and the Blue Hills Range System LAU.

As previously mentioned, the other main company operating in the Blue Hills Range System is SMC, who are responsible for the DSO Project and Mungada West/East Expansions (MS 811 and MS 1071). As spatial layers were not provided for these projects, approximate impacts to the LAU were extrapolated from the Mungada East PER and associated Appeals Convenor report (Appeals Convenor 2017; Sinosteel 2016).

Activities/uses for KML projects were derived from the metadata of the provided spatial layers to determine which disturbances would be deemed temporary or permanent. Thus, extents for individual activities and temporary and permanent impacts to the LAU, as well as overall cumulative impacts, could be calculated. While small areas of overlap exist between the datasets, this is unlikely to have had any meaningful impact on the results of the assessment. Impact areas were defined as any part of the KIOP MLE or currently approved projects' disturbance footprints within the boundary of the landforms spatial layer.

Spatial data utilised for the assessment is summarised in **Table 7.1**.

Table 7.1 Data Sources used for the Impact Assessment

Dataset	Description	Source/Date
KIOP805_DevEnvelope.shp	Development envelope for KIOP (MS 805).	KML (April 2024)
KIOP805_45C.shp	Disturbance footprint for KIOP (MS 805).	KML (April 2024)
MIOP806_45C.shp	Disturbance footprint for MIOP (MS 806).	KML (April 2024)
Proposed_DevEnvelope.shp	Development envelope for the proposed KIOP MLE.	KML (April 2024)
Proposed_S38Disturbance.shp	Disturbance footprint for the proposed KIOP MLE.	KML (April 2024)
LANDF_Slope_LGATE015_5up_buff50m_20240603_g20m50_ExportFeatures	LAU spatial representative layer.	Umwelt (June 2024)

The extents of permanent and temporary impacts to landforms in the Blue Hills LAU from the KIOP MLE and other KML projects are detailed in **Table 7.2**. These areas were calculated as the sum of the site layout, and in some cases the total disturbance area was less than the approved disturbance area under the Ministerial Statement.

The results of the calculations for standalone and cumulative impacts are presented in **Table 7.3** (Blue Hills LAU) and **Table 7.4** (Mt Karara landform) and are discussed in the subsequent sections.

7.2.2 Blue Hills LAU and Cumulative Impacts

The approved KML proposals (KIOP, MS 805 and MIOP, MS 806) will result in permanent impacts to the Blue Hills LAU of 427 ha. The proposed KIOP MLE would add an additional permanent impact to the Blue Hills LAU of 2% (39 ha) (**Table 7.3**).

The total approved impact contributed by all SMC projects is approximately 70 ha; 32 ha being permanent and 38 ha classified as temporary. However, it is unclear in the literature whether this impact area is solely confined to Mungada Ridge (Appeals Convenor 2017).

All approved projects (KML and SMC) plus the proposed KIOP MLE would result in permanent impacts to the Blue Hills LAU of 498 ha. The total permanent disturbance to the Blue Hills LAU would increase from 24% to 25% by the addition of the KIOP MLE.

7.2.3 Mt Karara

The current approved permanent disturbance to Mt Karara landform is 357 ha (71% of the landform) from two KML projects (KIOP, MS 805 and MIOP, MS 806).

The proposed KIOP MLE would add an additional permanent impact to Mt Karara of 8% (39 ha) (**Table 7.4**). The increase in permanent disturbance of the Mt Karara landform is due to minor expansions of WRDs and the Karara pit abandonment bund. There would also be approximately 28 ha of temporary impacts to Mt Karara due to general infrastructure. The KIOP MLE proposed disturbance footprint only impacts the Mt Karara aspect of the Blue Hills LAU.

Table 7.2 Permanent and Temporary Impacts to Local Assessment Unit per KML Project

Proponent	Project	Total Area (ha)*	Activity/Use	Temporary Impact on LAU	Permanent Impact on LAU	LAU Impact Area by Activity (ha)	Temporary Impact Area on LAU (ha)	Permanent Impact Area on LAU (ha)	Total LAU Impact Area (ha)	Disturbance Outside of LAU (ha)
Karara Mining Limited (KML)	Karara Iron Ore Project, MS 805	3,029	Waste Dump and ROM		✓	42.3	4	350	354	2,675
			Bore	✓	0.3					
			'Minesite expansion'		✓	7.3				
			Roads	✓	3.6					
			Pit		✓	226.9				
			Abandonment bund area		✓	73.3				
	Mungada Iron Ore Project, MS 806	1,056	Abandonment bund		✓	4.6	16	77	93	963
			Access road	✓	2.1					
			Gravel pit		✓	2.5				
			Haul roads	✓	3.2					
			Pits		✓	69.9				
			Plant	✓	10.2					
			Power distribution	✓	0.4					
Topsoil			✓	0.1						
Proposed KIOP MLE	1,522	'Miscellaneous activities'	✓	27.8	28	39	67	1,455		
		WRD		✓					39.4	

*Total area of MS 805 and MS 806 may differ slightly from the approved disturbance area in each Ministerial Statement as this table represents the sum of the site layout, rather than the approved disturbance area.

Table 7.3 Increase in Standalone and Cumulative Impacts on Blue Hills LAU from KIOP MLE

Project/s	Impact on Blue Hills LAU (ha)			Impact on Blue Hills LAU (%)		
	Temporary	Permanent	Total	Temporary	Permanent	Total
Blue Hills LAU total landform			1,939			
KML Projects						
KIOP MLE	28	39	67	1.4%	2.0%	3.5%
Approved KML Projects (KIOP MS 805 and MIOP MS 806)	20	427	447	1.0%	22.0%	23.1%
Approved KML Projects + KIOP MLE	48	466	514	2.5%	24.1%	26.6%
KML and SMC Projects						
All approved projects in Blue Hills LAU (KIOP MS 805, MIOP MS 806, SMC MS 1071, DSO MS 811)	58	459	517	3.0%	23.7%	26.7%
All approved projects in Blue Hills LAU + KIOP MLE	86	498	584	4.4%	25.7%	30.2%

Table 7.4 Increase in Standalone and Cumulative Impacts on Mt Karara from KIOP MLE

Project/s	Impact on Mt Karara (ha)			Impact on Mt Karara (%)		
	Temporary	Permanent	Total	Temporary	Permanent	Total
Mt Karara total landform			506			
KIOP MLE	28	39	67	5.5%	7.7%	13.2%
Approved KML Projects (KIOP MS 805 and MIOP MS 806)	13	357	370	2.6%	70.6%	73.1%
Approved KML Projects + KIOP MLE	41	396	437	8.1%	78.3%	86.4%

7.2.4 Discussion of Impacts

Current approved KML projects will cause permanent impacts of up to 71% of the Mt Karara landform. Therefore, Mt Karara range is already substantially impacted by approved mining activities and cannot be preserved in its entirety.

The planned site layout for the KIOP MLE would add an additional 7% permanent impacts to Mt Karara (for a total impact of 78%) and an additional 2% permanent impacts to the Karara/Mungada/Blue Hills Range System (Blue Hills Range System).

The *Strategic Review of the Banded Iron Formations Ranges of the Midwest and Goldfields* state that a minimum of 60% of a significant landform must be preserved in its entirety, to ensure examples of the complete landform are protected and conserved. Moreover, this area should largely be continuous to provide connectivity for any endemic species confined to the BIF range/s. While a conservation area greater than 60% is ideal, the review acknowledges the fact that these areas often share an overlap with the occurrence of mineral resources (DEC 2007).

Only 29% of Mt Karara landform is outside currently approved mining impacts. As a result of long-term mineral extraction, Mt Karara may no longer have the representation needed to be conserved at a sufficiently large scale to be ecologically beneficial. Additional impacts from the KIOP MLE would result in a permanent impact of 396 ha (78% total) and a total disturbance of 437 ha (86%). Although Mt Karara is already considerably impacted by disturbance, it is recommended that the KIOP MLE layout aim to minimise permanent and temporary impacts to the range, which would contribute to the value of the greater LAU.

Within the Blue Hills Range System, there are better and more complete representations of BIF ranges than Mt Karara (such as Mungada). The KIOP MLE only disturbs Mt Karara, which as an individual landform, is already impacted beyond the terms of conservation detailed in the *Strategic Review of the Banded Iron Formations Ranges of the Midwest and Goldfields* (DEC 2007).

7.3 Indicators of Impact to Significant Ecological Values

The *Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields* [within the Yilgarn Craton] (DEC 2007) includes the following principles relating to protection of significant ecological values:

- No development activity should proceed if it would result in the increase of an IUCN Threat Category of any plant or animal taxon.
- No development activity should proceed if it would result in the increase of an IUCN Threat Category of any ecological community.
- Conservation reserves should include at least 60% of largely contiguous ecosystem/habitat for each of the key BIF species and communities restricted to the BIF ranges.

The following significant ecological values are known to occur on Mt Karara:

- Blue Hills PEC (WA P1)
- *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (WA P1)
- Long-tailed Dunnart (*Antechinomys (Sminthopsis) longicaudata*) (WA P4)
- Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*) (WA Vulnerable).

The following sections evaluate alignment with the above principles.

7.3.1 Assessment of Changes to IUCN Category

This section presents the evaluation of potential changes to IUCN category for conservation significant ecological communities, flora and terrestrial fauna that may be affected by the proposed increase to disturbance of Mt Karara as a result of the KIOP MLE. The assessment results are presented in **Appendix A**.

The IUCN criteria assessment indicated that the KIOP MLE is unlikely to result in a change in IUCN category for the Blue Hills PEC and conservation significant species and that are associated with the BIF landform.

7.3.1.1 Blue Hills PEC

The assessment for the Blue Hills PEC utilised data from the below sources:

- Pre-European extent of PEC and existing scale of impacts: Maia Environmental Consultancy (Maia 2017) flora, vegetation and fauna impact assessment for the Mungada East Expansion Project.
- Extent of occurrence (EOO), area of occupancy (AOO) and median patch size: interrogation results from DBCA's Threatened and Priority Ecological Communities Database (DBCA 2023a). Note that the boundaries of the PEC from this dataset include a 500 m buffer applied by DBCA, and therefore these values may be overestimated. The EOO and AOO was calculated as described below:

- EOO: ‘convex hull’ minimum bounding geometry function in QGIS using the PEC extent from DBCA
- AOO: the sum area of 10 km x 10 km grid squares that overlap the mapped PEC extent.

The assessment against the IUCN criteria indicated that the Blue Hills PEC would likely already qualify for the Endangered IUCN category, due to meeting thresholds for Endangered under criterion 2 and Vulnerable under criterion 5 (**Appendix A**).

The Blue Hills PEC has a ‘Restricted’ EOO of ~43,750 ha, a ‘Limited’ AOO of ~90,000 ha and a ‘Very Restricted’ patch size. Coupled with demonstrable threats that may cause loss of the community in the next 20 years, the Blue Hills PEC is aligned with the Endangered category under criterion 2 for limited geographic distribution.

For criterion 5 (rate of continuing detrimental change), the assessment found that the Blue Hills PEC is potentially Vulnerable due to its restricted EOO and AOO, and is under threat by ongoing mining and associated impacts like edge effects. The current rate of detrimental change is considered ‘Substantial’ and meets the threshold for Vulnerable (**Appendix A**).

The Blue Hills PEC is not eligible for assessment under the remaining three criteria as it has not experienced significant decline in geographic distribution (criterion 1) or a reduction in community integrity (criterion 4) and is not defined by functionally important species (criterion 3).

The inclusion of the predicted impact of the KIOP MLE on the Blue Hills PEC (98 ha) does not increase the threshold category for any of the IUCN criteria. The IUCN category assessment indicates that the KIOP MLE is unlikely to result in a change in IUCN category for the Blue Hills PEC (**Appendix A**).

7.3.1.2 *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468)

The assessment for the flora taxon *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (P1) utilised data from the below sources:

- DBCA’s WA Herbarium Specimen and Threatened and Priority Flora Databases (DBCA 2023b).
- Umwelt’s database including data collected for KML by Umwelt (2021, 2025a) and Woodman Environmental (2009, 2011, 2012), and for other projects within the region (Woodman Environmental 2008, 2017).

The data sources above were consolidated into a single dataset for the assessment. The EOO and AOO were calculated as was done for the Blue Hills PEC, but using a 2 km x 2 km grid for AOO instead of 10 km x 10 km.

The assessment against the IUCN criteria indicates that, according to the data used, the taxon would likely already qualify as Vulnerable under criterion A due to ‘Substantial’ (45.5%) population size reduction, with ongoing threat of continuing decline (**Appendix A**).

Under criterion B, the restricted EOO and AOO of *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) meets the Endangered threat category (**Appendix A**). However, the taxon is not eligible for assessment under criterion B as it does not meet other specified conditions (DCCEEW 2024a). *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) is not eligible for assessment under any other criteria as it does not meet the thresholds of a very small or restricted population (DCCEEW 2024a).

Reassessment of *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) with predicted impacts from KIOP MLE reduces the taxon's population size by 2,914 individuals, resulting in a cumulative population decline of 48.9% (**Appendix A**). This remains within the 'Substantial' threshold indicative of Vulnerable status, although is approaching the 50% decline threshold that indicates an Endangered status.

It is worthy of note that the dataset used for this IUCN assessment is unlikely to represent a comprehensive dataset for the taxon across its entire range. Substantial survey effort has been undertaken for KML within impact areas that correspond to the taxon's preferred habitat, and therefore the high impact to this taxon (both current and proposed) may be a consequence of data deficiency for other habitat outside these impact areas. Therefore, it is likely that the population decline calculated in **Appendix A** is a conservative estimate, and that individuals are present in areas that have not been subject to extensive survey effort.

The IUCN Category assessment indicates that KIOP MLE is unlikely to result in a change in IUCN category for *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) from its current indicative Vulnerable status.

7.3.1.3 Terrestrial Fauna

Criterion A (population size reduction) of the IUCN category assessments for the Long-tailed Dunnart (P4) and Gilled Slender Blue-tongue (VU) could not be undertaken due to insufficient data. While point data for these species was available from Atlas of Living Australia (ALA 2025) and DBCA's Threatened and Priority Fauna Database (DBCA 2024), data from the former was sparse, and data from the latter was available from only a 40 km buffer of the KIOP MLE development envelope. However, it was considered unlikely that other species would trigger this criterion.

The EOO for each species was estimated for criterion B using point data from ALA (2025) and DBCA (2024) datasets, and comparison with published geographic extents of each species from IUCN (2025) and Menkhorst & Knight (2021). The method utilised was the same as for the Blue Hills PEC, with the EOO clipped to the WA coastline where the minimum convex hull extended into the Indian Ocean. While insufficient data was available to calculate AOO for these two species, it was deemed that neither species would be likely to meet the thresholds for AOO given their large EOOs ($\geq 60,000$ km²) (**Appendix A**).

While limited data was available, both Long-tailed Dunnart and Gilled Slender Blue-tongue were determined to be ineligible for assessment under any of the other IUCN criteria. Neither species met the thresholds (or were deemed likely to meet the thresholds) for limited geographic range, small population size and decline, or very small / restricted population thresholds (**Appendix A**). Therefore, neither taxon is likely to qualify as Vulnerable, Endangered, or Critically Endangered under IUCN criteria.

The Long-tailed Dunnart and Gilled Slender Blue-tongue both prefer rocky habitats and are not restricted to the LAU, as demonstrated by their large EOOs (~1.1M km² for the Long-tailed Dunnart and ~60,000 km² for the Gilled Slender Blue-tongue). For these taxa to qualify under the Vulnerable IUCN category, the EOO decline needs to have been at least 30% to date, or needs to increase to up to a 30% decline with inclusion of the predicted KIOP MLE impacts. Data deficiencies restrict the ability to accurately estimate the habitat decline for these species, however they are unlikely to be to the extents required to meet these thresholds given the large EOOs.

The Gilled Slender Blue-tongue was most recently assessed for The IUCN Red List of Threatened Species in 2017 and satisfied the requirements for ‘Near Threatened’ under criteria B1ab(iii) due to the population being severely fragmented and experiencing continuing decline in area, extent and /or quality of habitat (Cowan et al. 2018). However, the species ultimately did not qualify for listing under the IUCN threat categories as it did not meet the required thresholds under criterion B, nor any other criteria.

7.3.1.4 Conclusions

The IUCN category assessment for significant flora, terrestrial fauna, and ecological communities associated with the Mt Karara landform indicated that the proposed increase in disturbance as a result of the KIOP MLE is unlikely to result in a change to existing indicative IUCN threat categories. While the Blue Hills PEC and *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (P1) currently appear to meet criteria for Endangered and Vulnerable status respectively, the predicted impacts of the KIOP MLE do not elevate their threat levels. The assessed terrestrial fauna species do not meet thresholds for listing under IUCN criteria, and the predicted impacts of the KIOP MLE do not alter this outcome.

The KIOP MLE therefore aligns with the principles of the *Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields* (DEC 2007) relating to change in IUCN category of flora, fauna and ecological communities.

7.3.2 Significant Ecological Values in Conservation Reserves

The *Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields* (DEC 2007) includes a principle that conservation reserves should include at least 60% of largely contiguous ecosystem/habitat for each of the key BIF species and communities restricted to the BIF ranges. This was assessed for the Blue Hills PEC, *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (P1), Long-tailed Dunnart and Gilled Slender Blue-tongue.

According to DBCA’s Threatened and Priority Ecological Communities Database (DBCA 2023a), approximately 8,078 ha of the total 19,382 ha of Blue Hills PEC polygons (noting the polygons include a 500 m buffer applied by DBCA) occurs within DBCA conservation tenure (Karara Conservation Park and Mungada Ridge National Park) (DBCA 2025). While both extents are expected to be less once the 500 m DBCA-applied buffers are removed, this dataset is considered adequate to estimate the proportion of the PEC that is potentially protected in conservation reserves. Therefore, it is estimated that approximately 42% of the PEC is present in conservation reserves. It is considered that the area mapped as the PEC by DBCA represents the entire extent of the community and that there is no habitat outside this area. Consequently, the 60% principle of the *Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields* (DEC 2007) is not met.

According to the available location data for *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (P1) (as per **Section 7.3.1.2**), the taxon has been recorded within 21 DPIRD (2022) soil landscape systems as listed below:

- Bandy system
- Campsite system
- Challenge system
- Euchre system
- Gabanintha system

- Graves system
- Joseph system
- Kalli system
- Koolanooka system
- Moriarty system
- Nerramyne system
- Norie system
- Olympic system
- Pindar A system
- Singleton system
- Tallering system
- Tealtoo system
- Tindalarra system
- Waguin system
- Yalluwin system
- Yowie system.

Within the bound of the EOO of *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468), 80,762 ha of the total 254,339 ha (32%) of these 21 soil landscape systems occur within DBCA conservation reserves (Karara Conservation Park, Mungada Ridge National Park and Thundelarra Conservation Park) (DBCA 2025). Consequently, the 60% principle of contiguous habitat being within conservation reserves is not met.

Contiguous habitat for the Gilled Slender Blue-tongue and Long-tailed Dunnart is difficult to define given the very large EOOs of both species and sparse publicly available occurrence data. Furthermore, the point data obtained from ALA (2025) is generalised by ALA to obscure the actual geographical location of the records, limiting the ability to undertake spatial interrogations against other datasets. It was estimated that there is approximately 11,159 km² of conservation reserve² within the EOO of Gilled Slender Blue-tongue (19%), and 305,276 km² within the EOO of Long-tailed Dunnart (28%). However, these values are for each species' entire EOO and does not discriminate the areas within the EOOs that may actually provide habitat for the species. It is not known how much these proportions would change and whether they would meet the 60% threshold when limiting the extents to only those areas that provide contiguous habitat for each species.

The KIOP MLE will not remove any vegetation within protected areas, and will therefore not reduce the proportion of conservation reserve extent of the Blue Hills PEC, *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468), Gilled Slender Blue-tongue or Long-tailed Dunnart.

² Conservation reserves defined as areas contained within DBCA's Legislated Lands and Waters dataset (DBCA, 2025), and the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Collaborative Australian Protected Areas Database (DCCEEW, 2025).

8.0 Evaluation of Rehabilitation and Offsets

This section provides an evaluation of KML’s rehabilitation completed to date and implementation of previously proposed offsets. The section is not specific to the Blue Hills LAU but it is discussed where relevant.

8.1 Rehabilitation Evaluation

8.1.1 Rehabilitation Criteria

Ministerial Statements 805 and 806 include the following conditions for progressive rehabilitation:

“Re-establishment of vegetation in the rehabilitation area to be comparable with that of the pre-mining vegetation such that the following criteria are met within five years following the cessation of productive mining:

- a. Flora and vegetation are re-established with not less than 70 percent species composition³ (not including weed species); and*
- b. Weed coverage consistent with recorded baseline levels or 10 percent, whichever is less.”*

KML utilises an experienced botanist to undertake rehabilitation monitoring annually.

8.1.2 Rehabilitated Areas

Revision six of KML’s Rehabilitation Schedule (the Schedule) documents restoration efforts from 2011 to early 2023. The Schedule records rehabilitation across MS 805, MS 806, MS 968 and ‘other’, which includes several areas where NVCPs have been applied (**Table 8.1**).

Rehabilitation is monitored via quadrats that encompass a total area of 400 m². The majority of rehabilitation quadrats have an assigned control quadrat in undisturbed vegetation with comparable slope, aspect, soil type, resource regulation and vegetation community to the rehabilitation site. Rehabilitation and control quadrats are listed in **Table 8.2** and these are shown in **Figure 8.1** along with boundaries of rehabilitation areas.

³ In KML’s annual compliance assessment reports to Department of Water and Environmental Regulation (DWER), KML defines species composition as the diversity of the rehabilitated quadrat relative to the corresponding control quadrat.

Table 8.1 Rehabilitation Areas

Activity	Approval Ref.	Rehabilitation to Date (ha)
KIOP		122.9
WRDs	MS 805	7.7
Tailings impoundments	MS 805	5.1
Pits	MS 805	-
Infrastructure (roads, aerodrome, village, plant site, pipelines, laydown, ROM)	MS 805	110.1
MIOP		188.6
Blue Hills North WRDs	MS 806	30.0
Terapod WRDs	MS 806	31.6
Blue Hills North pit	MS 806	18.3
Terapod pit	MS 806	43.0
Infrastructure (ROM, roads, turkeys nests, laydowns, powerlines)	MS 806	65.7
HIOP		133.8
WRDs	MS 968	48.3
Pit	MS 968	33.1
Infrastructure (ROM, roads, turkeys nests, laydowns)	MS 968	52.4
Other		209.3
Rail		
All rail under native vegetation clearing permits	NCVP 3518/3	97.2
	NVCP 3603/2	87.1
Powerline		
Disturbed area at powerlines EE, ET & TK	NVCP 3961/4	6.8
Minesite infrastructure		
Process plant and rail loop	NVCP 3399/2	9.4
Water pipeline		
Disturbed area at pipeline	NVCP 3867/1	8.8
Telecommunication tower		
Disturbed area at pipeline	NVCP 9366/1	0
GRAND TOTAL		654.6

Table 8.2 Rehabilitation and Control Quadrats

Quadrat Name	Quadrat Type	Rehabilitation Year	On BIF Landform?
KIOP (MS 805)			
BPFive01	Rehabilitation	13/03/2012	
BPFive01C	Control (BPFive01)	NA	
Karara North	Control (KARWD)	NA	✓
KARWD01	Rehabilitation	1/08/2013	
KARWD02	Rehabilitation	25/08/2015	
Pipeline01	Rehabilitation	31/11/2011	
Pipeline01C	Control (Pipeline01)	31/11/2011	
Pipeline02	Rehabilitation	31/11/2011	
Pipeline02C	Control (Pipeline02)	NA	

Quadrat Name	Quadrat Type	Rehabilitation Year	On BIF Landform?
Pipeline03	Rehabilitation	31/11/2011	
Pipeline03C	Control (Pipeline03)	NA	
Pipeline04	Rehabilitation	31/11/2011	
Pipeline04C	Control (Pipeline04)	NA	
Pipeline05	Rehabilitation	31/11/2011	
Pipeline05C	Control (Pipeline05)	NA	
Power01	Rehabilitation	31/06/2012	
Power01C	Control (Power01)	NA	
Power02	Rehabilitation	31/06/2012	
Power02C	Control (Power02)	NA	
Power03	Rehabilitation	31/06/2012	
Power03C	Control (Power03)	NA	
Rail01	Rehabilitation	31/03/2012	
Rail01C	Control (Rail01)	NA	
Rail02	Rehabilitation	31/03/2012	
Rail02C	Control (Rail02)	NA	
Rail03	Rehabilitation	31/03/2012	
Rail03C	Control (Rail03)	NA	
Rail04	Rehabilitation	31/03/2012	
Rail04C	Control (Rail04)	NA	
TSF01	Rehabilitation	1/08/2013	
TSF02	Rehabilitation	1/08/2013	
MIOP (MS 806)			
BHNWD01	Rehabilitation	1/11/2012	✓
BHNWD01C	Control (BHNWD)	NA	✓
BHNWD03	Rehabilitation	1/07/2014	
BHNWD04	Rehabilitation	1/07/2014	
BHNWD05	Rehabilitation	1/07/2014	✓
Spyder West	Control (TPD)	NA	✓
TPD01	Rehabilitation	1/07/2014	✓
TPD02	Rehabilitation	1/07/2014	✓
TPD03	Rehabilitation	1/07/2014	
TPD04	Rehabilitation	1/07/2014	
TPD05	Rehabilitation	1/07/2014	
TPD06	Rehabilitation	1/07/2014	✓
TPD07	Rehabilitation	1/07/2014	✓
TPD08	Rehabilitation	1/07/2014	✓
TPD09	Rehabilitation	1/07/2014	✓
HIOP (MS 968)			
HIN04C	Control (HINWRD)	NA	
HINWRD01	Rehabilitation	31/12/2015	✓
HINWRD02	Rehabilitation	28/10/2015	✓
HINWRD03	Rehabilitation	14/11/2015	
HINWRD04	Rehabilitation	28/10/2015	✓

Quadrat Name	Quadrat Type	Rehabilitation Year	On BIF Landform?
HINWRD05	Rehabilitation	4/12/2015	✓
HINWRD06	Rehabilitation	6/12/2015	✓
Other sites			
Windaning	Control	NA	✓

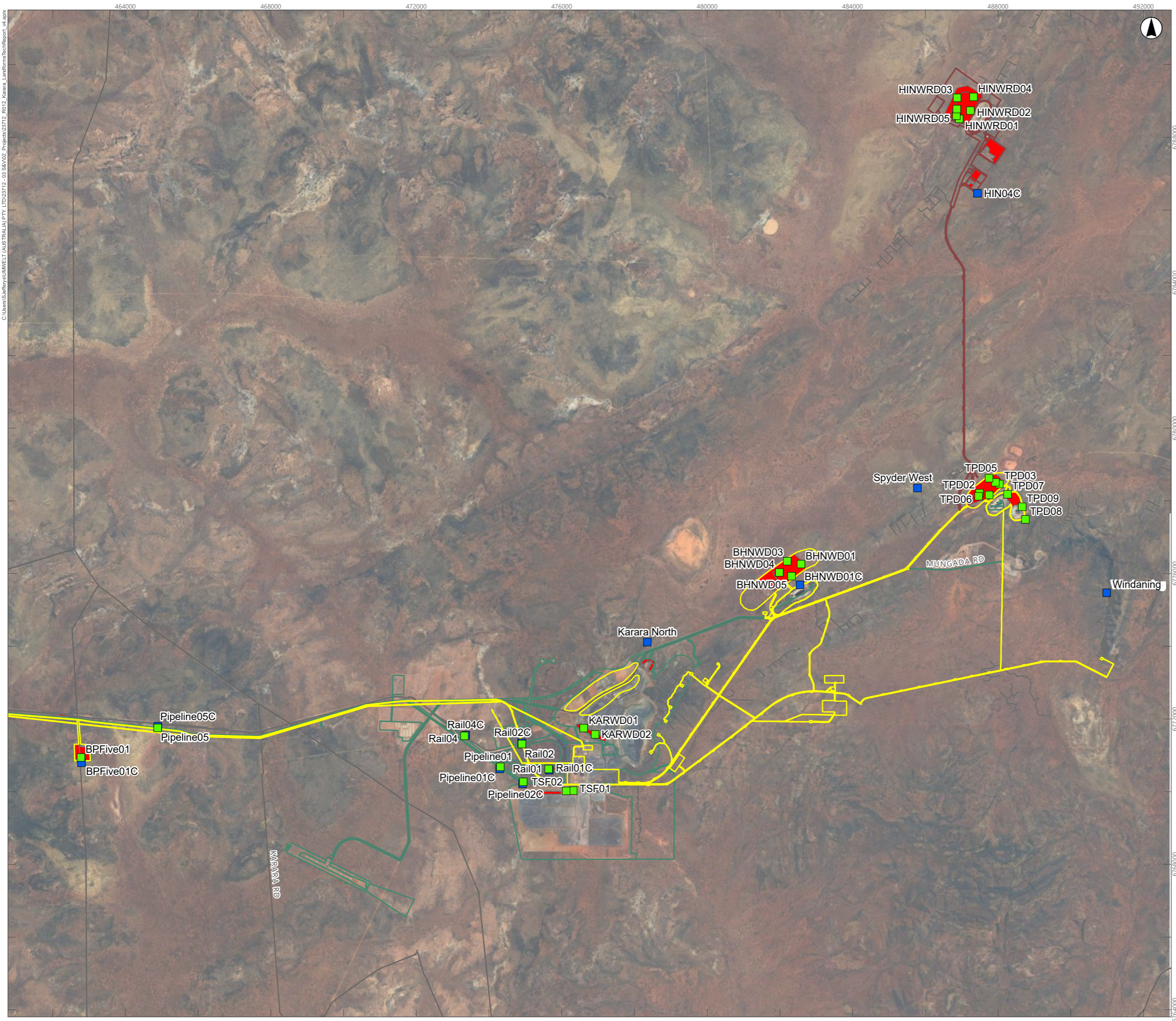
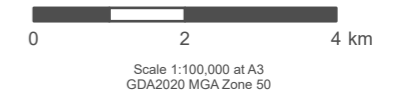


FIGURE 8.1
Rehabilitation

- Legend**
- MIOP MS 806 Disturbance Footprint
 - KIOP MS 805 Disturbance Footprint
 - HIOP MS 968 Disturbance Footprint
 - Rehabilitation Area
 - Road
 - Control Quadrat
 - Rehabilitation Quadrat



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8.1.3 Evaluation of Rehabilitation

8.1.3.1 Review of Rehabilitation Criteria in Ministerial Statements 805 and 806

Flora Species Composition (Taxon Richness)

A comparison of the taxon richness of rehabilitation and control quadrats was undertaken to assess for compliance against the species composition criteria in MS 805 and MS 806. The taxon richness of rehabilitation quadrats was compared to control quadrats four different ways as below:

1. All rehabilitation quadrats compared to all control quadrats.
2. Rehabilitation quadrats from each project (MS 805, 806 and 968) compared to control quadrats from that project.
3. Rehabilitation quadrat(s) compared to their designated control quadrat.
4. Rehabilitation quadrats that are targeting re-establishment of the Blue Hills PEC compared to control quadrats in the PEC.

The results are presented in **Table 8.3**. When all quadrat data was pooled, rehabilitation quadrats had 150.6% the taxon richness of control quadrats. However, the assessment of a group of rehabilitation quadrats for the same rehabilitated infrastructure/landform against their designated control quadrats is considered the most appropriate comparison (data from rehabilitation quadrats pooled where multiple quadrats for the same rehabilitated infrastructure/landform were assigned to one control quadrat). This analysis found that the taxon richness of rehabilitation quadrats compared to control quadrats ranged from 26.9% (Power03) to 789% (HINWRD), with an average of 165.1%.

Rehabilitation quadrats Power03 (26.9%) and Rail01 (58.8%) were the only two quadrats to not meet the 70% target. However, all power line monitoring quadrats (Power01-03) and their associated control quadrats (Power01C-03C) were removed in 2016, and the four rail rehabilitation quadrats (Rail01-04) and associated control quadrats (Rail01C-04C) in the vicinity of the rail loop were removed in 2019 following approval of KML's Environmental Management Plan by DWER.

According to the analyses done by KML for their 2025 annual compliance assessment report to DWER, rehabilitation quadrats BHNWRD04 and Pipeline03 did not meet the 70% taxon richness target (KML, 2025). The analysis undertaken here found that with all BHNWRD rehabilitation data pooled, the taxon richness of rehabilitation quadrats exceeded that of the control quadrat with 243.5% the taxon richness of BHNWD01C. When looking solely at rehabilitation quadrat BHNWRD04, which had a taxon richness of 25, this equates to 108.7% the taxon richness of control quadrat BHNWD01C (taxon richness of 23). This result contradicts KML's result. Similarly, KML's result for Pipeline03 was not replicated here, with the rehabilitation quadrat found to have 77.3% the taxon richness of control quadrat Pipeline03C. It is not clear why this analysis produced a dissimilar result to KML's given the same dataset was used, but perhaps the prior review of the dataset for nomenclatural and taxonomic currency, and removal of indeterminate records, played a role (list of taxa retained and removed presented at the end of **Appendix B**).

Table 8.3 Comparison of Taxon Richness of Rehabilitation and Control Quadrats

Comparison		Taxon Richness in Control Quadrat(s)	Taxon Richness in Rehab Quadrat(s)	Taxon Richness of Rehab cf. Control (%)	
1: All quadrats		156	235	150.6	
2: Projects	MS 805 (KIOP)	173	154	89.0	
	MS 806 (MIOP)	39	104	266.7	
	MS 968 (HIOP)	9	71	788.9	
3: Assessment against designated control quadrat(s)	MS 805 (KIOP)			Ave. 98.8	
	BPFive	40	33	82.5	
	KARWD	23	45	195.7	
	Pipeline01	39	37	94.9	
	Pipeline02	43	33	76.7	
	Pipeline03	22	17	77.3	
	Pipeline04	44	37	84.1	
	Pipeline05	34	26	76.5	
	Power01	11	12	109.1	
	Power02	8	7	87.5	
	Power03	26	7	26.9	
	Rail01	34	20	58.8	
	Rail02	16	31	193.8	
	Rail03	26	24	92.3	
	Rail04	26	33	126.9	
		MS 806 (MIOP)			Ave. 317.6
		BHNWD	23	56	243.5
		TPD	24	94	391.7
		MS 968 (HIOP)			-
		HINWRD	9	71	788.9
	Overall Average			165.1	
4: Blue Hills PEC		53	105	198.1	

Weed Cover

The weed cover of rehabilitation and control quadrats are assigned to one of the following categories during quadrat monitoring:

1. Nil: <1%
2. Low: 2-15%
3. Moderate: 15-30%
4. High: 30-60%
5. Extremely High: 60-90%.

Umwelt has reviewed KML’s rehabilitation monitoring data, and weed cover does not appear to be recorded as a specific percentage value in addition to a category rank. Consequently, if a quadrat was assigned to category 2, it cannot be determined whether the weed cover in that quadrat was more or less than 10% and therefore whether it met the weed cover criterion of MS 805 and 806. However, for

the purpose of this assessment, a rehabilitation quadrat was deemed to meet the criterion if the quadrat was assigned to weed cover categories 1 or 2.

The weed cover category ranks of each quadrat's most recent monitoring event are presented in **Table 8.4** and summarised in **Table 8.5**. All control quadrats were assigned to category 1 with the exception of Spyder West which was assigned to category 2. Weed cover category rankings of rehabilitation quadrats ranged from 1 (18 quadrats) to 5 (1 quadrat). Rehabilitation quadrats at HIOP had the highest weed covers. A total of 28 rehabilitation quadrats (78%) were assigned to categories 1 or 2 and therefore met the MS weed cover criterion. Eight rehabilitation quadrats were assigned to weed cover categories 3 to 5 and therefore did not meet the criterion.

Table 8.4 Weed Cover Categories of Rehabilitation and Control Quadrats

Quadrat Name	Quadrat Type	Weed Cover Category
KIOP (MS 805)		
BPFive01	Rehabilitation	3
BPFive01C	Control (BPFive01)	1
Karara North	Control (KARWD)	1
KARWD01	Rehabilitation	3
KARWD02	Rehabilitation	2
Pipeline01	Rehabilitation	1
Pipeline01C	Control (Pipeline01)	1
Pipeline02	Rehabilitation	1
Pipeline02C	Control (Pipeline02)	1
Pipeline03	Rehabilitation	1
Pipeline03C	Control (Pipeline03)	1
Pipeline04	Rehabilitation	1
Pipeline04C	Control (Pipeline04)	1
Pipeline05	Rehabilitation	1
Pipeline05C	Control (Pipeline05)	1
Power01	Rehabilitation	1
Power01C	Control (Power01)	1
Power02	Rehabilitation	1
Power02C	Control (Power02)	1
Power03	Rehabilitation	1
Power03C	Control (Power03)	1
Rail01	Rehabilitation	1
Rail01C	Control (Rail01)	1
Rail02	Rehabilitation	2
Rail02C	Control (Rail02)	1
Rail03	Rehabilitation	2
Rail03C	Control (Rail03)	1
Rail04	Rehabilitation	2
Rail04C	Control (Rail04)	1
TSF01	Rehabilitation	1
TSF02	Rehabilitation	1
MIOP (MS 806)		
BHNWD01	Rehabilitation	5

Quadrat Name	Quadrat Type	Weed Cover Category
BHNWD01C	Control (BHNWD)	1
BHNWD03	Rehabilitation	2
BHNWD04	Rehabilitation	3
BHNWD05	Rehabilitation	1
Spyder West	Control (TPD)	2
TPD01	Rehabilitation	1
TPD02	Rehabilitation	2
TPD03	Rehabilitation	1
TPD04	Rehabilitation	1
TPD05	Rehabilitation	2
TPD06	Rehabilitation	1
TPD07	Rehabilitation	1
TPD08	Rehabilitation	2
TPD09	Rehabilitation	1
HIOP (MS 968)		
HIN04C	Control (HINWRD)	1
HINWRD01	Rehabilitation	4
HINWRD02	Rehabilitation	3
HINWRD03	Rehabilitation	4
HINWRD04	Rehabilitation	2
HINWRD05	Rehabilitation	4
HINWRD06	Rehabilitation	2
Other sites		
Windaning	Control	1

Table 8.5 Summary of Weed Cover Categories of Rehabilitation and Control Quadrats

Quadrat Type	Number of Quadrats Assigned to Weed Cover Category				
	1	2	3	4	5
Control	17	1	-	-	-
Rehabilitation	18	10	4	3	1
Total	35	11	4	3	1

8.1.3.2 Floristic Composition Comparison

In addition to comparison of taxon richness of rehabilitation and control quadrats (**Section 8.1.3.1**), a further comparison was made to determine the number of flora taxa in control quadrats that have been returned in rehabilitation quadrats, and thus the compositional similarity. The same four comparisons were made as for taxon richness.

The results are presented quantitatively in **Table 8.6**, and graphically in **Appendix B** (excluding comparison 1). When all quadrat data was pooled, 85.3% of native taxa present in control quadrats were recorded in rehabilitation quadrats. The assessment of rehabilitation quadrats against their designated control quadrats found that the number of native taxa present in control quadrats that were recorded in rehabilitation quadrats ranged from 15.4% (Power03) to 62.5% (Power02), with an average of 40.5%.

For rehabilitation quadrats targeting the return of the Blue Hills PEC, the comparison of the pooled rehabilitation quadrat data against all Blue Hills PEC control quadrats found that 58.5% of native taxa present in control quadrats were recorded in rehabilitation quadrats. The results of further statistical compositional analysis of Blue Hills PEC rehabilitation and control quadrats is presented in

Section 8.1.3.3.

Table 8.6 Comparison of Native Flora Taxa Recorded in Rehabilitation and Control Quadrats

Comparison		Taxon Richness in Control Quadrat(s)	Taxon Richness in Rehab Quadrat(s)	Total Taxa Shared	Shared Taxa as Proportion of Total Taxa in Control(s) (%)	
1: All quadrats		156	235	133	85.3	
2: Projects	MS 805 (KIOP)	173	154	102	59.0	
	MS 806 (MIOP)	39	104	24	61.5	
	MS 968 (HIOP)	9	71	5	55.6	
3: Assessment against designated control quadrat(s)	MS 805 (KIOP)				Ave. 40.5	
	BPFive	40	33	7	17.5	
	KARWD	23	45	6	26.1	
	Pipeline01	39	37	21	53.8	
	Pipeline02	43	33	18	41.9	
	Pipeline03	22	17	10	45.5	
	Pipeline04	44	37	21	47.7	
	Pipeline05	34	26	14	41.2	
	Power01	11	12	4	36.4	
	Power02	8	7	5	62.5	
	Power03	26	7	4	15.4	
	Rail01	34	20	9	26.5	
	Rail02	16	31	9	56.2	
	Rail03	26	24	10	38.5	
	Rail04	26	33	15	57.7	
		MS 806 (MIOP)				Ave. 53.2
		BHNWD	23	56	12	52.2
		TPD	24	94	13	54.2
		MS 968 (HIOP)				-
		HINWRD	9	71	5	55.6
		Overall Average				Ave. 42.9
	4: Blue Hills PEC		53	105	31	58.5

8.1.3.3 Blue Hills PEC Floristic Composition Analysis

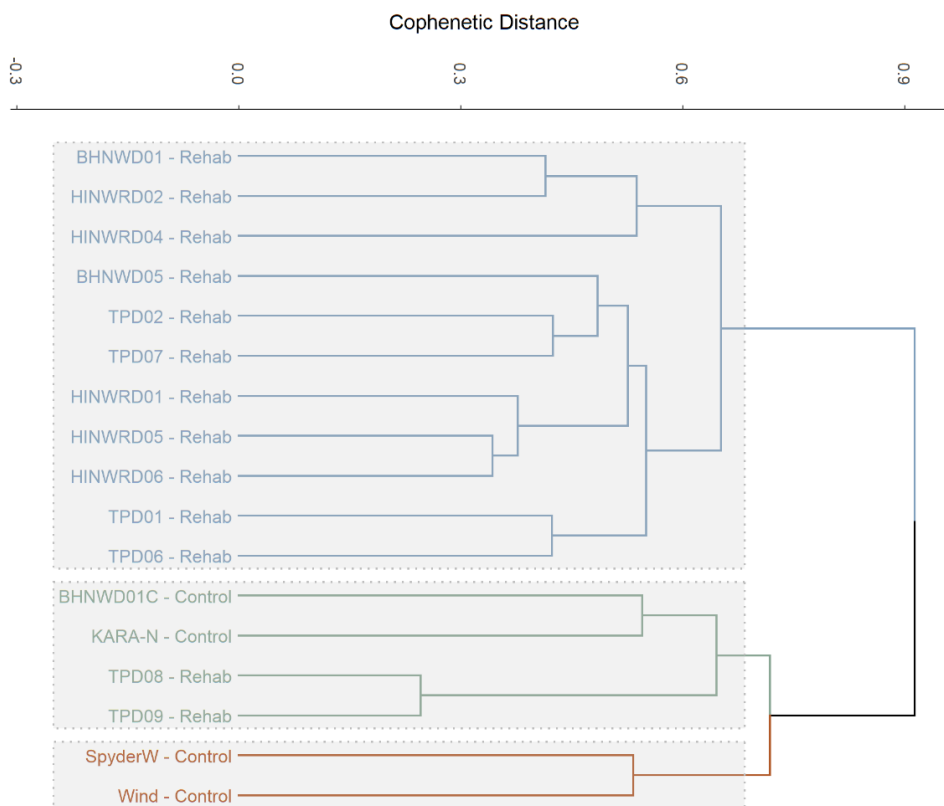
An agglomerative hierarchical clustering dendrogram and 2D cluster plot were prepared to visualise the floristic relationship between control and rehabilitation quadrats of the Blue Hills PEC. The purpose of the analyses was to assess the floristic similarity of control and rehabilitation quadrats, and thus to determine whether the rehabilitation is re-establishing compositionally similar vegetation. In a dendrogram, the joining of branches at a lower height (cophenetic distance) signifies greater similarity. In a 2D cluster plot, quadrats that are plotted closer together are more similar. Therefore, the placement of quadrats in the two analysis outputs can be used to indicate whether rehabilitation quadrats are compositionally similar to control quadrats.

PCA of the floristic quadrat dataset determined that three clusters may be appropriate to capture the majority of the variation in the dataset. Therefore, the dendrogram (**Graph 8.1**) and 2D cluster plot (**Graph 8.2**) were produced with quadrats grouped into three clusters. Each cluster contains quadrats that are most compositionally similar to each other.

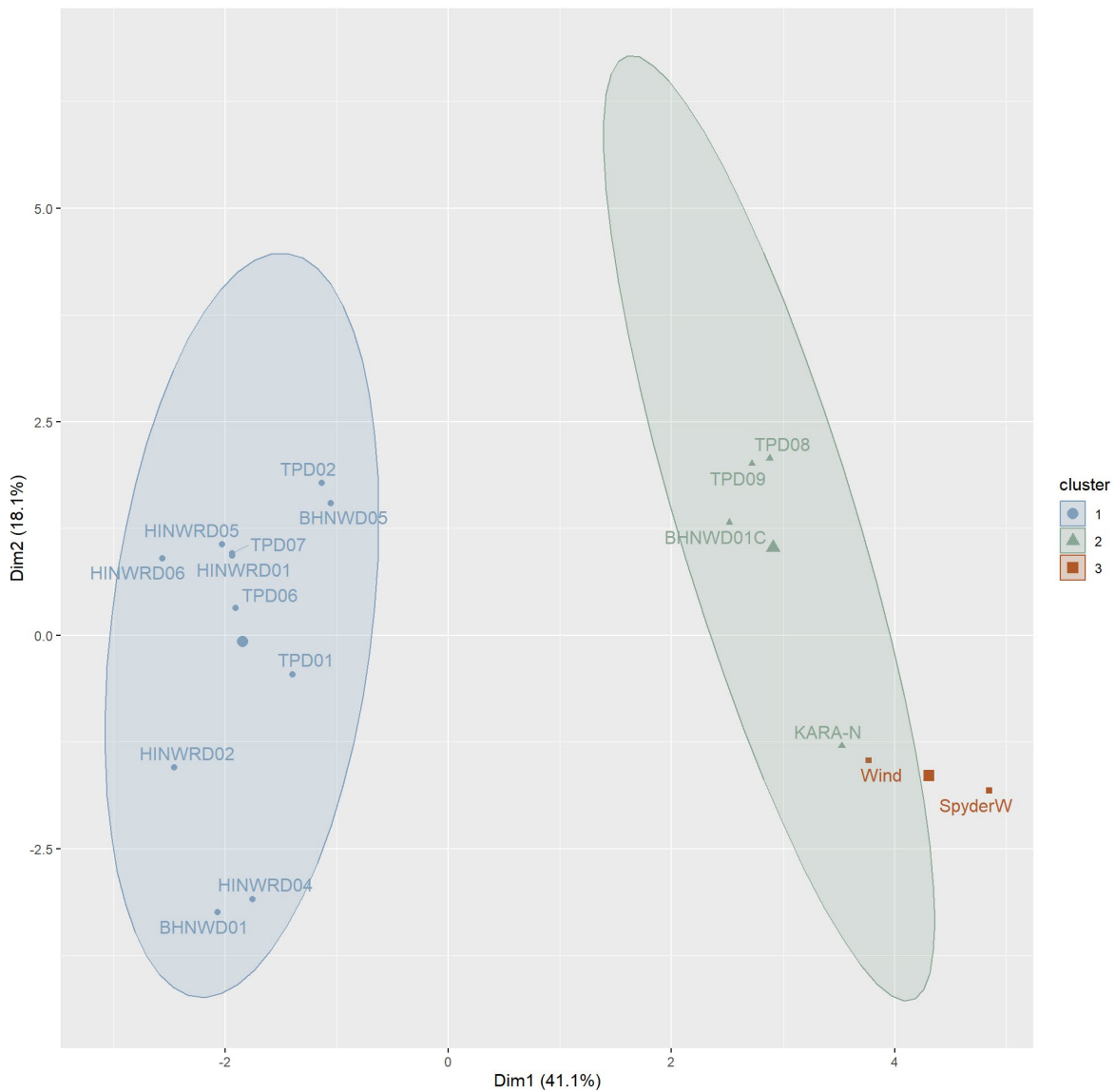
The three clusters in the dendrogram (**Graph 8.1**) were arranged into two supergroups: the first supergroup contained cluster 1 (comprising 11 rehabilitation quadrats) and the second supergroup contained cluster 2 (comprising two rehabilitation and two control quadrats) and cluster 3 (comprising two control quadrats). The supergroups are represented in the 2D cluster plot (**Graph 8.2**) by clusters 2 and 3 being plotted in close proximity in the two dimensional space.

Rehabilitation quadrats TPD08 and TPD09 grouped together in cluster 2 with control quadrats BHNWD01C and Karara North (“KARA-N”), indicating that they share a high number of species in common (as well as having similar patterns of species absence). The 2D cluster plot suggests that these two rehabilitation quadrats have greatest similarity to control quadrat BHNWD01C. The grouping of the remaining rehabilitation quadrats in cluster 1 of the dendrogram and 2D cluster plot indicates that their floristic compositions are more similar to those of other rehabilitation quadrats in cluster 1 than to control quadrats in clusters 2 or 3. The grouping of the control quadrats Spyder West (SpyderW) and Windaning (“Wind”) in their own cluster in the dendrogram and in the corner of the 2D cluster plot (distanced from all rehabilitation quadrats) suggests that these quadrats are not particularly similar to any rehabilitation quadrat.

In summary, the results of the analyses suggest that rehabilitation quadrats TPD08 and TPD09 have compositional similarity to Blue Hills PEC control quadrats BHNWD01C and Karara North, while all other rehabilitation quadrats are less similar to control quadrats.



Graph 8.1 Agglomerative Hierarchical Clustering Dendrogram of Blue Hills PEC Rehabilitation and Control Sites



Graph 8.2 2D Cluster Plot of Blue Hills PEC Rehabilitation and Control Sites

8.1.3.4 Return of Significant Flora Taxa

A total of 41 significant flora taxa have been recorded within the KIOP MLE development envelope (Umwelt 2025a). Of these, 18 have records within MS 805 and MS 806 and have either been already removed or are within areas that are approved to be cleared (Umwelt 2025b).

Seven significant flora taxa have been recorded in rehabilitation at KIOP and MIOP, as listed in **Table 8.7**. Six of the seven taxa (all but *Grevillea globosa* (P3)) have preferred habitat that includes the landforms of the LAU (Umwelt 2025a).

Table 8.7 Significant Flora Taxa Recorded in Rehabilitation at KIOP and MIOP

Taxon	Status (WA)	Status (EPBC)	Total Individuals (#)	Year Recorded	Rehabilitation Site(s)
<i>Acacia karinae</i>	P3	-	1	2024	KARWD01
			1	2024	TPD03
			1	2024	TPD04
			Total: 3		
<i>Acacia woodmaniorum</i>	EN	EN	1	2017	TSF01
<i>Drummondita fulva</i>	P3	-	8	2024	TPD08
			2	2024	TPD09
			Total: 10		
<i>Grevillea globosa</i>	P3	-	2	2013, 2014	TSF02
<i>Micromyrtus acuta</i>	P3	-	1	2024	TPD09
<i>Micromyrtus trudgenii</i>	P3	-	3	2015	TSF08
<i>Rhodanthe collina</i>	P3	-	1	2024	BHNWD05
			28	2024	TPD08
			1	2024	TPD09
			Total: 30		

In addition to the record of *Acacia woodmaniorum* at TSF01, this taxon has been re-established at Terapod North Pit and Blue Hills North rehabilitated WRD via cuttings and translocation of whole plants. These individuals were artificially introduced in March 2017 as part of KML’s Translocation Proposal. Monitoring of these translocation sites has been undertaken since 2017, with the most recent monitoring from October 2024 demonstrating a survival rate of 100% of cuttings and 83% of salvaged plants at the first translocation site (a total of 15 plants present in October 2024), and a survival rate of 55% for cuttings and 61% for salvaged plants at the second site (a total of 25 plants present in October 2024) (KML 2024). The translocated plants have demonstrated evidence of flowering and fruiting over the history of monitoring, although KML’s Translocation Report (KML 2024) does not indicate whether second-generation seedlings have been recorded at the translocation sites.

8.1.4 Establishment of Habitat for Significant Terrestrial Fauna

Rehabilitation actions include establishment of habitat for conservation significant terrestrial fauna (e.g. utilising large trees and logs or rocks retained during clearing activities to resemble Western Spiny-tailed Skink habitat and encourage the return of the species to rehabilitated areas). Monitoring for significant fauna species is not currently undertaken by KML within rehabilitated areas, but areas rehabilitated in accordance with KML’s *Environmental Procedure - Land Rehabilitation* (Document Number CORP-EN-PRO-1002, revision 5) that achieve compositionally similar vegetation to control quadrats will likely provide habitat for species that are resident/regulator visitors to the area.

8.1.5 Conclusions and Recommendations

Although rehabilitation cannot effectively recreate vegetation communities that were removed, it has the potential to create self-sustaining vegetation communities and provide conservation significant fauna habitat, return significant flora taxa, and produce areas with a similar floristic composition.

Rehabilitation efforts have returned rehabilitation that is in compliance with the species composition (taxon richness) criterion of Condition 12 – (1) (1a) of MS 805 and Condition 11 – (1) (1a) of MS 806, with the exception of rehabilitation quadrats Power03 and Rail01 that had < 70% the taxon richness of control quadrats. A total of 78% of quadrats met the weed cover criterion (when weed cover category 2 is considered as meeting the criterion). Weed control may be required within areas that are not compliant with this criterion. It is also recommended that KML amend their weed cover categories to make it clear which quadrats have more or less than 10% weed cover.

The compositional similarity of rehabilitation quadrats to control quadrats varied, but on average 40.5% of native taxa present in control quadrats were recorded in the respective rehabilitation quadrat(s). Rehabilitation quadrats TPD08 and TPD09 demonstrated statistical compositional similarity to Blue Hills PEC control quadrats BHNWD01C and Karara North.

Seven significant flora taxa have been recorded in rehabilitation at KIOP and MIOP.

While not a requirement of the Ministerial Statement conditions, efforts to improve the compositional similarity of rehabilitation quadrats to control quadrats could include:

- review of seed mixes to prioritise inclusion of flora taxa that have been recorded at control quadrats
- undertaking analyses of seed germination and viability to ensure seed included in seed mixes are viable and are present at sufficient rates
- trial planting of tube stock for flora taxa that do not return via seed mixes
- undertaking rehabilitation during the appropriate season
- investigating topsoil and mulch handling and application methods.

8.2 Offsets Evaluation

The EPA Notice Requiring Information for Assessment (issued 16 October 2023) requested evaluation of the implementation of previously proposed offsets to help protect the landscape. This section describes the frameworks relevant to offsets for previous KML approvals.

8.2.1 Offsets Framework

KML's 2008 PER for KIOP included a table of Conceptual Offsets for the project. KML proposed to implement an offsets package that included some or all of the conceptual offsets, as required by the Ministerial Statement (when issued) for the KIOP MLE.

EPA Report 1321 for KIOP (issued in 2009) concluded that the EPA objectives would not be compromised by KIOP, on the basis that the Minister of Environment had advised that the Government would set aside Mungada Ridge as a Class A Nature Reserve and statutorily protect the reserve from development. The proposed protected area of Mungada Ridge would provide key environmental values including those that would be impacted by KIOP. The offsets proposed by KML were not considered by EPA to be direct or like-for-like offsets relevant to addressing impacts to protected species or ecological communities. MS 805 for KIOP and 806 for MIOP do not include any conditions requiring offsets.

The Federal environmental approval for KIOP did include offset requirements. Approval issued under the EPBC Act in 2009 (EPBC 2006/3017) included the following conditions relating to offsets:

- “In order to minimise the impact on the EPBC listed endangered Western Spiny-tailed Skink (*Egernia stokesii badia*) and the EPBC listed vulnerable Malleefowl (*Leipoa ocellata*) from the loss of potential habitat, the persons taking the action must relinquish tenure over the tenements M59/650, E59/1138, E59/1496 to E59/1499 and E59/1500 at or before the time the Government of Western Australia gazettes the areas for the purpose of Conservation and/or
 - Within 2 years of commencement of operation either provide the Department with confirmation that the tenements have been relinquished and secured under a conservation agreement or, if not,
 - Provide an offset area approved by the Minister, of at least equal area to the project’s disturbance footprint and with suitable habitat for both Western Spiny-tailed Skink and Malleefowl, which can be vested for conservation purposes.
- In order to increase knowledge of the EPBC listed endangered Western Spiny-tailed Skink (*Egernia stokesii badia*) and the EPBC listed vulnerable Malleefowl (*Leipoa ocellata*) the person taking the action must provide for the Minister’s approval a Research Plan that includes:
 - How the \$400,000 research offset over ten years will be directed to improve knowledge of the Western Spiny-tailed Skink and the Malleefowl
 - Who will be responsible for the research
 - What the aims of the research will be
 - The commencement date of the research
 - Who will be provided with the research data.
- The Research Plan must be provided within six months of commencement of operations. The approved plan must be implemented.”

In 2013, KML separately entered into a Memorandum of Understanding (MOU) with the Department of Parks and Wildlife (DPaW) for the Greater Karara Iron Ore Project (being the Mungada Iron Ore Project and Karara Iron Ore Projects). The MOU states that the approval to mine KIOP and MIOP is subject to MS 805 and 806, and implementation of an offsets package proposed by KML and accepted by the Minister for Environment. The MOU references an offsets package as detailed in a letter from KML to DPaW (then Department of Environment and Conservation), which comprises the conceptual offsets that were included in the KIOP PER. The MOU established structures for management of the “Karara Block”, which comprised 560,672 ha of DPaW-managed former pastoral properties and other DPaW-managed public lands. KML committed to developing and implementing procedures for management of threatening processes, particularly feral animals and weeds.

8.2.2 Completed Offset Actions

Table 8.5 summarises offset actions completed by KML, and their current status.

Table 8.8 Offset Actions Completed by KML

Item	KML Actions Completed	Current Status
Tenement relinquishment and conservation	<p>The following exploration tenements were surrendered in 2014: E59/1138, E59/1496 to E59/1499 and E59/1500.</p> <p>KML completed rehabilitation of exploration activities on Mungada Ridge in 2020.</p> <p>Mining tenement M59/650 was surrendered by KML in August 2021 (DEMIRS Tengraph system records). M59/650 had an area of 995.95 ha.</p>	<p>Mungada Ridge was declared a National Park in 2022, with an area of 1,000 ha, covering essentially the same area as relinquished tenement M59/650.</p> <p>KML had one quadrat in the national park for vegetation monitoring as an analogue site for rehabilitation (Quadrat Windaning), however it is no longer assessed since M59/650 was surrendered.</p>
Research plan	<p>KML was a founding research partner with the Centre for Mine Site Restoration (CMSR).</p>	<p>The CMSR undertook research including improved translocation management for Western Spiny-tailed Skink, restorage techniques for tailings facilities, and fauna utilisation of restored habitats.</p> <p>The findings of the CMSR have informed ecologically effective restoration at the dry-stack TSF. Five cover substrate mediums and a specific seeding plan were developed with the CMSR. These have been trialled at six sections of the northern wall of the dry-stack TSF since 2013. A mix of 200 mm BIF waste rock, 500 mm of rocky materials and 100 mm of topsoil has been identified as the most effective cover medium for rehabilitation of the dry-stack TSF.</p>
Karara Block conservation management	<p>KML provided support and assistance with land management activities of the Karara Block.</p>	<p>KML worked collaboratively with the DBCA and completed some on-ground control actions (e.g. feral animal control) at the Karara Block (now the “Karara Conservation Park”) under the MoU for the Greater KIOP environmental offsets. This work discontinued in 2020/21. Karara Conservation Park is now managed by the DBCA.</p>

8.2.3 Evaluation of Offsets

The only offset action that contributed directly towards protection of landforms was relinquishment of tenements and establishment of Mungada Ridge National Park. Mungada Ridge is the first largely intact BIF within the Mid-West region to become a national park, creating a stronghold for many listed flora and fauna species, as well as vegetation communities which are constrained to the landform’s unique geology, soils and relative isolation (GoWA 2022).

9.0 Mitigation of Impacts

The mitigation hierarchy of avoid, minimise, rehabilitate, and offset has been applied in accordance with the *Statement of environmental principles, factors, objectives and aims of EIA* (EPA 2023). The mitigation measures listed below are arranged according to the mitigation hierarchy.

The KIOP MLE Proposal was designed to **avoid** impacts to landforms and BIF ecological values by avoiding impacts to BIF landforms outside of Mt Karara.

The KIOP MLE Proposal was designed to **minimise** potential impacts to landforms and BIF ecological values by designing the WRD to expand to the north to minimise impacts to BIF landforms. The nearest BIF landforms are located to the east of the WRD expansion.

The following measures will be implemented to **rehabilitate** impacts to landforms and BIF ecological values:

- Temporary impacts to landforms, such as infrastructure, will be reshaped during mine closure to blend to the natural surface, restoring landform values as much as possible.
- Re-establishment of vegetation in rehabilitation that targets at least 70% species composition comparable with the pre-mining vegetation within five years of cessation of productive mining, as required by MS 805 condition 12 – (1) (1a) and MS 806 condition 11 – (1) (1a).

10.0 Residual Impact

The *Strategic Review of the Banded Iron Formation Ranges of the Midwest and Goldfields* (DEC 2007) states three conservation principles and three guiding items that should be considered for environmental assessment for impacts to landforms. The principles and guiding items are listed in **Table 10.1**.

Based on the significance considerations of the Landforms Environmental Factor Guideline (EPA 2018), Mt Karara is not considered a significant example of a BIF landform (**Section 6.4**). Nevertheless, Mt Karara does support significant ecological values that are associated with the BIF landform, including the Blue Hills PEC, *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468), Long-tailed Dunnart and Gilled Slender Blue-tongue. The assessment of IUCN criteria identified that the proposed KIOP MLE will not have a significant additional cumulative impact on these ecological values (i.e. it will not result in a change in their IUCN threat categories). The KIOP MLE flora and vegetation impact assessment (Umwelt 2025b) and terrestrial fauna impact assessment (Umwelt 2025c) provide further information regarding assessment of residual impacts and proposed offsets for ecological values, including those supported by the BIF landform.

Table 10.1 Assessment of KIOP MLE Proposal Compliance with Principles of the Strategic Review of the BIF Ranges

Strategic Review of the BIF Ranges – Principles and Guidance	Assessment for KIOP MLE Proposal
No development activity should proceed if it would result in the increase of an IUCN Threat Category of any plant or animal taxon.	<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (P1) is already aligned with the Vulnerable IUCN category due to existing substantial population size reduction. The predicted cumulative population decline that includes the proposed KIOP MLE does not result in an increase in category. The Long-tailed Dunnart (<i>Antechinomys (Sminthopsis) longicaudata</i>) (P4) and Gilled Slender Blue-tongue (<i>Cyclodomorphus branchialis</i>) (VU) do not meet thresholds for listing under IUCN criteria, and the predicted impacts of the KIOP MLE do not alter this outcome.
No development activity should proceed if it would result in the increase of an IUCN Threat Category of any ecological community.	The Blue Hills PEC already qualifies for the Endangered IUCN category due to having limited geographic distribution with ongoing threat, and an existing substantial rate of continuing detrimental change. The predicted cumulative impact of the proposed KIOP MLE do not increase the Blue Hills PEC IUCN threat category.
15–30% of the total number of ranges should be reserved in their entirety so complete examples of landform and ecosystem are protected.	Approximately 23% of the total regional BIF landform area is reserved, but only one range in the region (Red Hill BIF landform) is reserved in its entirety (3% of the total number of ranges in the region). This is less than the 15 – 30% target. The KIOP and MIOP mining areas, including the proposed KIOP MLE, are within Karara Conservation Park, which is managed by DBCA for conservation. Although further ranges would need to be reserved to achieve the target protection, Mt Karara is already substantially impacted and thus is not a complete landform. Therefore, the proposed additional disturbance to Mt Karara would not influence achievement of this target.

Strategic Review of the BIF Ranges – Principles and Guidance

Assessment for KIOP MLE Proposal

<p>Conservation reserves should include at least 60% of largely contiguous ecosystem/habitat for each of the key BIF species and communities restricted to the BIF ranges.</p>	<p>Contiguous habitat could only be defined for the Blue Hills PEC and <i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468). Neither met the 60% target of conservation of contiguous habitat, with the Blue Hills PEC having 42% of the PEC present in conservation reserves, and <i>Lepidosperma</i> having 32% of suitable soil landscape systems present in conservation reserve within the taxon’s EOO.</p> <p>Contiguous habitat for the Gilled Slender Blue-tongue and Long-tailed Dunnart could not be defined given the very large EOOs of both species and sparse publicly available occurrence data. However, across the entire extent of each species’ EOOs, approximately 19% and 28% respectively represents conservation reserves. It is not known how much these proportions would change and whether they would meet the 60% threshold when limiting the extents to only those areas that provide contiguous habitat for each species. The KIOP MLE will not reduce the proportion of conservation reserve extent for any assessed value.</p>
<p>An objective of detailed mine site planning should be to maximise protection of any flora species or ecological community identified as being restricted to the BIF or dependent on the BIF for its conservation.</p>	<p>The proposed WRD has been designed to expand towards the north, which minimises impact to the Blue Hills PEC. Most of the undisturbed Blue Hills PEC is located to the east of the WRD expansion. The TSF expansion to the south will not result in any impact to the Blue Hills PEC (Umwelt 2025b).</p> <p>Any disturbance to the Blue Hills PEC and associated significant flora species that cannot be avoided will be minimised following KML’s operational procedures and will be progressively rehabilitated to restore ecological values. Plant propagules and seed will be collected from significant flora species in preparation of rehabilitation.</p>
<p>Landscape, geodiversity, Aboriginal heritage values and the potential for nature-based tourism should be considered in developing a reserve system.</p>	<p>Mt Karara has not been identified as having significant landscape, geodiversity or Aboriginal heritage values.</p>

10.1 Environmental Outcomes

Table 10.2 details the proposed outcomes and outcomes-based conditions for landforms, how outcomes can be assured, and proposed monitoring of outcomes.

The KIOP MLE Proposal is a significant amendment to MS 805. There are no current conditions on MS 805 relating to management of impacts specific to landforms.

Table 10.2 Proposed Outcomes for Landforms

Proposed Outcome	Is Proposed Outcome Consistent with EPA Objectives	How Proposed Outcome can be Assured	Proposed Outcome-based Condition	Proposed Monitoring of Outcomes
Temporary impacts to landforms, such as infrastructure, will be reshaped during mine closure to blend to the natural surface, restoring landform values as much as possible.	Yes, aims to restore landform where possible.	Mine Closure Plan regulation by DMPE.	Not required – to be administered by DMPE.	Annual environmental reports to DMPE include information regarding rehabilitation.
Re-establishment of vegetation in rehabilitation will achieve at least 70% species composition comparable with the pre-mining vegetation within five years of cessation of productive mining.	Yes, aims to restore ecological values associated with the landform.	Ministerial Statement condition.	As per MS 805 Condition 12-1.	Annual monitoring of rehabilitated vegetation species condition and reporting in annual compliance assessment reports.

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Appendix A

IUCN Criteria Assessment



Table A.1 IUCN Ecosystems Criteria Assessment for Blue Hills PEC (P1)

Criteria	Critically Endangered	Endangered	Vulnerable	Assessment for Estimated Current State	Assessment Including KIOP MLE (98 ha impact)
1 – Decline In Geographic Distribution					
Current decline relative to the longer-term (beyond 50 years ago), based on the below:	≥ 90%; Very Severe	≥ 70%; Severe	≥ 50%; Substantial	939 ha (13%); Below criteria	Cumulative decline 1,037 ha (15%); Below criteria
Pre-European Extent (ha)				7,098	7,098
Current Extent (ha)				6,159	6,061
Criterion 1 category	Not applicable for assessment under this criterion as thresholds are not met.				
2 – Limited Geographic Distribution					
Its geographic distribution is:	Very Restricted	Restricted	Limited		
Extent of occurrence (ha)	< 10,000	< 100,000	< 1,000,000	43,750; Restricted	43,750; Restricted
Area of occupancy (ha)	< 1,000	< 10,000	< 100,000	90,000; Limited	90,000; Limited
Median patch size (ha)	< 10	< 100	NA	~1,000; above criteria	~1,000; above criteria
Coupled with demonstrable threat that could cause loss in the;					
Immediate future (within 10 years)	Critically Endangered	Endangered	Vulnerable	Near future	Near future
Near future (within 20 years)	Endangered	Endangered	Vulnerable		
Medium-term future (within 50 years)	Vulnerable	Vulnerable	Vulnerable		
Criterion 2 category				Endangered	Endangered
3 - Loss or Decline of Functionally Important Species					
For a population of a native species that is likely to play a major role in the community, there is a very severe/severe/substantial decline;	Very severe	Severe	Substantial	Not applicable for assessment under this category. The PEC is predominately defined by the extent of the BIF landform which supports the overall flora diversity, rather than functionally important species.	
to the extent that restoration of the community is not likely to be possible in the immediate/near/medium term future.	Immediate future	Near future	Medium-term future		
4 – Reduction in Community Integrity					
The reduction in its integrity across most of its geographic distribution is very severe/severe/substantial,	Very severe	Severe	Substantial	Below criteria. The PEC is predominantly in Excellent condition and not currently impacted by weed invasion or exhibiting loss of native species diversity such that it is causing a reduction in integrity of the community across its distribution.	The KIOP MLE is not expected to increase the reduction in community integrity to Substantial.
as indicated by degradation of the community or its habitat, or disruption of important community processes that is very severe/severe/substantial.	Very severe	Severe	Substantial		
5 – Rate of Continuing Detrimental Change					
Its rate of continuing detrimental change is: as indicated by:	Very severe	Severe	Substantial	Substantial; Vulnerable: Continuing detrimental change could occur over time due to ongoing threats by mining.	The KIOP MLE is not expected to increase the rate of continuing detrimental change to Severe.
a) rate of continuing decline in its geographic distribution, or a population of a native species that is believed to play a major role in the community, that is:	Very severe	Severe	Substantial	Substantial; Vulnerable; restricted EOO and AOO due to its association with the BIF landform.	The KIOP MLE is not expected increase the rate of decline the geographic distribution to Severe.
OR b) intensification, across most of its geographic distribution, in degradation, or disruption of important community processes, that is:	Very severe	Severe	Substantial	Substantial; Vulnerable: The main threatening process is vegetation clearing due to mining of the BIF, and associated edge effects.	The KIOP MLE is not expected increase the intensification of degradation to Severe.
6 – Quantitative Analysis Showing Probability of Extinction				Not calculated	Not calculated

Table A.2 IUCN Species Criteria Assessment for *Lepidosperma* sp. Blue Hills (A. Markey & S. Dillon 3468) (P1)

Criteria	Critically Endangered	Endangered	Vulnerable	Assessment for Estimated Current State	Assessment including KIOP MLE
A – Population Size Reduction					
A1 (causes of reduction ceased); or	Very severe; ≥ 90%	Severe; ≥ 70%	Substantial; ≥ 50%	NA	NA
A2, A3, A4 (causes of reduction not ceased), based on the below	Very severe; ≥ 80%	Severe; ≥ 50%	Substantial; ≥ 30%	38,717 (45.5%), Substantial; Vulnerable	41,631 (48.9%), Substantial; Vulnerable
Estimated original population size				85,140	85,140
Estimated reduced population size				46,423	43,509
B – Geographic Range in the Form of Either Extent of Occurrence (EOO) and/or Area of Occupancy (AOO)					
EOO (km ²); or	< 100; Very restricted	< 5,000; Restricted	< 20,000; Limited	3,312; Restricted (Indicates Endangered)	3,312; Restricted (Indicates Endangered)
AOO (km ²); and	< 10; Very restricted	<500; Restricted	< 2,000; Limited	304; Restricted (Indicates Endangered)	284; Restricted (Indicates Endangered)
At least two of the following conditions: a) Severely fragmented or number of locations	1	≤ 5	≤ 10	Above criteria	Above criteria
b) Continuing decline i), ii), iii), iv) and/or (v) c) Extreme fluctuations i), ii), iii), iv) and/or (v)				Continuing decline only	Continuing decline only
Criterion B category				Not applicable for assessment under this criterion due to only one condition being met.	
C – Small Population Size and Decline					
Number of mature individuals; and	< 250; Very low	< 2,500; Low	< 10,000; Limited	46,423; above criteria	43,509; above criteria
C1. Decline; or	Very high rate: 25% in 3 years or 1 generation	High rate: 20% in 5 years or 2 generations	Substantial rate: 10% in 10 years or 3 generations	38,717 decline (45.5%) over ~15-20 years. High rate	Cumulative 41,631 decline (38,717 existing + 2,914 from KIOP MLE) (48.9%) over ~15-20 years. High rate
C2. Decline and: a) i) Number of mature individuals in each subpop. ii) % of mature individuals in one subpop. B) Extreme fluctuations in mature individuals	≥ 50 90-100%	≥ 250 95-100%	≥ 1,000 100%	N/A	N/A
Criterion C category				Not applicable for assessment under this criterion due to only one condition being met.	
D – Very Small or Restricted Population					
D1. Number of mature individuals; or	< 50; Extremely low	< 250; Very low	<1,000; Low	46,423; above category	43,509; above category
D2. Restricted AOO or number of locations with plausible threats that could increase conservation status (applies to Vulnerable only).				N/A	
Criterion D category				Not applicable for assessment under this criterion due to thresholds not being met.	
E – Quantitative Analysis					
Indicating the probability of extinction in the wild.	≥ 50% in 10 years or 3 generations	≥ 20% in 20 years or 5 generations	≥ 10% in 100 years	Not calculated	Not calculated

Table A.3 IUCN Species Criteria Assessment for Long-tailed Dunnart (*Antechinomys (Sminthopsis) longicaudata*) (P4)

Criteria	Critically Endangered	Endangered	Vulnerable	Assessment for Estimated Current State	Assessment including KIOP MLE
A – Population Size Reduction					
A2, A3, A4 (causes of reduction not ceased), based on: c) decline in EOO, AOO, and/or quality of habitat	Very severe; ≥ 80%	Severe; ≥ 50%	Substantial; ≥ 30%	Insufficient data available, but unlikely to be below thresholds	
B – Geographic Range in the Form of Either Extent of Occurrence (EOO) and/or Area of Occupancy (AOO)					
EOO (km ²); or	< 100; Very restricted	< 5,000; Restricted	< 20,000; Limited	1,100,000 km ² ; above criteria	1,100,000 km ² ; above criteria
AOO (km ²); and	< 10; Very restricted	< 500; Restricted	< 2,000; Limited	Insufficient data available, but unlikely to be below thresholds	
At least two of the following conditions: a) Severely fragmented or number of locations b) Continuing decline i), ii), iii), iv) and/or (v) c) Extreme fluctuations i), ii), iii), iv) and/or (v)	1	≤ 5	≤ 10	Continuing decline only	Continuing decline only
Criterion B Category					Not applicable for assessment under this criterion as thresholds are not met.
C – Small Population Size and Decline					
Number of mature individuals; and	< 250; Very low	< 2,500; Low	< 10,000; Limited	Not applicable for assessment under this criterion as thresholds are not met (small population size).	
C1. Decline; or	Very high rate: 25% in 3 years or 1 generation	High rate: 20% in 5 years or 2 generations	Substantial rate: 10% in 10 years or 3 generations		
C2. Decline and: a) i) Number of mature individuals in each subpop. ii) % of mature individuals in one subpop. B) Extreme fluctuations in mature individuals	≥ 50 90-100%	≥ 250 95-100%	≥ 1,000 100%		
D – Very Small or Restricted Population					
D1. Number of mature individuals; or	< 50; Extremely low	< 250; Very low	<1,000; Low	Not applicable for assessment under this criterion as thresholds are not met (very small or restricted population).	
D2. Restricted AOO or number of locations with plausible threats that could increase conservation status (applies to Vulnerable only).					
E – Quantitative Analysis					
Indicating the probability of extinction in the wild.	≥ 50% in 10 years or 3 generations	≥ 20% in 20 years or 5 generations	≥ 10% in 100 years	Not calculated	Not calculated

Table A.4 IUCN Species Criteria Assessment for Gilled Slender Blue-tongue (*Cyclodomorphus branchialis*) (VU)

Criteria	Critically Endangered	Endangered	Vulnerable	Assessment for Estimated Current State	Assessment Including Proposal
A – Population Size Reduction					
A2, A3, A4 (causes of reduction not ceased), based on: c) decline in EOO, AOO, and/or quality of habitat	Very severe; ≥ 80%	Severe; ≥ 50%	Substantial; ≥ 30%	Insufficient data available, unlikely to meet threshold	
B – Geographic Range in the Form of Either Extent of Occurrence (EOO) and/or Area of Occupancy (AOO)					
EOO (km ²); or	< 100; Very restricted	< 5,000; Restricted	< 20,000; Limited	60,000 km ² ; above criteria	60,000 km ² ; above criteria
AOO (km ²); and	< 10; Very restricted	< 500; Restricted	< 2,000; Limited	Insufficient data available, unlikely to meet threshold	
At least two of the following conditions: a) Severely fragmented or number of locations b) Continuing decline i), ii), iii), iv) and/or (v) c) Extreme fluctuations i), ii), iii), iv) and/or (v)	1	≤ 5	≤ 10	Continuing decline in area, extent and/or quality of habitat.	Continuing decline in area, extent and/or quality of habitat.
Criterion B Category					Not applicable for assessment under this criterion as thresholds are not met.
C – Small Population Size and Decline					
Number of mature individuals; and	< 250; Very low	< 2,500; Low	< 10,000; Limited	Not applicable for assessment under this criterion as thresholds are not met (small population size).	
C1. Decline; or	Very high rate: 25% in 3 years or 1 generation	High rate: 20% in 5 years or 2 generations	Substantial rate: 10% in 10 years or 3 generations		
C2. Decline and: a) i) Number of mature individuals in each subpop. ii) % of mature individuals in one subpop. B) Extreme fluctuations in mature individuals	≥ 50 90-100%	≥ 250 95-100%	≥ 1,000 100%		
D – Very Small or Restricted Population					
D1. Number of mature individuals; or	< 50; Extremely low	< 250; Very low	<1,000; Low	Not applicable for assessment under this criterion as thresholds are not met (very small or restricted population).	
D2. Restricted AOO or number of locations with plausible threats that could increase conservation status (applies to Vulnerable only).					
E – Quantitative Analysis					
Indicating the probability of extinction in the wild.	≥ 50% in 10 years or 3 generations	≥ 20% in 20 years or 5 generations	≥ 10% in 100 years	Not calculated	Not calculated

Appendix B

Rehabilitation Composition Assessment Plots

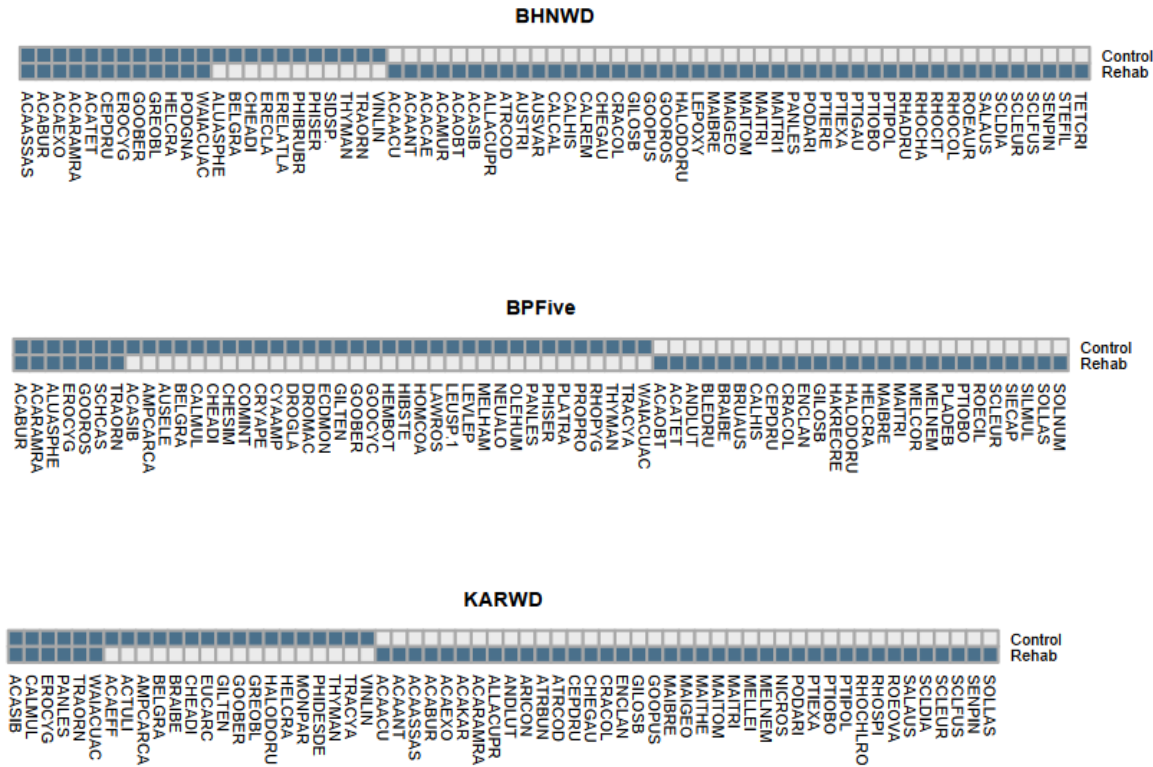
Note: blue shading indicates at least one individual of a flora taxon was recorded at least once. Species codes are defined at the end of this appendix.

Comparison 2: Rehabilitation Quadrats cf. Control Quadrat(s) Within the Same Project Area

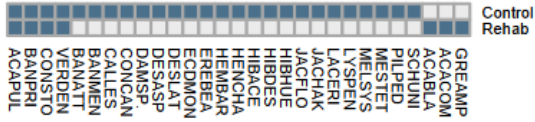
KIOP

Species Code	Control	Rehab
WAIACU		
TRISP		
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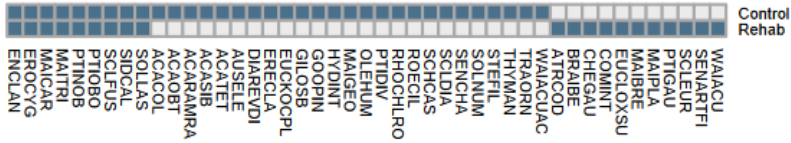
Comparison 3: Rehabilitation Quadrat(s) cf. their Designated Control Quadrat



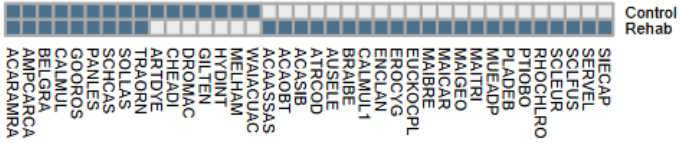
Power03



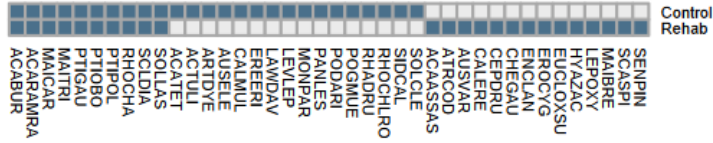
Rail01



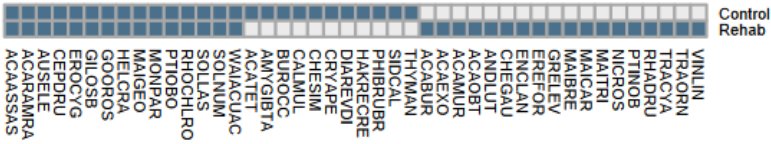
Rail02



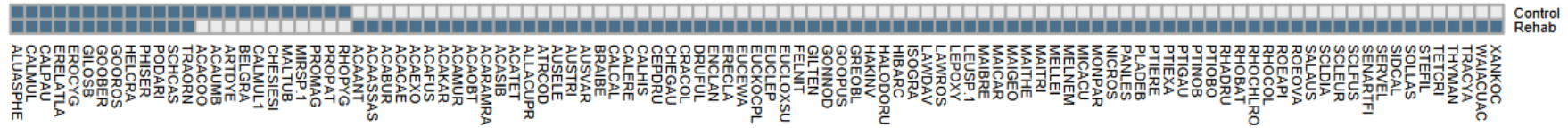
Rail03



Rail04



TPD



Species Codes Definitions (native taxa only)

Code	Taxon	Comment
ACAACU	<i>Acacia acuaria</i>	
ACAACU1	<i>Acacia acuminata</i>	
ACAANT	<i>Acacia anthochaera</i>	
ACAASSAS	<i>Acacia assimilis</i> , <i>Acacia assimilis</i> subsp. <i>assimilis</i>	
ACABLA	<i>Acacia blakelyi</i>	
ACABUR	<i>Acacia burkittii</i>	
ACACAE	<i>Acacia caesaneura</i>	
ACACOL	<i>Acacia colletioides</i>	
ACACOM	<i>Acacia comans</i>	
ACACOO	<i>Acacia coolgardiensis</i>	
ACAEFF	<i>Acacia effusifolia</i>	
ACAERI	<i>Acacia erinacea</i>	
ACAEXO	<i>Acacia exocarpoides</i>	
ACAFUS	<i>Acacia fuscaneura</i>	
ACAKAR	<i>Acacia karinae</i> (P3)	
ACAMUR	<i>Acacia murrayana</i>	
ACAOBT	<i>Acacia obtecta</i>	
ACAPUL	<i>Acacia pulchella</i>	
ACARAMRA	<i>Acacia ramulosa</i> , <i>Acacia ramulosa</i> var. <i>ramulosa</i>	
ACASIB	<i>Acacia sibina</i>	
ACATET	<i>Acacia tetragonophylla</i>	
ACAUMB	<i>Acacia umbraculiformis</i>	
ACAWOO	<i>Acacia woodmaniorum</i> (T)	
	<i>Acacia</i> sp.	Removed from analysis; indeterminate
ACTULI	<i>Actinobole uliginosum</i>	
ALLACUPR	<i>Allocasuarina acutivalvis</i> subsp. <i>prinsepiana</i>	
ALUASPHE	<i>Aluta aspera</i> subsp. <i>hesperia</i>	
AMPCARCA	<i>Amphipogon caricinus</i> , <i>Amphipogon caricinus</i> var. <i>caricinus</i>	
AMYGIBTA	<i>Amyema gibberula</i> var. <i>tatei</i>	
ANDLUT	<i>Androcalva luteiflora</i>	
ARICON	<i>Aristida contorta</i>	
ARTCUR	<i>Arthropodium curvipes</i>	
ARTDYE	<i>Arthropodium dyeri</i>	
	Asteraceae sp.	Removed from analysis; indeterminate
ATRBUN	<i>Atriplex bunburyana</i>	
ATRCOD	<i>Atriplex codonocarpa</i>	
ATRHYM	<i>Atriplex hymenotheca</i>	
ATRNUM	<i>Atriplex nummularia</i>	
ATRSEM	<i>Atriplex semilunaris</i>	
	<i>Atriplex</i> sp.	Removed from analysis; indeterminate
AUSELE	<i>Austrostipa elegantissima</i>	
AUSTRI	<i>Austrostipa trichophylla</i> , <i>Austrostipa ?trichophylla</i>	

Code	Taxon	Comment
AUSVAR	<i>Austrostipa variabilis</i>	
	<i>Austrostipa</i> sp.	Removed from analysis; indeterminate
BANATT	<i>Banksia attenuata</i>	
BANMEN	<i>Banksia menziesii</i>	
BANPRI	<i>Banksia prionotes</i>	
BELGRA	<i>Bellida graminea</i>	
BLEDRU	<i>Blennospora drummondii</i>	
BORSPH	<i>Borya sphaerocephala</i>	
BRACIL	<i>Brachyscome ciliaris</i>	
BRAIBE	<i>Brachyscome iberidifolia</i>	
BRUAUS	<i>Brunonia australis</i>	
BUROCC	<i>Bursaria occidentalis</i>	
CAESP.	<i>Caesia</i> sp. Koolanooka Hills (R. Meissner & Y. Caruso 78) (P1)	
CALCAL	<i>Calandrinia calyptrata</i>	
CALERE	<i>Calandrinia eremaea</i>	
CALGRA	<i>Calandrinia granulifera</i>	
CALREM	<i>Calandrinia remota</i>	
	<i>Calandrinia</i> sp.	Removed from analysis; indeterminate
CALCOL	<i>Callitris columellaris</i>	
CALMUL	<i>Calocephalus multiflorus</i>	
CALHIS	<i>Calotis hispidula</i>	
CALMUL1	<i>Calotis multicaulis</i>	
CALPAU	<i>Calycopeplus paucifolius</i>	
CALLES	<i>Calytrix leschenaultii</i>	
CARMOD	<i>Carpobrotus modestus</i>	
CEPDRU	<i>Cephalopterum drummondii</i>	
CHEADI	<i>Cheilanthes adiantoides</i>	
CHESIESI	<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	
CHEFIL	<i>Cheiranthera filifolia</i>	
CHESIM	<i>Cheiranthera simplicifolia</i>	
CHEGAU	<i>Chenopodium gaudichaudianum</i>	
CHTPSE	<i>Chthonocephalus pseudevax</i>	
CODCOT	<i>Codonocarpus cotinifolius</i>	
COMINT	<i>Comesperma integerrimum</i>	
CONSTO	<i>Conospermum stoechadis</i>	
CONCAN	<i>Conostylis candicans</i>	
CRACOL	<i>Crassula colorata</i> , <i>Crassula colorata</i> var. <i>acuminata</i> , <i>Crassula colorata</i> var. <i>colorata</i>	
CRYAPE	<i>Cryptandra apetala</i>	
CYAAMP	<i>Cyanicula amplexans</i>	
DAMSP.	<i>Dampiera</i> sp.	Retained in analysis; unique entity
DARCAP	<i>Darwinia capitellata</i>	
DAVBEN	<i>Daviesia benthamii</i>	
DESASP	<i>Desmocladus asper</i>	

Code	Taxon	Comment
DESLAT	<i>Desmocladus lateriflorus</i>	
DIAREVDI	<i>Dianella revoluta</i> , <i>Dianella revoluta</i> var. <i>divaricata</i>	
DIDROE	<i>Didymanthus roei</i>	
DODINA	<i>Dodonaea inaequifolia</i>	
DROBUL	<i>Drosera ?bulbosa</i>	
DROGLA	<i>Drosera glanduligera</i>	
DROMAC	<i>Drosera macrantha</i>	
DRUFUL	<i>Drummondita fulva</i> (P3)	
ECDMON	<i>Ecdeiocolea monostachya</i>	
ENCLAN	<i>Enchylaena lanata</i>	
	<i>Enchylaena</i> sp.	Removed from analysis; indeterminate
ERADIE	<i>Eragrostis dielsii</i>	
EREBEA	<i>Eremaea beaufortioides</i>	
ERECLA	<i>Eremophila clarkei</i>	
EREERI	<i>Eremophila eriocalyx</i> , <i>Eremophila ?ericalyx</i>	
EREFOR	<i>Eremophila forrestii</i>	
ERELATLA	<i>Eremophila latrobei</i> subsp. <i>latrobei</i>	
ERESER	<i>Eremophila serrulata</i>	
EROCYG	<i>Erodium cygnorum</i>	
EUCARC	<i>Eucalyptus arctata</i>	
EUCEWA	<i>Eucalyptus ewartiana</i>	
EUCKOCP	<i>Eucalyptus kochii</i> subsp. <i>plenissima</i>	
EUCLEP	<i>Eucalyptus leptopoda</i>	
EUCLOXSU	<i>Eucalyptus loxophleba</i> subsp. <i>supralaevis</i>	
EXOAPH	<i>Exocarpos aphyllus</i>	
FELNIT	<i>Feldstonia nitens</i>	
FRASP.	<i>Frankenia</i> sp.	Retained in analysis; unique entity
GILTEN	<i>Gilberta tenuifolia</i>	
GIOSB	<i>Gilruthia osbornei</i>	
GNETRI	<i>Gnephosis trifida</i>	
GONNOD	<i>Gonocarpus nodulosus</i>	
GOOBER	<i>Goodenia berardiana</i>	
GOOCYC	<i>Goodenia cycnopotamica</i>	
GOOMIM	<i>Goodenia mimuloides</i>	
GOOPIN	<i>Goodenia pinnatifida</i>	
GOOPUS	<i>Goodenia pusilliflora</i>	
GOOROS	<i>Goodenia rosea</i>	
GREAMP	<i>Grevillea amplexans</i>	
GRELEV	<i>Grevillea levis</i>	
GREOBL	<i>Grevillea obliquistigma</i>	
GREPIT	<i>Grevillea pityophylla</i>	
GUNROD	<i>Gunniopsis rodwayi</i>	
GUNRUB	<i>Gunniopsis rubra</i>	
GUNSEP	<i>Gunniopsis septifraga</i>	

Code	Taxon	Comment
	<i>Gunniopsis</i> sp.	Removed from analysis; indeterminate
HAKINV	<i>Hakea invaginata</i>	
HAKRECRE	<i>Hakea recurva</i> , <i>Hakea recurva</i> subsp. <i>recurva</i>	
HALCYAAL	<i>Halgania cyanea</i> var. Allambi Stn (B.W. Strong 676)	
HALODORU	<i>Haloragis odontocarpa</i> , <i>Haloragis odontocarpa</i> forma <i>rugosa</i>	
HELCRA	<i>Helipterum craspedioides</i>	
HEMBEN	<i>Hemigenia benthamii</i>	
HEMBOT	<i>Hemigenia botryphylla</i>	
	<i>Hemigenia</i> sp.	Removed from analysis; indeterminate
HEMBAR	<i>Hemiphora bartlingii</i>	
HENCHA	<i>Hensmania chapmanii</i> (T)	
HIBACE	<i>Hibbertia acerosa</i>	
HIBARC	<i>Hibbertia arcuata</i>	
HIBDES	<i>Hibbertia desmophylla</i>	
HIBHUE	<i>Hibbertia huegelii</i>	
HIBSTE	<i>Hibbertia stenophylla</i>	
HOMCOA	<i>Homalocalyx coarctatus</i>	
HYAGLUVE	<i>Hyalosperma glutinosum</i> subsp. <i>venustum</i>	
HYAZAC	<i>Hyalosperma zacchaeus</i>	
HYDINT	<i>Hydrocotyle intertexta</i>	
	Indeterminate sp.	Removed from analysis; indeterminate
ISOGRA	<i>Isoetopsis graminifolia</i>	
JACFLO	<i>Jacksonia floribunda</i>	
JACHAK	<i>Jacksonia hakeoides</i>	
LACERI	<i>Lachnostachys eriobotrya</i>	
LAWDAV	<i>Lawrencella davenportii</i>	
LAWROS	<i>Lawrencella rosea</i>	
LEPOXY	<i>Lepidium oxytrichum</i>	
LEPSP.	<i>Lepidosperma</i> sp. Blue Hills (A. Markey & S. Dillon 3468) (P1)	
LEUSP.1	<i>Leucopogon</i> sp. Clyde Hill (M.A. Burgman 1207)	
	<i>Leucopogon</i> sp.	Removed from analysis; indeterminate
LEVLEP	<i>Levenhookia leptantha</i>	
LYSPEN	<i>Lysinema pentapetalum</i>	
MAIAMO	<i>Maireana amoena</i>	
MAIATK	<i>Maireana atkinsiana</i>	
MAIBRE	<i>Maireana brevifolia</i>	
MAICAR	<i>Maireana carnosa</i>	
MAIGEO	<i>Maireana georgei</i>	
MAIGLO	<i>Maireana glomerifolia</i>	
MAIPLA	<i>Maireana planifolia</i>	
MAITHE	<i>Maireana thesioides</i>	
MAITOM	<i>Maireana tomentosa</i>	
MAITRI	<i>Maireana trichoptera</i>	

Code	Taxon	Comment
MAITRI1	<i>Maireana triptera</i>	
	<i>Maireana</i> sp.	Removed from analysis; indeterminate
MALTUB	<i>Malleostemon tuberculatus</i>	
MELCOR	<i>Melaleuca cordata</i>	
MELELE	<i>Melaleuca eleuterostachya</i>	
MELHAM	<i>Melaleuca hamata</i>	
MELLEI	<i>Melaleuca leiocarpa</i>	
MELNEM	<i>Melaleuca nematophylla</i>	
MELSYS	<i>Melaleuca systema</i>	
	<i>Melaleuca</i> sp.	Removed from analysis; indeterminate
MESTET	<i>Mesomelaena tetragona</i>	
MICSP.	<i>Microcorys</i> sp. Mt Gibson (S. Patrick 2098)	
MICACU	<i>Micromyrtus acuta</i> (P3)	
MIRDEP	<i>Mirbelia depressa</i>	
MIRSP.1	<i>Mirbelia</i> sp. <i>Bursarioides</i> (T.R. Lally 760)	
MIRSPI	<i>Mirbelia spinosa</i>	
	<i>Mirbelia</i> sp.	Removed from analysis; indeterminate
MONPAR	<i>Monachather paradoxus</i>	
MUEADP	<i>Muehlenbeckia adpressa</i>	
NEUALO	<i>Neurachne alopecuroidea</i>	
NICROS	<i>Nicotiana rosulata</i>	
OLEHUM	<i>Olearia humilis</i>	
OLEPIM	<i>Olearia pimeleoides</i>	
	? <i>Olearia pimelioides</i>	Removed from analysis; indeterminate
PANLES	<i>Panaetia lessonii</i>	
PHETUB	<i>Phebalium tuberculatum</i>	
PHIBRUBR	<i>Philothea brucei</i> subsp. <i>brucei</i>	
PHIDESDE	<i>Philothea deserti</i> subsp. <i>deserti</i>	
PHISER	<i>Philothea sericea</i>	
PILPED	<i>Pileanthus peduncularis</i>	
PIMMIC	<i>Pimelea microcephala</i>	
PLADEB	<i>Plantago debilis</i>	
PLATRA	<i>Platysace trachymenioides</i>	
	Poaceae sp.	Removed from analysis; indeterminate
PODARI	<i>Podolepis aristata</i> , <i>Podolepis aristata</i> subsp. <i>affinis</i>	
PODGNA	<i>Podotheca gnaphalioides</i>	
POGMUE	<i>Pogonolepis muelleriana</i>	
PROMAG	<i>Prostanthera magnifica</i>	
PROPAT	<i>Prostanthera patens</i>	
PROPRO	<i>Prostanthera prostantheroides</i>	
PTIDIV	<i>Ptilotus divaricatus</i>	
PTIDRU	<i>Ptilotus drummondii</i>	
PTIERE	<i>Ptilotus eremita</i>	
PTIEXA	<i>Ptilotus exaltatus</i>	

Code	Taxon	Comment
PTIGAU	<i>Ptilotus gaudichaudii</i>	
PTIHEL	<i>Ptilotus helipteroides</i>	
PTINOB	<i>Ptilotus nobilis</i>	
PTIOBO	<i>Ptilotus obovatus</i>	
PTIPOL	<i>Ptilotus polystachyus</i>	
RHADRU	<i>Rhagodia drummondii</i>	
RHOBAT	<i>Rhodanthe battii</i>	
RHOCHA	<i>Rhodanthe charsleyae</i>	
RHOCHLRO	<i>Rhodanthe chlorocephala</i> subsp. <i>rosea</i> , <i>Rhodanthe chlorocephala</i> subsp. <i>splendida</i>	
RHOCIT	<i>Rhodanthe citrina</i>	
RHOCOL	<i>Rhodanthe collina</i> (P3)	
RHOPOL	<i>Rhodanthe ?polycephala</i>	
RHOPYG	<i>Rhodanthe pygmaea</i>	
RHOSPI	<i>Rhodanthe spicata</i>	
	<i>Rhodanthe</i> sp.	Removed from analysis; indeterminate
ROECIL	<i>Roebuckiella ciliocarpa</i>	
ROEAPI	<i>Roepera apiculata</i>	
ROEAUR	<i>Roepera aurantiaca</i>	
ROEOVA	<i>Roepera ovata</i>	
	<i>Roepera</i> sp.	Removed from analysis; indeterminate
SAL AUS	<i>Salsola australis</i>	
SCASPI	<i>Scaevola spinescens</i>	
SCHCAS	<i>Schoenia cassiniana</i>	
SCHUNI	<i>Scholtzia uniovulata</i>	
SCLDIA	<i>Sclerolaena diacantha</i>	
SCLEUR	<i>Sclerolaena eurotioides</i>	
SCLFUS	<i>Sclerolaena fusiformis</i>	
SENPIN	<i>Senecio pinnatifolius</i> , <i>Senecio</i> sp.	<i>Senecio</i> sp. likely to represent <i>Senecio pinnatifolius</i> based on records from the area
SENARTFI	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	
SENCHA	<i>Senna charlesiana</i>	
	<i>Senna</i> sp.	Removed from analysis; indeterminate
SERVEL	<i>Seringia velutina</i>	
SIDCAL	<i>Sida calyxhymenia</i>	
SIDSP.	<i>Sida</i> sp. <i>Excedentifolia</i> (J.L. Egan 1925)	
SIECAP	<i>Siemssenia capillaris</i>	
SILMUL	<i>Siloxerus multiflorus</i>	
SOLCLE	<i>Solanum cleistogamum</i>	
SOLLAS	<i>Solanum lasiophyllum</i>	
SOLNUM	<i>Solanum nummularium</i>	
SOLORB	<i>Solanum orbiculatum</i>	
STEFIL	<i>Stenopetalum filifolium</i>	
STESAL	<i>Stenopetalum salicola</i>	
STYSER	<i>Styphelia serratifolia</i>	

Code	Taxon	Comment
TECDIS	<i>Tecticornia disarticulata</i>	
TECIND	<i>Tecticornia indica</i>	
TECLAE	<i>Tecticornia laevigata</i>	
TETCRI	<i>Tetragonia cristata</i>	
THYMAN	<i>Thysanotus manglesianus</i>	
THYPYR	<i>Thysanotus pyramidalis</i>	
TRACYA	<i>Trachymene cyanopetala</i>	
TRAORN	<i>Trachymene ornata</i>	
TRAPIL	<i>Trachymene pilosa</i>	
TRISP.1	<i>Tricoryne</i> sp.	Retained in analysis; unique entity
TRISP.	<i>Triglochin</i> sp.	Retained in analysis; unique entity
VERDEN	<i>Verticordia densiflora</i>	
VINLIN	<i>Vincetoxicum lineare</i>	
WAIACU	<i>Waitzia acuminata</i>	
WAIACUAC	<i>Waitzia acuminata</i> var. <i>acuminata</i>	
WURDEN	<i>Wurmbea densiflora</i>	
XANKOC	<i>Xanthosia kochii</i>	

