

**LENNEBERG NATIVE VEGETATION CLEARING
PERMIT (PURPOSE PERMIT) APPLICATION –
SUPPORTING DOCUMENT**

TENEMENTS M 77/86, M 77/380, L 77/290

PREPARED FOR **BARTO GOLD MINING PTY LTD**

December 2021

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Abbreviations

Barto	Barto Gold Mining Pty Ltd
BC Act	<i>Biodiversity Conservation Act 1999</i>
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
BoM	Bureau of Meteorology
DPIRD	Department of Primary Industries and Regional Development
DoAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EPA	Environmental Protection Authority
HSET	Health, Safety, Environment and Training
Ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
Km	Kilometres
LGA	Local Government Area
m	metres
mg	Milligrams
MCP	Mine Closure Plan
NVCP	Native Vegetation Clearing Permit
PEC	Priority Ecological Community
SXO	Southern Cross Operations
TEC	Threatened Ecological Community
TDS	Total Dissolved Solids
WA	Western Australia
WRL	Waste Rock Landform
WoNS	Weed of National Significance

Barto Gold Mining Pty Ltd

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APPENDICES

Appendix A Chuditch Survey Memo

Appendix B Lenneberg Vegetation and Fauna Survey (Stantec 2021)

1. Introduction

Barto Gold Mining Pty Ltd (Barto) propose to develop the Lenneberg project area (the Project) located within their Southern Cross Operations (SXO), approximately 19 kilometres south-east of Southern Cross in the Eastern Goldfields region of Western Australia (**Figure 1-1**).

Stantec Australia Pty Ltd (Stantec) was commissioned by Barto to prepare a Part V Native Vegetation Clearing Permit (NVCP) application to the Department of Industry, Mining, Regulations and Safety (DMIRS) to seek approval for clearing native vegetation on Mining tenements M 77/86, M 77/380 and Miscellaneous Licence tenement L 77/290 to facilitate the Project's resource development. This document has been prepared to support the NVCP application, which seeks approval for the clearing of up to 55 hectares (ha) within a 145.36 ha Purpose Permit Area located on these tenements. All Mining and Miscellaneous Licence tenements are owned by Barto.

1.1 Purpose of the Report

The purpose of this document is to provide the necessary information and justification, as prescribed within the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* to seek approval under Part V of the EP Act for clearing of native vegetation. Stantec provides this supporting document for a NVCP application to DMIRS on behalf of Barto, to clear up to 55 hectares (ha) within a 145.36 ha Purpose Permit Area located on tenements M 77/86, M 77/380, and L 77/290.

This NVCP application supporting document is structured to provide the following information:

- description and map of the area proposed for clearing in regard to location, size and purpose;
- site overview with a brief description of local climate, biogeographic region, geology, land use and land systems, soils, hydrology and hydrogeology;
- description of the area to be cleared in regard to vegetation type, condition and representation in a regional context;
- list of flora species present and their conservation status;
- identification of any Threatened or Priority flora within the proposed clearing area;
- description of broad fauna habitat;
- a list of conservation significant terrestrial fauna species; and
- discussion of the proposed vegetation clearing in relation to the Ten Clearing Principles.

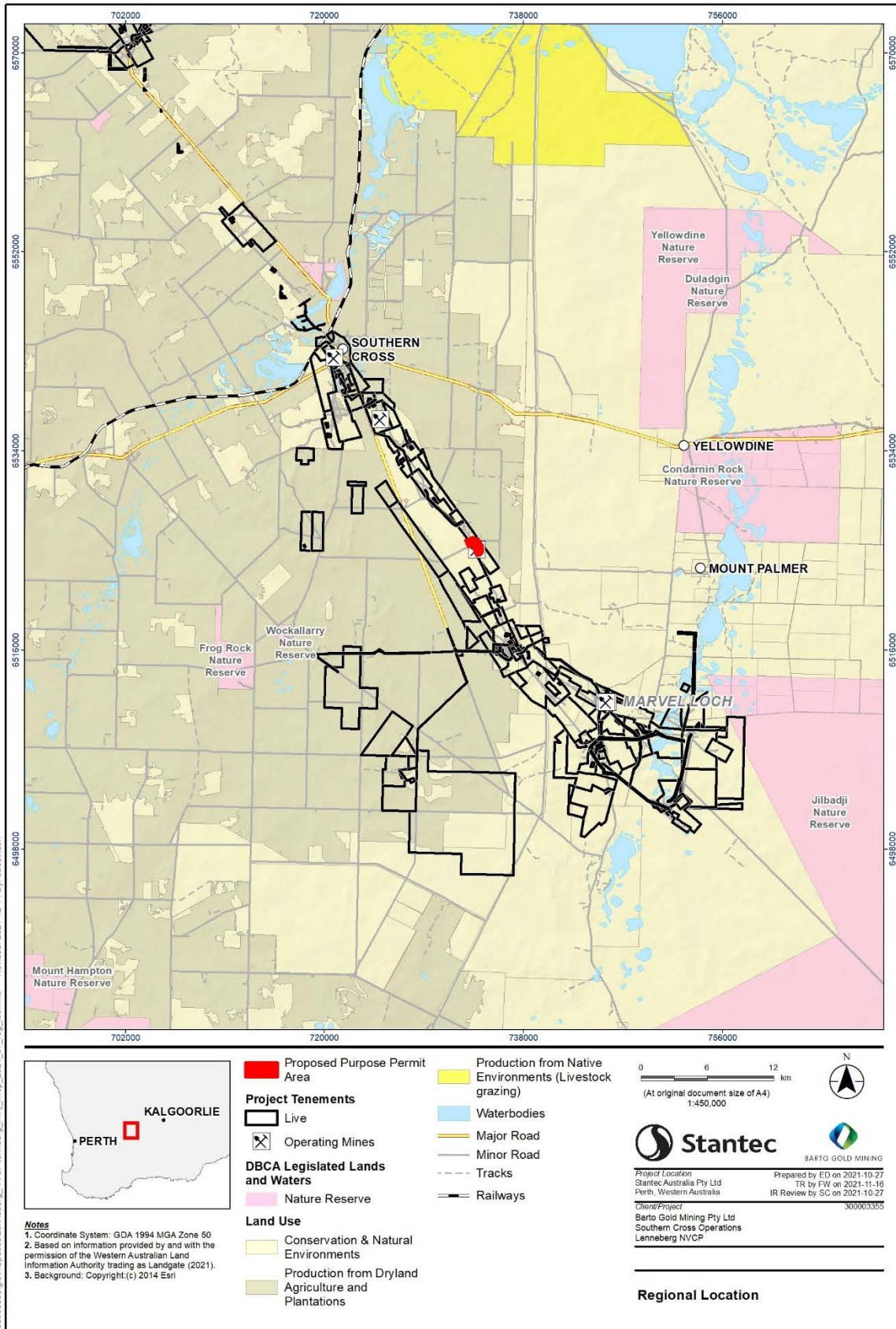


Figure 1-1: Regional Location

1.2 NVCP Application Supporting Document Scope

The application for the proposed NVCP (Purpose Permit) is based primarily on the findings from the Lenneberg Flora, Vegetation and Fauna Survey work (Stantec, 2021a)(**Appendix B**), which focused on a survey area of 263.02 hectares (**Figure 1-2**)(herein referred to as the Survey Area) and the targeted Chuditch Survey (Stantec, 2021b) which spanned the broader SXO area (>60,000 ha)(**Appendix A**).

In addition to the above, the proposed Purpose Permit Area (145.36 ha) lies within broader biological study areas that have been regularly surveyed for flora, vegetation and fauna. The information in the supporting documentation has been sourced from the below documents:

- Stantec (2021a) Targeted Chuditch (*Dasyurus geoffroii*) Survey Memorandum (**Appendix A**)
- Stantec (2021b) Lenneberg Flora, Vegetation and Fauna Survey (**Appendix B**);
- Phoenix (2021) Baseline flora, vegetation and fauna surveys for the Parker Range Haul Road Project;
- Stantec (2020b) Parker Range PEC, Flora and Fauna Reconnaissance Survey and Priority Flora Search;
- Stantec (2020a) Achilles Targeted Significant Flora Survey – October 2020; and
- Stantec (Unpublished) Phoenix, Bronco, Brumby and Zeus Flora, Vegetation and Fauna Surveys.

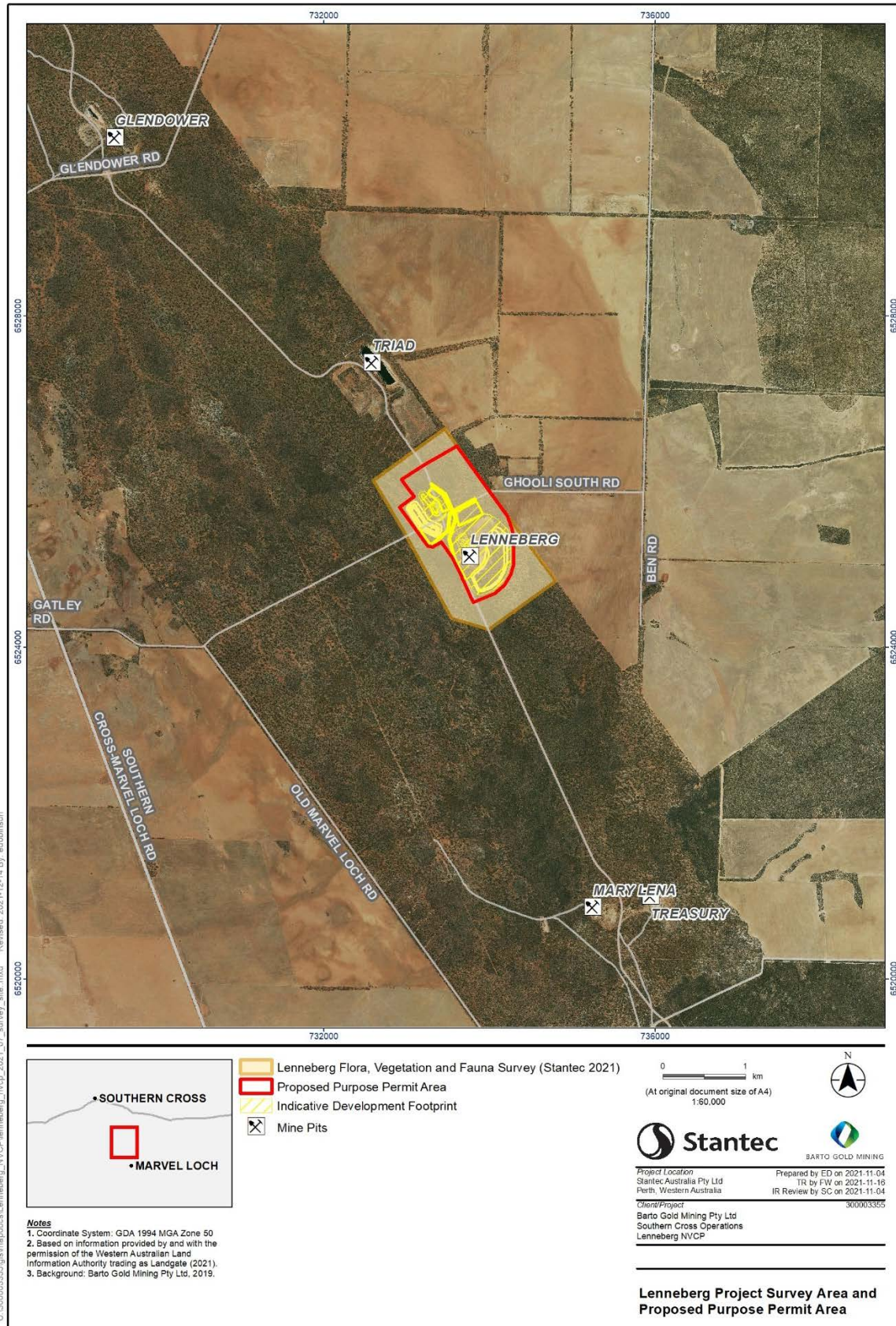


Figure 1-2: Lenneberg Flora, Vegetation and Fauna Survey Area

2. Background

2.1 Location, Tenure and Site Layout

The proposed Purpose Permit Area lies within three tenements, (M 77/86, M 77/380, and L 77/290) held by Barto Gold Mining Pty Ltd (Barto), which is the owner of the Southern Cross Operations (SXO) gold mine, which in turn is managed by Minjar Gold Pty Ltd (Minjar).

The Project's tenements relevant to this application are approximately 10 kms from Marvel Loch Processing Plant and administrative centre for the SXO. (Table 2-1, Figure 2-1).

Table 2-1: Barto Project Tenements within the proposed Permit Area.

Tenement	Area (ha)	Granted	Expires	Leasee
M 77/86	24.92	20/05/1986	26/05/2028	Barto Gold Mining Pty Ltd
M 77/380	174.98	08/10/1989	11/10/2031	Barto Gold Mining Pty Ltd
L 77/290	5.8	14/12/2017	13/12/2038	Barto Gold Mining Pty Ltd

2.2 Contact Details

Company Details:

- Name: Max Ji (CEO), Barto Gold Mining Pty Ltd
- Trading Name: Barto Gold Mining Pty Ltd
- ABN/ACN: 13 161 566 490 / 161 566 490
- Postal Address: Level 3, 66 Kings Park Road, West Perth WA 6872

All compliance and regulatory correspondence should be forwarded by post or email to the following address:

Table 2-2: Contact details for Barto

Contact	Email	Phone
Authorised Person & Contact Person	Bronwen Smith, Senior Approvals Specialist bronwen.smith@minjargold.com.au	0437320834

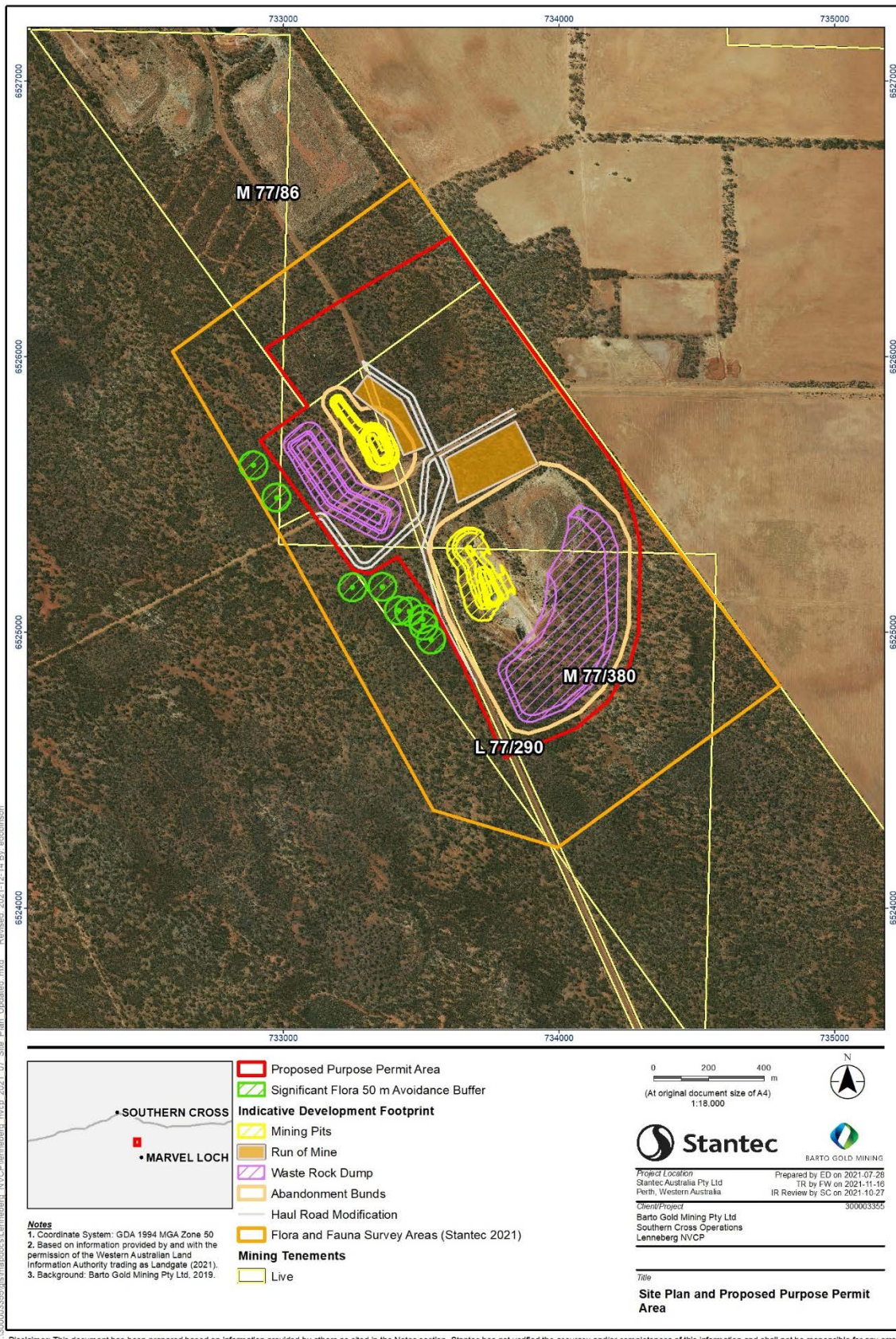


Figure 2-1: The Lenneberg proposed Purpose Permit Area and relevant mining tenements.

3. Proposed Activities

The proposed Project involves the development a new pit and expansion of the existing Lenneberg Pit to allow the continued extraction of gold from the Lenneberg deposits. Ore extracted from the Project will be processed through the existing Marvel Loch Processing Plant.

3.1 Description of Proposed Activities

The Project will consist of the development of one new open pit, associated Waste Rock Dump (WRD), the excavation of a cut-back to the existing Lenneberg open pit and expansion of the existing WRD and supporting mining infrastructure, as detailed below. The Project will require the re-alignment of a short haul road (~1.1 km) to accommodate the north pit and allow access to transport ore to the Marvel Loch Processing Plant.

The main mining activities that will require vegetation clearing are listed below:

- cutback to the existing Lenneberg Open Pit;
- Lenneberg North Open Pit;
- relocation of a portion of the existing haul road;
- access roads;
- extension to the existing Lenneberg WRD;
- Lenneberg North WED;
- laydown area and Mine Ore Pads (MOP);
- topsoil stockpiles;
- abandonment bunds; and
- turkeys nest for mine dewater (if required).

Conventional drill and blast methods will be used to release ore and waste from the Lenneberg and Lenneberg North Open pit. Ore and waste will be extracted by using excavators and dump trucks. Mining will be undertaken using a top-down mining method. Ore will be placed at MOPs to be established adjacent to pits and hauled to the Marvel Loch Processing Plant for processing. Waste will be placed to Project's WRDs with a potential for some backfilling of the existing Lenneberg Pit. A recent hydrogeological assessment indicates that the Project will likely not require dewatering as both mine pits sit above the water table, however it is still considered a possibility.

At the end of the mine life abandonment bunds will be installed around the open pits in accordance with relevant regulations by removing vegetation within the footprint area (if present) by dozer to the width of the abandonment bund. Dump trucks will be used to end dump inert rock material to create the bund.

3.2 Estimated Vegetation Disturbance Requirements

Barto propose that up to 55 ha of native vegetation will be required to be cleared within 145.36 ha proposed Purpose Permit Area to allow the works listed in **Section 3.1**. An indicative site layout (55 ha) and proposed Purpose Permit Area is shown in Figure 2-1.

Barto note that detailed design and layout of the mining infrastructure is currently being finalised, with the current indicative footprint calculated to be ~55 ha. Barto will ensure that clearing is minimised as much as practicable and is maintained within the boundaries of the proposed Purpose Permit Area, which has been designed to avoid and minimise impacts to the *Stenanthemum bremerense* (P4) adjacent to the Proposed Permit Area (>50m away).

3.3 Indicative Time

Barto proposes to commence vegetation clearing in Q1 2022 with vegetation clearing being progressively implemented over the life of the mine.

3.4 Method of Vegetation Clearing

Barto will ensure all clearing and ground disturbance is carried out in accordance with their *Surface Disturbance and Clearing Procedures* (Barto, 2017). Noting this, the following methods of vegetation clearing will be implemented during the construction phase of the Project:

- prior to clearing, a project specific internal Surface Disturbance Permit (SDP) (Doc No. SX-EN-FO-0030) will be completed and signed off by the Environmental Department;
- clearing areas will be delineated in accordance with the project specific internal SDP, the clearing boundary will be surveyed and demarcated with survey pegs and flagging tape;
- vegetation will be removed prior to topsoil stripping. Vegetation will generally be cleared 'blade up' with bulldozers or graders within the proposed Purpose Permit Area. Diggers and loaders may be used around drainage lines as required;
- vegetation will typically be stripped and stored to the side of each disturbed area for use in rehabilitation works. Areas with thicker vegetation may need to have the vegetation pushed into piles and mulched;
- the upper 0.2 m (topsoil) of the soil profile within the proposed disturbance areas is stripped (where possible) and placed in stockpiles (paddock dumped not greater than 2m in height with adequate distance between them to create a series of mounds and troughs);
- subsoil may also be stripped and stockpiled separately to ensure adequate capping and growth media is collected;
- any rock fragments and surface litter present within the soil profiles will be collected and stockpiled with the topsoil;
- machinery operators will aim to minimise the frequency and intensity of disturbance, so they do not compromise the structural integrity of the material. Handling of topsoil will be minimised as much as possible, particularly when wet;
- soil stripping is planned to occur as close as possible to the time when the proposed disturbance is scheduled to commence.

3.5 Rehabilitation and Maintenance

Barto and its contractors will complete a Weed, Seed and Hygiene Certificate (Doc No. SX-EN-FO-0031) prior to arrival upon site and adhere to hygiene procedures to minimise the risk of spreading or introducing weeds within the proposed Purpose Permit Area.

In areas where topsoil has been disturbed it will be spread back over the area and rehabilitated according to the specifications of the Southern Cross Operations Mine Closure Plan (Reg ID 84650) and seeded with local native species.

Rehabilitation monitoring will be undertaken on all substantial rehabilitation areas within one year of seeding to determine whether germination and establishment has been successful. Ongoing monitoring will determine if further management activities are required, including re-seeding or other interventions (for example, to remediate eroded areas) will be undertaken.

4. Site Overview

4.1 Biogeographic Location

The proposed Purpose Permit Area lies within the Southern Cross (COO2) subregion of the Coolgardie bioregion (COO) (Cowan et al., 2001)(Figure 4-2). The Southern Cross (COO2) subregion is described as having subdued relief, comprising gently undulating uplands dissected by broad valleys with bands of low greenstone hills. The valleys include chains of saline playa-lakes. Diverse *Eucalyptus* Woodlands (*Eucalyptus salmonophloia*, *Eucalyptus salubris*, *Eucalyptus transcidentalis* and *Eucalyptus longicornis*) rich in endemic eucalypts occur around these salt lakes, as well as on the low greenstone hills, valley alluvials and broad plains of calcareous earths (Cowan et al., 2001).

Dwarf shrublands of samphire are associated with salt lakes within the COO2 subregion. Granite basement outcrops occur at mid-levels in the landscape and support swards of *Borya constricta* with stands of *Acacia acuminata* and *Eucalyptus loxophleba*. The yellow sandplains, gravelly sandplains and lateritic breakaways of the uplands support mallees (*Eucalyptus leptopoda*, *Eucalyptus platycorys* and *Eucalyptus scyphocalyx*) and scrub-heaths (*Allocasuarina coniculata*, *Callitris preissii*, *Melaleuca uncinata* and *Acacia beauverdiana*) (Cowan et al., 2001).

Rare vertebrate fauna that may occur include species such as the Chuditch (*Dasyurus geoffroi*), Slender-Billed Thornbill (*Acanthiza iredalei*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Malleefowl (*Leipoa ocellata*), Carpet Python (*Morelia spilota imbricata*), Major Mitchell's Cockatoo (*Cacatua leadbeateri*), and Red-tailed Black Cockatoo (*Calyptorhynchus banksii*) (Cowan et al., 2001).

4.2 Climate

The Coolgardie Botanical District of Western Australia has a semi-arid climate, characterised by hot summers and cool winters (Beard, 1990). Long-term climate data (1996-2021) was obtained from the Bureau of Meteorology (BoM) weather station at Southern Cross Airfield (Station 12320), located approximately 35 km north west of the Project Area. The majority of the region's annual average rainfall is received during January to March and from June to August (Figure 4-1). The hottest months of the year are the summer months (December to February, with daily maximum temperatures regularly exceeding 30 degrees Celsius (°C)) and the coolest months occur between June and August, with minimum temperatures frequently falling below 5°C (Figure 4-1).

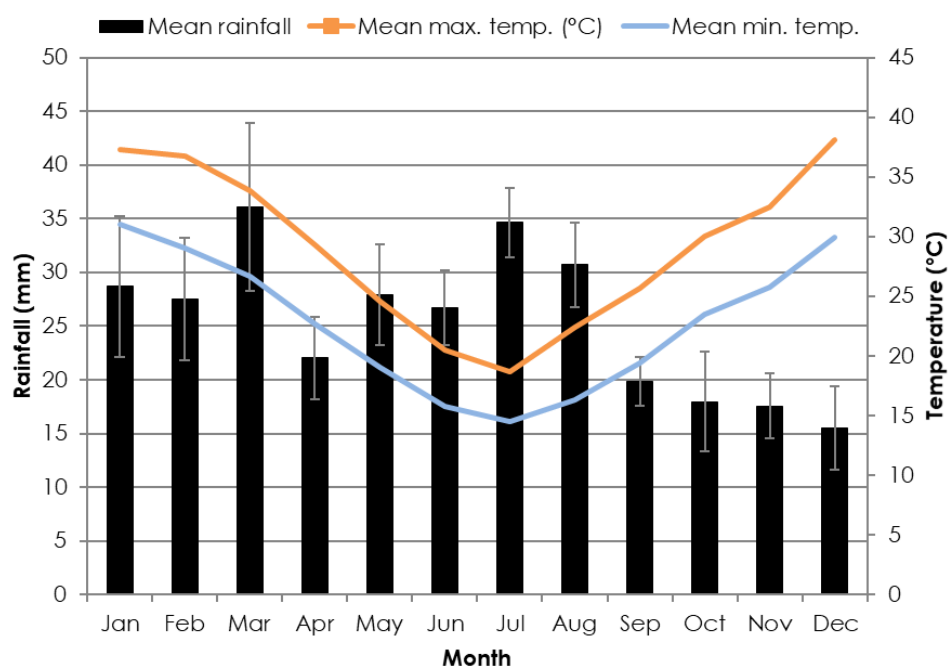
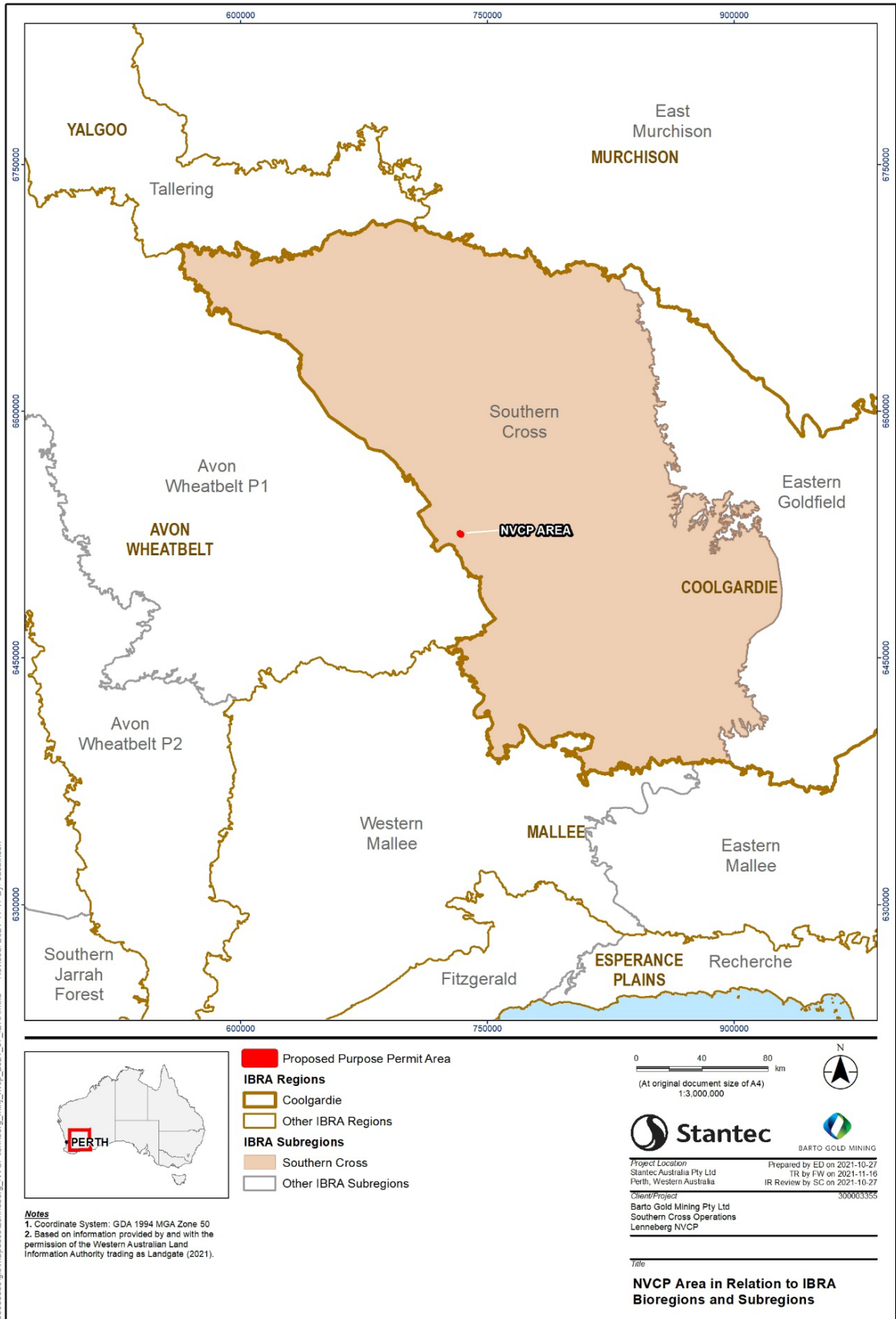


Figure 4-1: Long-term (1996 – 2021) rainfall (mm) and temperature (°C) data recorded at the Southern Cross Airfield weather station (station 12320) (BOM 2021).



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Figure 4-2: Interim Biogeographic Regionalisation for Australia

4.3 Land Use

Land use in the area is predominantly for agriculture purposes such as cropping and grazing (Cowan et al., 2001). Crown Reserves and mining are also other dominant land uses in the areas surrounding Southern Cross, with numerous small and abandoned mines and open shafts dotted across the Yilgarn landscape. The proposed Purpose Permit Area has been subject to previous mining exploration activity.

4.4 Conservation Reserves and Environmentally Sensitive Areas

Under Section 51B of the *Environmental Protection Act 1986* (EP Act), Environmentally Sensitive Areas (ESAs) are declared by the Minister for Environment (Government of Western Australia, 2017). The aim of these areas is to protect against the degradation of environmental values such as declared rare flora, threatened ecological communities (TECs) or significant wetlands. The criteria for the declaration of ESAs do not include State-listed Priority Ecological Communities (PECs), which are protected under the *Biodiversity Conservation Act 2016* (BC Act).

The Project area does not overlap with any reserves or ESAs. The nearest reserves are Wockallary and Yellowdine, both located approximately 17 km from the Project area. Wockallary Nature Reserve is 205 ha area comprised of medium woodland. It is typically dominated by *Eucalyptus salmonophloia*, *Eucalyptus longicornis*, *Eucalyptus salubris*, and *Eucalyptus sheathiana* (Bidwell, 2004). It lies in the South-west botanical province. Yellowdine Nature Reserve lies in the transition zone between the Eremaean and South-west botanical provinces, supporting a rich and diverse flora community with many species of plant and animal persisting on the extremities of their distributions (DotEE, 2019). No TECs were found to have buffers that overlap the Project area and the nearest TEC, *Eucalypt Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)*- Critically Endangered TEC (EPBC Act), is recorded over 12 km from the Project area. The nearest Ramsar wetland is more than 240 km to the southeast (Toolibin Lake), and the nearest nationally important wetland (Lake Cronin) is approximately 113 km south of the Project area.

4.5 Land Systems and Soils

Land systems are defined as an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation (Tille, 2006a). An assessment of land systems provides an indication of the occurrence and distribution of vegetation types within and surrounding the Survey Area (Pringle et al., 1994). Land systems across the Goldfields have been mapped by the Natural Resources Assessment Group of the Department of Primary Industries and Regional Development (formerly the Department of Agriculture and Food; DAFWA), providing a comprehensive description of biophysical resources (Pringle et al., 1994). The Survey Area occurs entirely within the Greenmount System. (Table 4-1; Figure 4-3).

Table 4-1 Extent of land systems within the Survey Area.

Land System	Description	Extent within the Purpose Permit Area	
		Area (ha)	Proportion (%)
Greenmount System	Gently undulating rises to rolling low hills in the eastern Zone of Ancient Drainage. Loamy earth (mostly red, calcareous, and clayey and stony). Vegetation: Eucalypt woodland.	145.36	100

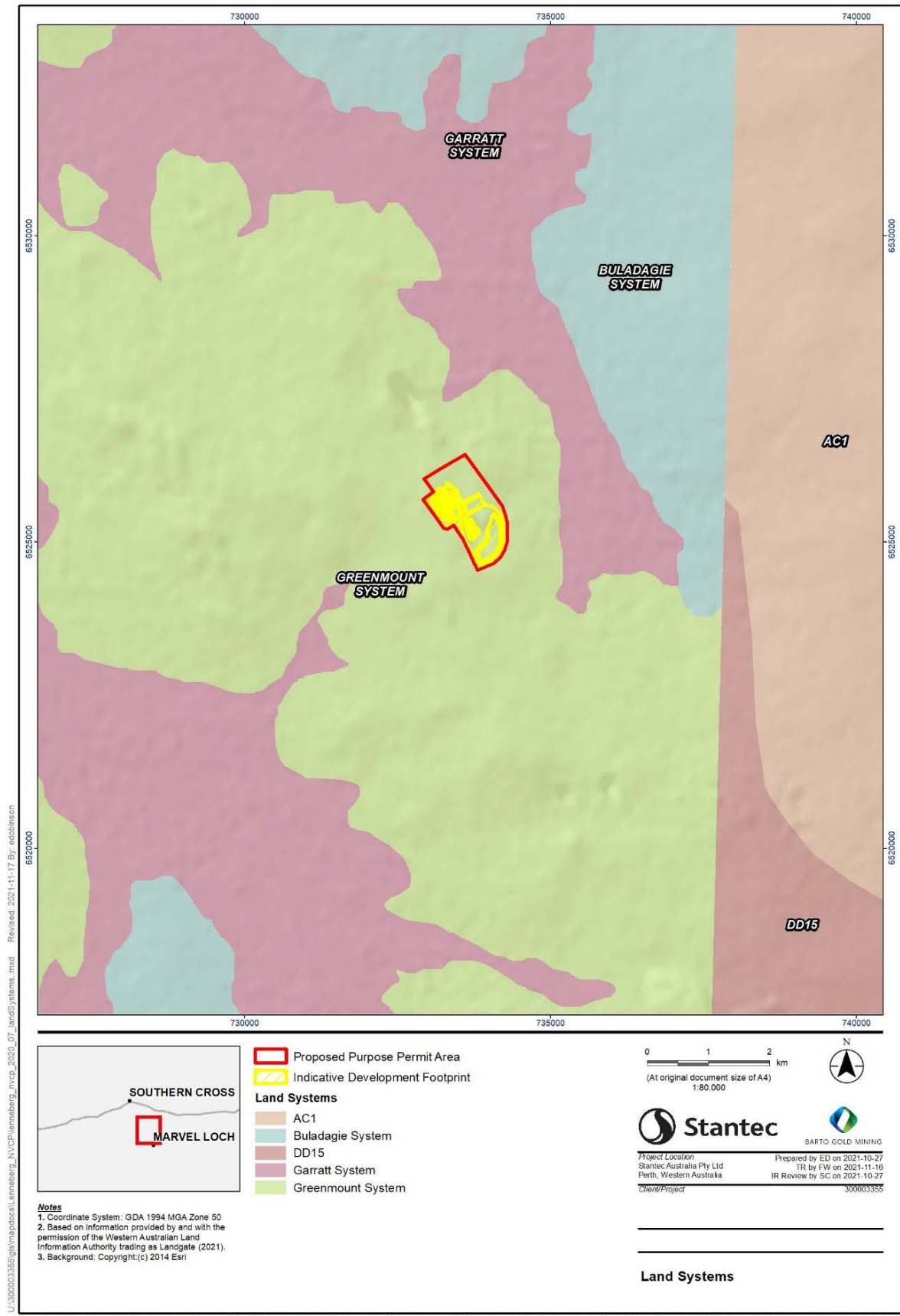


Figure 4-3: Land Systems

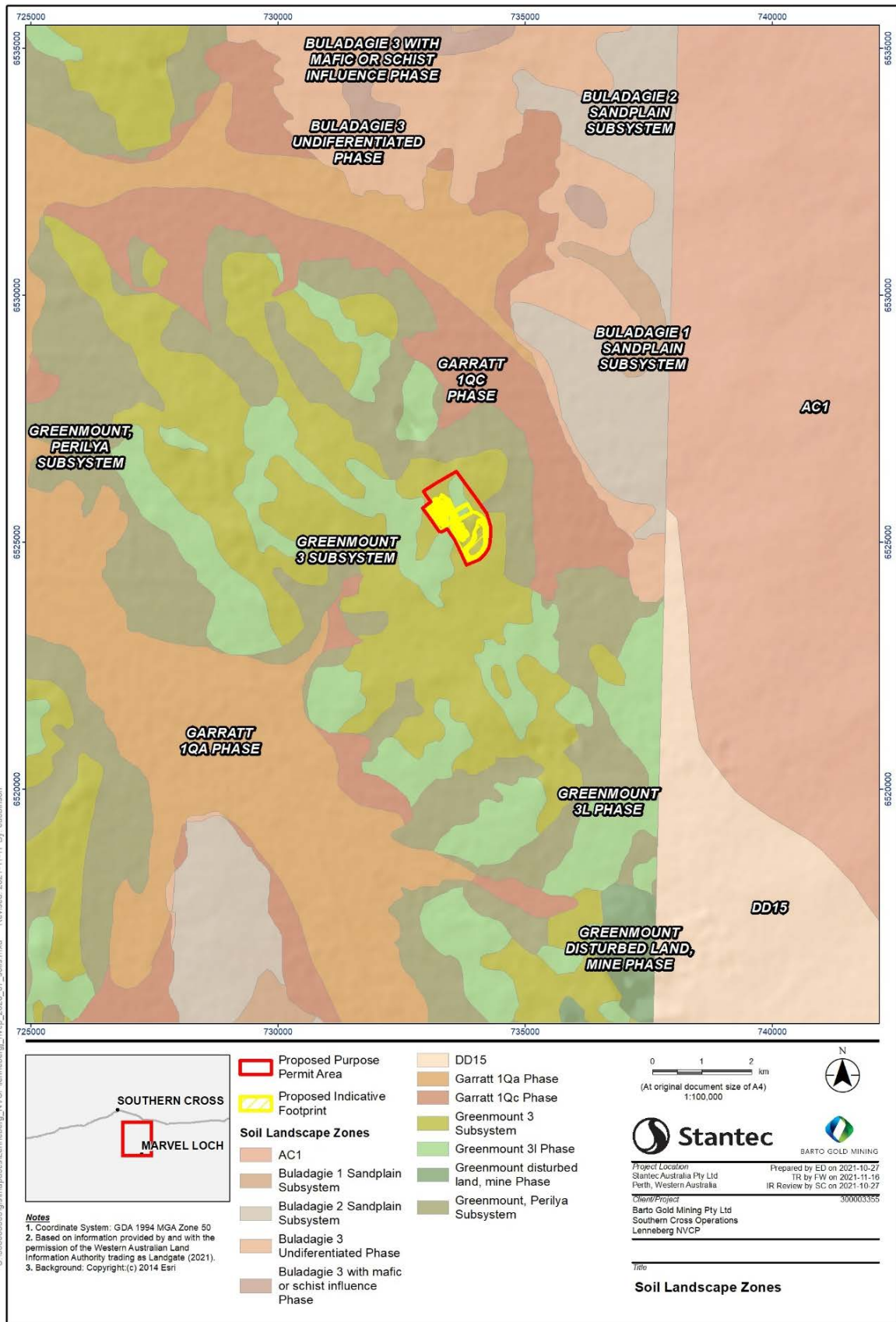
4.5.1 Soil Characteristics

The proposed Purpose Permit Area is mapped as soil landscape zone 261 – Southern Cross, in the Kalgoorlie Province (Tille, 2006b) (**Figure 4-4**). The Southern Cross soil unit is described as undulating plains and uplands, with some salt lakes and low hills, on deeply weathered mantle, colluvium and alluvium over greenstone and granite rocks of the Yilgarn Craton (Tille, 2006b). Soils of this unit are varied and consist of calcareous loamy earths, red and yellow loamy earths, and alkaline deep and shallow sandy duplexes, with some yellow sandy earths, salt lake soils, yellow deep sand and red shallow loamy duplexes (Tille, 2006b).

4.5.1.1 Land Degradation Summary

Land degradation includes any alteration to land capability, soil erosion, salinity, nutrient export, acidification, waterlogging and flooding that affects the present or future use of land.

A review of the grade of soil erosion for the Yilgarn Plateau Province of Australia (Geoscience Australia, 2021) indicated the proposed Purpose Permit Area lies within an area graded as 'Poor' owing to the province being vulnerable to wind erosion due to low ground cover and erodible soils. Poor soil erosion grading of the province is likely attributed to agriculture and grazing activities that dominate the region. The proposed Purpose Permit Area does not occur within a known acid sulphate risk area.



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Figure 4-4: Soil Landscape Zones

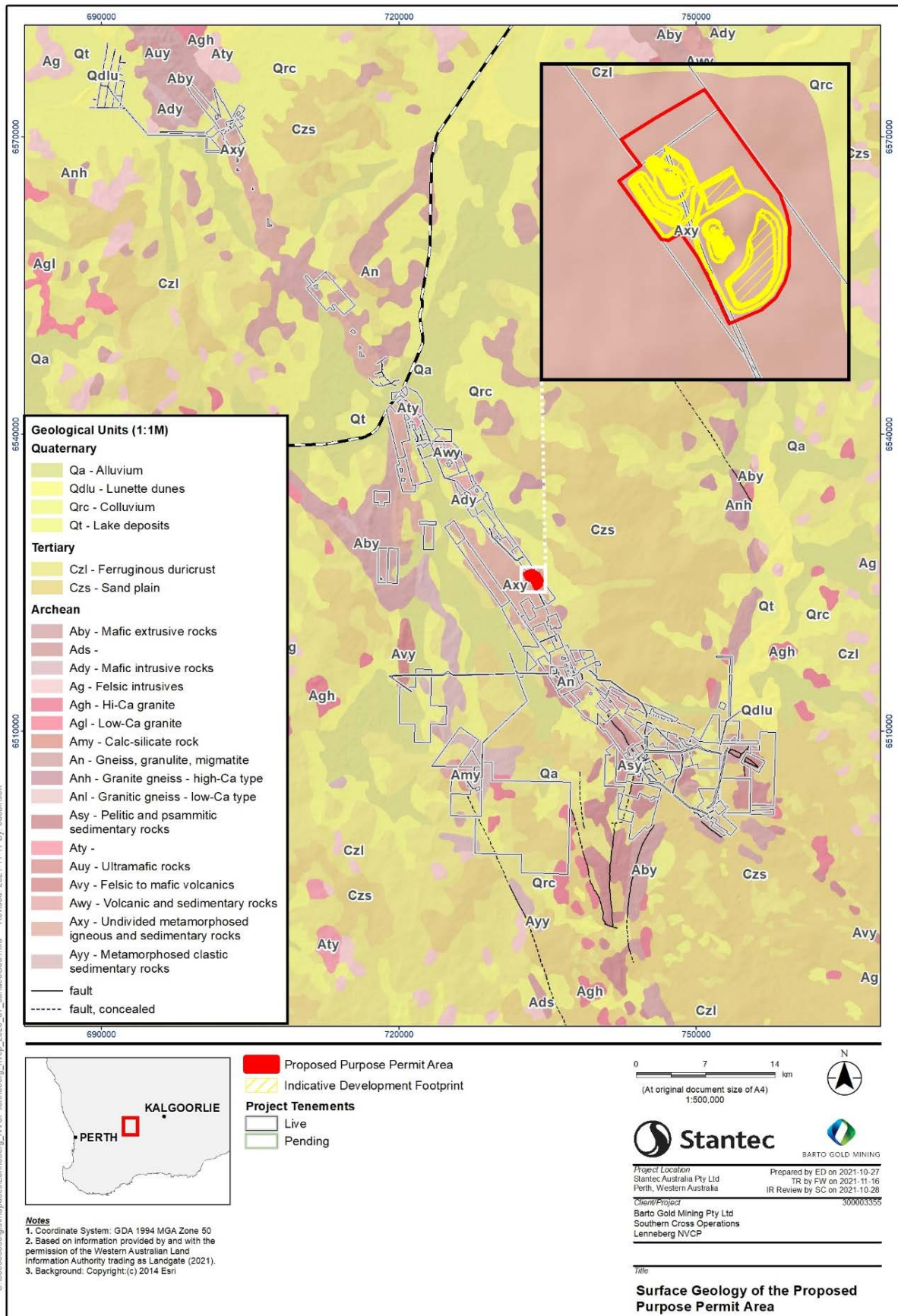
4.6 Geology

4.6.1 Local Geology

The proposed Purpose Permit Area intersects one geological unit; comprised of undivided metamorphosed igneous and sedimentary rocks (unit: 74367; **Table 4-1**; **Figure 4-5**) (Australian Government, 2012). The geological unit is characterised by gently undulating rises to rolling low hills in the eastern zone of ancient drainage, with loamy earth that is mostly red, calcareous and clayey with stones.

Table 4-2: Geological features within the proposed Purpose Permit Area.

Geological unit	Description	Proposed Purpose Permit Area (ha)
Axy: Undivided metamorphosed igneous and sedimentary rocks 74367	Komatiitic basalt, quartz-muscovite-andalusite schist, basalt, dacitic porphyry, granite with greenstone rafts, agglomerate, talc schist, banded gneiss, quartzite, amphibolite, schist, ultramafic rocks, banded iron formation, dolerite, granite.	145.36
Total		145.36



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Figure 4-5: Regional and Local Surface Geology

4.7 Surface Water and Hydrology

The COO2 subregion has occluded drainage with any excess surface water after heavy rainfall draining into salt lakes (BoM 2012, Cowan et al. 2001). The Project area occurs within the Lake Julia sub-catchment of the Swan-Avon River catchment (State of Western Australia 2020). Numerous ephemeral watercourses and lakes occur within proximity to the Project area, however, none of these intersect the Project area. A chain of salt lakes occurs just over 20 km east of the Project area and another chain is 30 km west of the Project area (Figure 4-6 Figure 4-5).

4.8 Hydrogeology

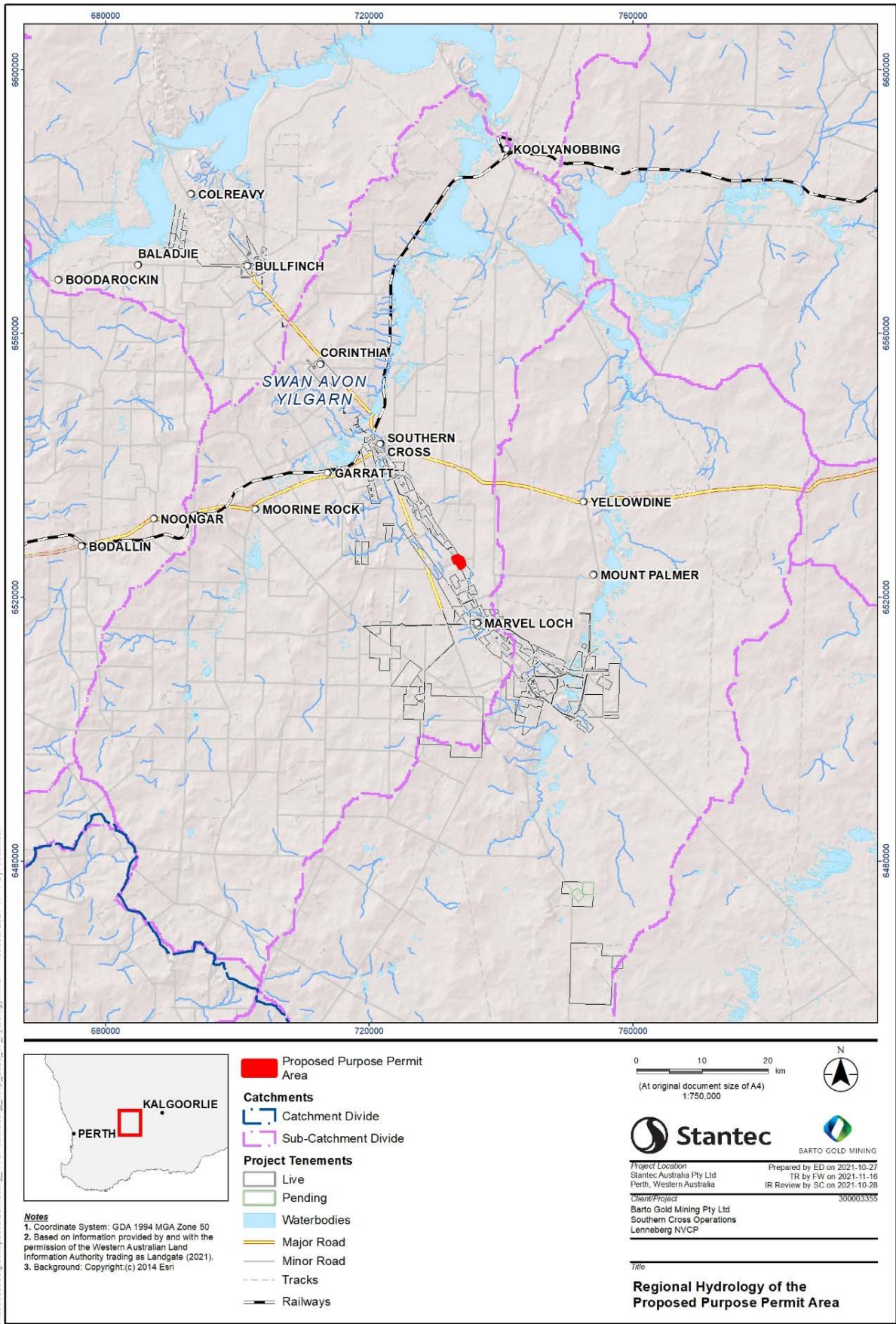
The Southern Cross Operations are located within the Swan-Avon Yilgarn catchment, an area dominated by Archaean Greenstones with significant granitic and gneiss inliers. The Greenstones within the area can be significantly metamorphosed. The Archaean units are generally considered to be a poor groundwater source; however some quartzite rocks, together with shear zones, can offer potential groundwater resources (Barto Gold, 2020).

The aquifer units found with the Southern Cross area comprise superficial, paleochannel and bedrock aquifers (Barto Gold, 2020). Groundwater recharge in the area is generally restricted to the southern margins of the Ghooli Dome, where lower salinity groundwater has been located within fractured rocks and alluvium (Barto Gold, 2020).

The groundwater flows are generally towards the north, and the chains of Lakes (such as Seabrook, Polaris, Koorkoordinate and Deborah). The regional groundwater table is 5 to 45 m deep, with groundwater flowing in a north-westerly direction, towards the paleodrainages (Barto Gold, 2020)

Groundwater is hypersaline and has no near-by users or value to vegetation. Groundwater salinities are generally in the range of 10,000 and 180,000 mg/L Total Dissolved Solids (TDS), but more typically between 20,000 and 110,000 mg/L TDS (Barto Gold, 2020).

The proposed Purpose Permit Area is located within the Goldfields Groundwater Area Proclaimed under the *Rights in water Irrigation Act 1914*, meaning a licence is required for the abstraction of groundwater or the construction of bores (DWER 2020). Clearing is unlikely to impact on groundwater quality provided that appropriate management practices are followed to reduce the likelihood of spills and contamination of groundwater.



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Figure 4-6: Regional Hydrology

5. Environmental Values

This section contains information about the environmental characteristics of the proposed Purpose Permit Area (within the context of the region), specifically relating to flora, vegetation and terrestrial fauna values, that may be relevant to this NVCP application. The assessment against the 10 clearing principles has also taken into regard the geological, soil characteristics and hydrogeology to inform the impact predictions.

5.1 Flora

5.1.1 Survey Objectives and Methods

A combined Flora, Vegetation and Fauna Survey was conducted by Stantec in October 2020 and March 2021. The Survey Area encompassed and extended beyond the proposed NVCP Area (**Figure 5-1**).

The objective of the survey work was to understand the flora and vegetation values of the Survey Area, including characterising the flora, delineating vegetation units, and providing an assessment of the conservation significance of the flora and vegetation.

The EPA (2016) recommends that flora and vegetation surveys be undertaken following the season of highest rainfall to optimise the likelihood of encountering flowering and fruiting taxa and capturing ephemeral species. The recommended survey timing for the South-Western Interzone Province is during spring (September to November).

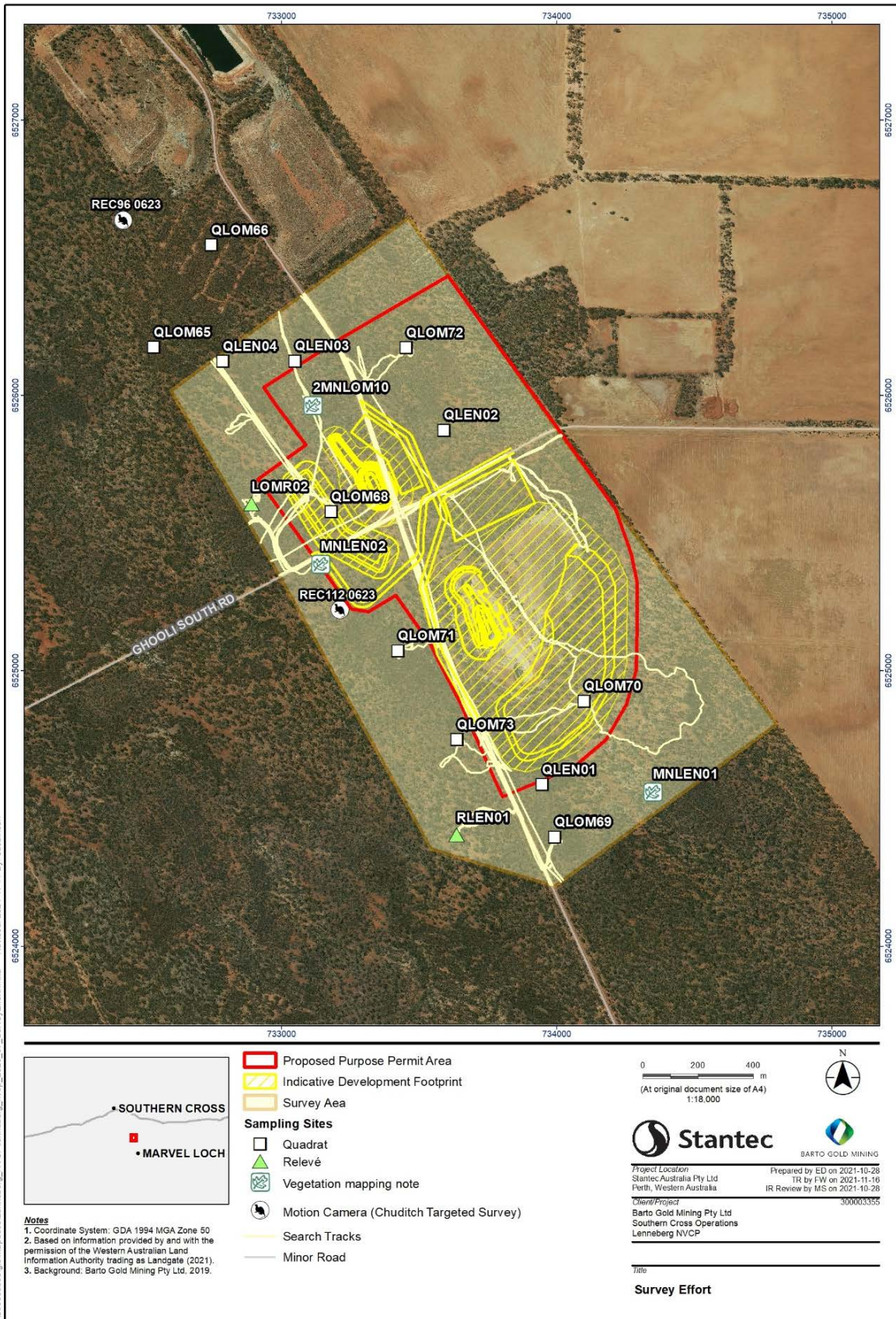
5.1.1.1 Desktop Assessment

A desktop assessment, comprising database searches and a literature review, was undertaken prior to the field survey to gather contextual information on the Survey Area and to inform a likelihood of occurrence for significant flora and vegetation to occur within the Survey Area. Database searches were completed to generate a list of vascular flora and vegetation communities previously recorded within, and in the vicinity of, the Survey Area, with an emphasis on species and communities of conservation significance and introduced species.

Background information relating to the Survey Area and surrounds was compiled prior to conducting the field work for the Survey. Historic vegetation mapping (Beard, 1972, Shepherd et al., 2002b), soil and land system mapping and characteristics (Cowan et al., 2001, Tille, 2006a), and the IBRA classification system information (Thackway and Cresswell, 1995) were reviewed to provide broad contextual information. The literature review also considered 13 publicly available survey reports of relevance to the Survey Area, comprising eight flora and vegetation surveys.

5.1.1.2 Field Survey

The phase 1 survey was undertaken on the 1st of October 2020 and the second field survey was undertaken between 21 and 22 March 2021. The survey methods comprised the establishment of quadrats, habitat assessments, mapping notes, targeted searches, opportunistic collections of flora and opportunistic recordings of fauna. Survey effort consisted of 10 combined quadrats and habitat assessments and two relevés. Targeted searches were conducted for significant flora identified during the desktop assessment (**Figure 5-1**).



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Figure 5-1: Field Survey Effort

5.1.2 Flora

A total of 77 vascular flora taxa, representing 24 families and 41 genera, were recorded within the Survey Area (Appendix B). Three specimens were unable to be confidently identified beyond genus level due to a lack of diagnostic characteristics and are likely to represent additional species. However, these additional species are unlikely to represent significant flora in the region. The dominant plant family was Myrtaceae, with 12 confirmed species, while Eucalyptus was the most frequently recorded genus (Table 5-1). Floristic diversity and composition were considered typical of the COO2 subregion (Cowan et al., 2001) and also showed similarities to the nearby Avon Wheatbelt 1 (AW1) subregion, with the presence of mixed eucalypts and Eucalyptus loxophleba subsp. lissophloia woodland. Diversity was largely consistent with previous surveys undertaken within and in close proximity to the Survey Area (Stantec, 2019, Botanica, 2016a, Spectrum Ecology, 2020, GHD, 2016, MWH, 2014, Recon Environmental, 2008b, Recon Environmental, 2008a, Gibson and Lyons, 1998).

Table 5-1: Most represented vascular plant families and genera for the Survey Area.

Family	Number of taxa
Myrtaceae	12
Chenopodiaceae	10
Fabaceae	9
Scrophulariaceae, Rutaceae and Asteraceae	5
Genus	Number of taxa
Eucalyptus	7
Acacia and Eremophila	5
Dodonaea, Maireana and Melaleuca	4

A full list of flora species identified during the Flora, Vegetation and Fauna Survey is provided in the Survey Report (**Appendix B**).

5.1.3 Flora of Significance

No Commonwealth or State-listed threatened or priority flora have been recorded within the Proposed Permit Area, and no Commonwealth or State-listed threatened flora were recorded within the Survey Area. Two State-listed priority flora species, *Rinzia fimbriolata* (P1) and *Stenanthemum bremerense* (P4), were recorded from six and 12 locations, respectively (**Table 5-2**). These records were found within the Survey Area, but outside of the Proposed Permit Area. *S. bremerense* (P4) has been located adjacent to the Proposed Permit Area (>50 m away), and *R. fimbriolata* has been recorded 62 m from the Proposed Permit Area.

One record of *Rinzia fimbriolata*, was found to occur within surveyed quadrats and relevés. An additional five occurrences of *Rinzia fimbriolata* were recorded opportunistically within the Survey Area (**Table 5-2**). Details regarding individual populations location and abundance are presented in **Appendix B**.

According to the WAH, only three records of *Rinzia fimbriolata* (P1) are currently listed (WAH, 2021), with records identified up to 33 km north of the survey area. This species generally occurs on well-drained soils of brown sandy loam, as well as clays with quartz pieces (WAH 2021). Surveys in the vicinity of the Survey Area have recorded an estimated 2829 individuals (**Table 5-2**). The distribution of *Rinzia fimbriolata* (P1) is therefore not restricted to the Survey Area, also extending into the adjacent AW01 subregion.

Five records of *Stenanthemum bremerense* (P4) were found to occur within quadrats and relevés. An additional 12 populations were recorded opportunistically within the survey area (**Table 5-2**). Details regarding individual populations location and abundance are presented in **Appendix B**. This species is known to occur on orange-brown sandy loam, orange-red gravelly loam, skeletal red loam, laterite, ironstone. Its habitats can include top or sides of outcrops and breakaways (WAH 2021).

Currently there are 33 records of *Stenanthemum bremerense* (P4) held by the Western Australian Herbarium, with records identified up to 160 km south-east of the Survey Area (WAH, 2021). Surveys in the vicinity of the Survey Area have recorded an estimated 1334 individuals (**Table 5-2**). As such, this species is not restricted to the Survey Area. Within the Survey Area, *Stenanthemum bremerense* was recorded from 12 locations, with 398 individuals estimated in total (**Table 5-2**).

Table 5-2: Priority flora species recorded opportunistically in the Survey Area. (No priority flora were recorded within the Proposed Permit Area.)

Species	Number of occurrences (estimated individuals)	Life stage (average)	Reproductive stage (average)	Health (range)	Estimated Regional individuals recorded (Stantec & WAH Herb)
<i>Rinzia fimbriolata</i> (P1)	6 (48)	Mature	Vegetative	Healthy	2829
<i>Stenanthemum bremerense</i> (P4)	12 (398)	Mature	Flowering	Healthy	1334

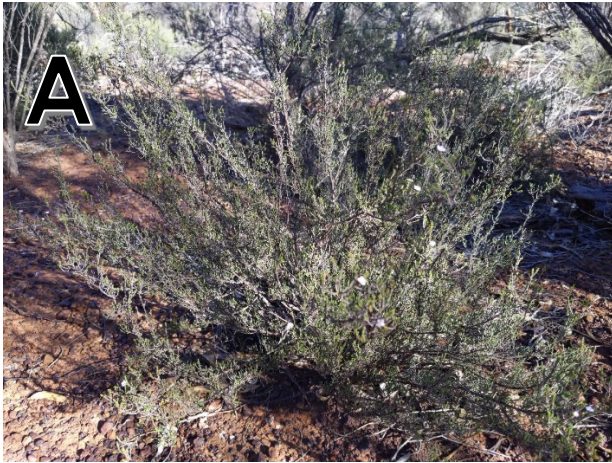
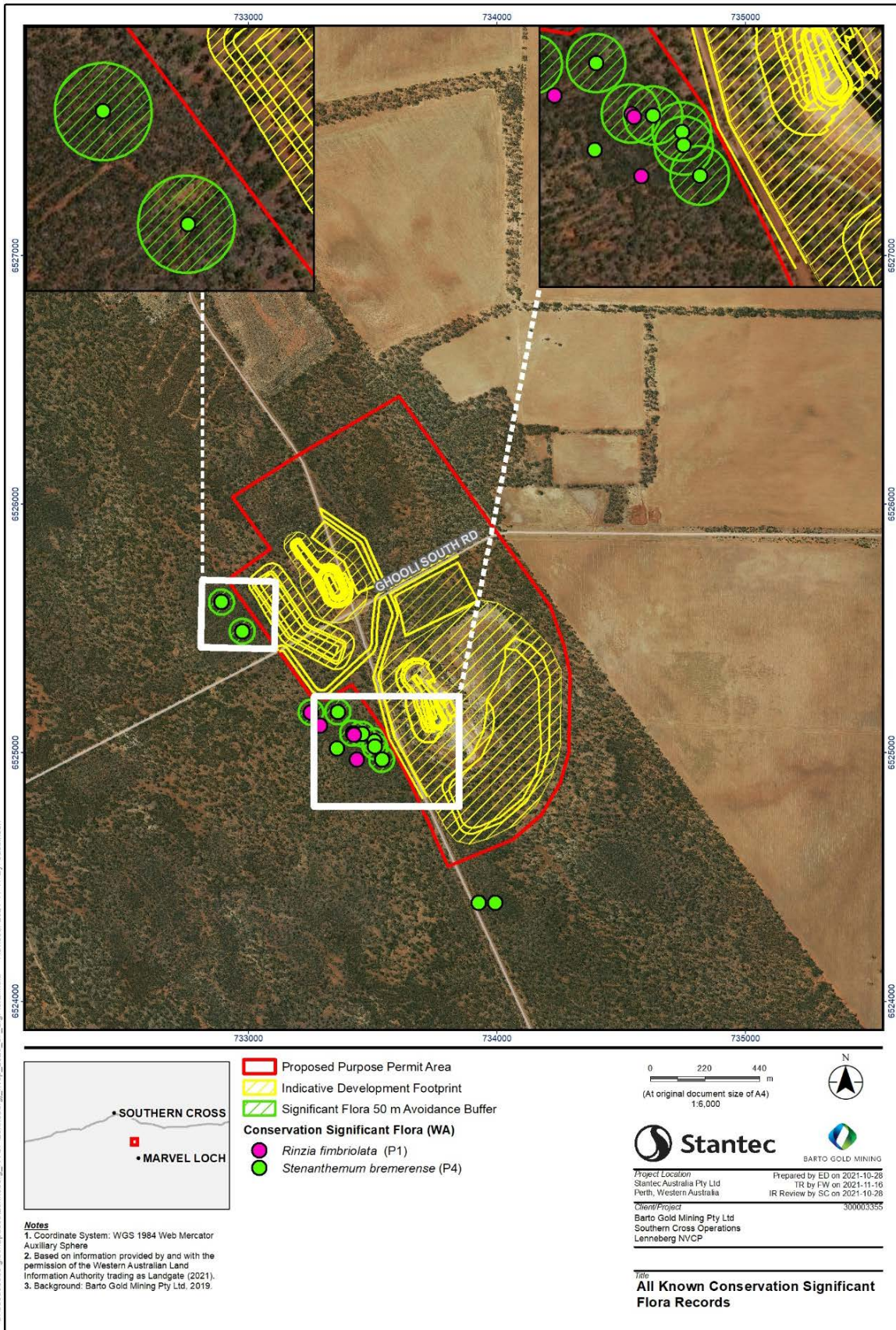


Plate 5-1: Significant flora species recorded and photographed in the Survey Area; (A) *Rinzia fimbriolata* (P1), and (B) *Stenanthemum bremerense* (P4).

The EPA (2016a) advises that flora species, subspecies, varieties, hybrids and ecotypes may be considered significant for reasons other than listing as a threatened or priority flora species, and may include the following:

- a keystone role in a habitat for Threatened species or supporting large populations representing a significant proportion of the local regional population of a species.
- relic status.
- anomalous features that indicate a potential new discovery.
- being representative of the range of a species (particularly at the extremes of range, recently discovered range extensions, or isolated outliers of the main range).
- the presence of restricted subspecies, varieties, or naturally occurring hybrids.
- local endemism/a restricted distribution; and/or
- being poorly reserved.

Based on these parameters, none of the remaining 74 vascular flora taxa recorded from the Survey Area are of 'other' significance. The native vascular flora taxa recorded from the Survey Area are represented in the local and regional area and no unique or unusual taxa were recorded.



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Figure 5-2: Records of Priority Flora from the Survey Area.

5.1.4 Introduced Flora

Eight introduced flora (weed) species were recorded within the Survey Area: **Carthamus lanatus*, **Carrichtera annua*, **Centaurea melitensis*, **Lysimachia arvensis*, **Mesembryanthemum nodiflorum*, **Medicago minima*, **Opuntia stricta* and **Sonchus oleraceus*. Of these, only six occurred within the Purposed Permit Area. The ecological impact and invasiveness classifications (DPaW, 2013) for these weed species are provided in Table 5-3. One species, *Opuntia stricta* is listed as a declared pest under Section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act), and as a Weed of National Significance (WoNS) (Commonwealth of Australia, 2020). The specimen was recorded at quadrat QLEN01. State-wide legislation dictates that this species must have some form of management applied to alleviate the environmentally harmful impacts of the species, reduce the numbers or distribution of the species or contain the spread of the organism. **Opuntia stricta* or Common Prickly Pear can dominate the vegetation of rocky outcrops displacing natives, some of which may be restricted to such outcrops, and consequently be relatively rare. It is drought and fire tolerant and is easily dispersed by fragmentation. Individuals are able to establish themselves in the majority of soil types and climatic zones throughout Australia (DPIRD, 2017, DPIRD, 2021). After a search in the vicinity for additional **Opuntia stricta* the single specimen was physically removed and destroyed by Stantec Botanists and part of it was used for identification by the taxonomist. Species characteristic descriptions, preferred habitat information and representative photographs of all weeds recorded is provided in **Appendix B**, in addition to abundance, cover and location data captured during the survey.

Table 5-3: Introduced flora taxa identified in the Survey Area.

Taxon	Common name	DBC Classification		Individual specimens
		Ecological Impact	Invasive	
<i>*Carthamus lanatus</i>	Saffron Thistle	High	Rapid	50-100
<i>*Mesembryanthemum nodiflorum</i>	Slender Iceplant	Unknown	Unknown	1
<i>*Opuntia stricta</i>	Common Prickly Pear	High	Rapid	1
<i>*Lysimachia arvensis</i>	Pimpernel	Unknown	Rapid	100
<i>*Centaurea melitensis</i>	Maltese Cockspur	High	Rapid	200
<i>*Carrichtera annua</i>	Ward's Weed	High	Rapid	1000
<i>*Medicago minima</i>	Small Burr Medic	Unknown	Unknown	10-15
<i>*Sonchus oleraceus</i>	Common Sowthistle	Unknown	Rapid	10

Note: the single specimen of **Opuntia stricta* recorded was purposely eradicated by Stantec botanists.

5.2 Vegetation

5.2.1 Vegetation Type

There were four vegetation types described and delineated for the Survey Area (**Table 5-4**). Vegetation type mapping is presented in **Figure 5-3**, while the data collected from each quadrat/relevé is provided in **Appendix B**.



The vegetation of the Survey Area is broadly represented by mid height to tall *Eucalyptus* Woodlands, *Acacia* and *Melaleuca* shrublands and a low Chenopod shrubland. The most dominant vegetation type was EIEsuMpAv (178.45 ha), which occupied approximately 68% of the Survey Area.



The least dominant vegetation type was EIEsp.EyMpTcOm (6.16 ha), which occupied just over two percent of the Survey Area. The small size of the vegetation type within the Survey Area restricted the number of monitoring sites that could be installed. As a result, only one quadrat was established in the EIEsp.EyMpTcOm vegetation type.

The Proposed Permit Area contained all four vegetation types, with the most dominant vegetation type being EIEsuMpAv (104.04 ha), which comprised 71.57% of the Proposed Permit Area (**Table 5-4**). The least dominant vegetation type was EIEsp.EyMpTcOm, which comprised just 0.3 ha (0.2%) of the Proposed Permit Area.

The pattern of vegetation within the Survey Area is considered typical of the South-Western Interzone (Gibson and Lyons, 2001, Gibson and Lyons, 1998, Recon Environmental, 2008b, Recon Environmental, 2008a) and of the *Eucalyptus* Woodlands of the COO2 subregion (Cowan et al., 2001).

Table 5-4: Vegetation types occurring within the Survey area, and within the Proposed Permit Area.

Vegetation type code	Vegetation type description	Sample sites	Extent within Survey Area		Extent within the Proposed Permit Area		Representative photograph
			Hectares (ha)	Proportion (%)	Hectares (ha)	Proportion (%)	
EIEsEsuMpEi iSaOm	<p><i>Eucalyptus longicornis</i> and <i>Eucalyptus salmonophloia</i> and <i>Eucalyptus salubris</i> open forest over <i>Melaleuca pauperiflora</i> and <i>Eremophila interstans</i> subsp. <i>interstans</i> tall open shrubland over <i>Santalum acuminatum</i> scattered shrubs over <i>Olearia muelleri</i> scattered herbs</p> <p><u>Associated species:</u> <i>Acacia erinacea</i>, <i>Acacia merrallii</i>, <i>Atriplex vesicaria</i>, <i>Austrostipa elegantissima</i>, <i>Dodonaea stenozyga</i>, <i>Eremophila scoparia</i>, <i>Maireana carnosa</i>, <i>Ptilotus holosericeus</i>, <i>Sclerolaena diacantha</i>, <i>Senna artemisioides</i> subsp. <i>filifolia</i> and <i>Templetonia ceracea</i></p>	QLOM70 QLEN02 RLEN01	27.29	10.37	5.41	3.72	
EIEsp.EyMp TcOm	<p><i>Eucalyptus longicornis</i>, <i>Eucalyptus</i> sp. <i>Eucalyptus yilgarnensis</i> open forest over <i>Melaleuca pauperiflora</i> and <i>Templetonia ceracea</i> open shrubland over <i>Olearia muelleri</i> scattered herbs</p> <p><u>Associated species:</u> <i>Acacia merrallii</i>, <i>Atriplex vesicaria</i>, <i>Eremophila ionantha</i>, <i>Eremophila scoparia</i>, <i>Eucalyptus calycogona</i>, <i>Eucalyptus salubris</i>, <i>Maireana trichoptera</i>, <i>Microcybe multiflora</i>, <i>Ptilotus exaltatus</i>, <i>Sclerolaena diacantha</i>, <i>Sclerolaena drummondii</i></p>	QLEN04	6.16	2.34	0.3	0.21	

Vegetation type code	Vegetation type description	Sample sites	Extent within Survey Area		Extent within the Proposed Permit Area		Representative photograph
			Hectares (ha)	Proportion (%)	Hectares (ha)	Proportion (%)	
EIEsuMpAv	<p><i>Eucalyptus longicornis</i>, <i>Eucalyptus salubris</i> woodland over <i>Melaleuca pauperifolia</i> tall shrubland over <i>Atriplex vesicaria</i> low open shrubland</p> <p><u>Associated species:</u></p> <p><i>Acacia erinacea</i>, <i>Acacia merrallii</i>, <i>Austrostipa elegantissima</i>, <i>Dodonaea stenozyga</i>, <i>Eremophila oppositifolia</i> subsp. <i>angustifolia</i>, <i>Eremophila scoparia</i>, <i>Eucalyptus salmonophloia</i>, <i>Exocarpos aphyllus</i>, <i>Maireana trichoptera</i>, <i>Olearia muelleri</i>, <i>Santalum acuminatum</i>, <i>Sclerolaena diacantha</i>, <i>Templetonia ceracea</i></p>	QLOM68 QLOM72 QLOM73 QLEN01	178.45	67.85	104.04	71.57	
EIIAcMhAa BssDb	<p><i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i> woodland over <i>Allocasuarina campestris</i> and <i>Melaleuca hamata</i> and <i>Acacia acuminata</i> tall open shrubland over <i>Beyeria sulcata</i> var. <i>sulcata</i> and <i>Dodonaea bursariifolia</i> open shrubland.</p> <p><u>Associated species:</u></p> <p><i>Austrostipa elegantissima</i>, <i>Dodonaea bursariifolia</i>, <i>Grevillea obliquistigma</i> subsp. <i>obliquistigma</i>, <i>Olearia muelleri</i>, <i>Phebalium tuberculosum</i>, <i>Prostanthera semiteres</i> subsp. <i>semiteres</i>, <i>Stenanthemum bremerense</i> (P4), <i>Thysanotus manglesianus</i>, <i>Trymalium myrtillus</i>, <i>Waitzia acuminata</i></p>	QLEN03 QLOM69 QLOM71 LOMR02	21.49	8.17	7.25	4.98	
Cleared	Cleared		29.63	11.26	28.16	19.37	

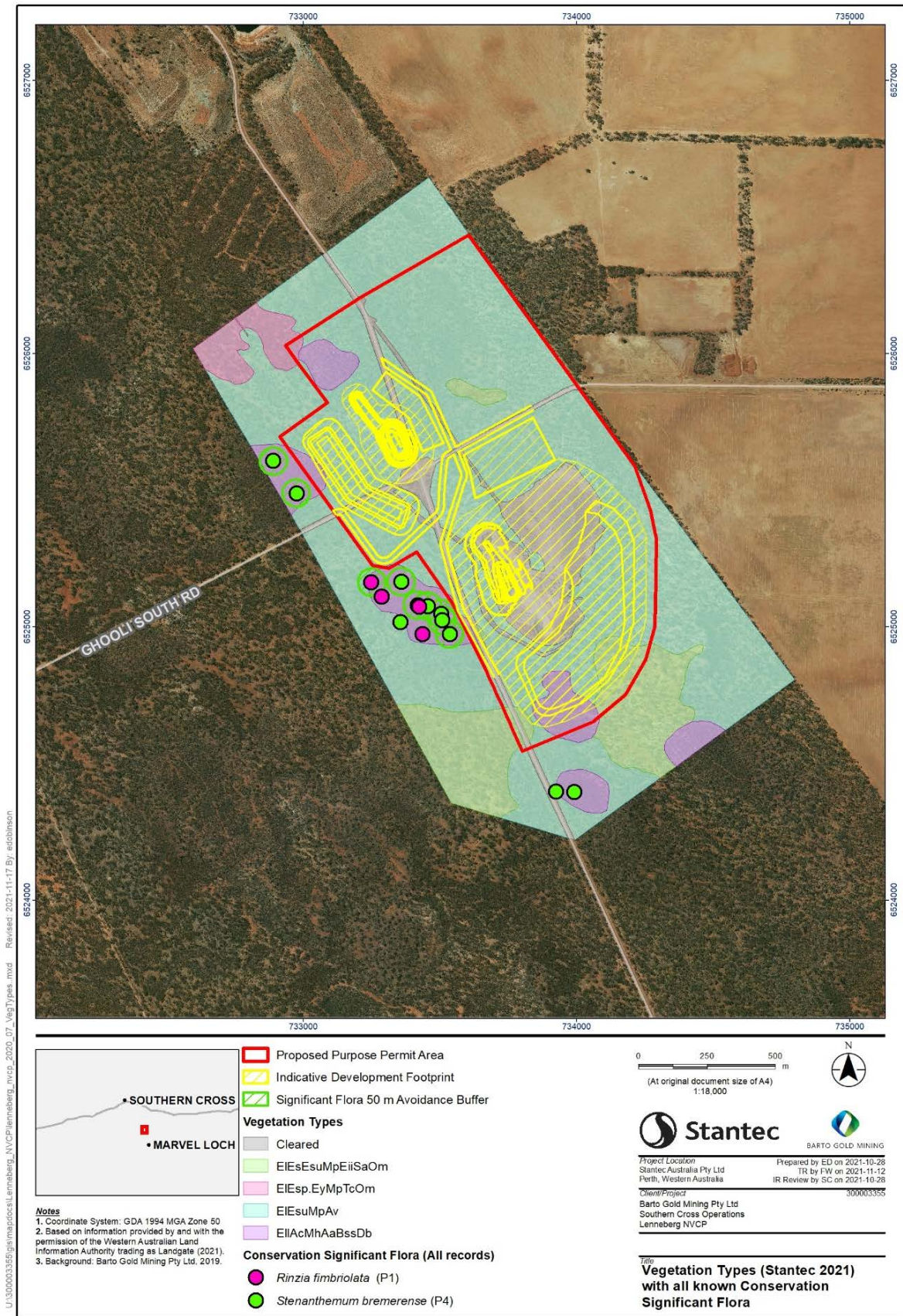


Figure 5-3: Vegetation types recorded from the Survey Area.

5.2.2 Vegetation of Significance

Based on the desktop assessment, one P3 PEC, the *Parker Range vegetation complexes*, has a buffer that was mapped in close proximity (approximately 6km) to the Survey Area (DBCA, 2020a) (**Table 5-5; Figure 5-4**). Vegetation defined within the Survey Area was assessed against the descriptions of the vegetation communities that comprise this PEC, as detailed in Gibson and Lyons (1998).

Within the Survey Area, vegetation type EIEsuMpAv was considered to be analogous with Community 2 of the PEC (**Table 5-5**). This vegetation type covered an area of 178.45 ha, representing almost 68% of the Survey Area. It predominantly occurred on the broad flats and was dominated by *Eucalyptus longicornis* and *E. salubris*. Previous surveys undertaken near the Survey Area have also identified the presence of this PEC (Recon Environmental, 2008b, Botanica, 2016a, Gibson and Lyons, 1998, Stantec, 2019, Recon Environmental, 2008a). Within the Proposed Permit Area, vegetation type EIEsuMpAv covered an area of 104.04 ha, representing approximately 72% of the Proposed Permit Area.

Vegetation type EIEsuMpEiiSaOm was considered to be analogous with Community 3 of the PEC (**Table 5-5**). This vegetation type covered an area of 27.29 ha, representing 10.37% of the Survey Area. It predominantly occurred on the broad flats and was dominated by *Eucalyptus salmonophloia* and *E. salubris*. Previous surveys undertaken near the Survey Area have also identified the presence of this PEC (Recon Environmental, 2008b, Botanica, 2016a, Gibson and Lyons, 1998, Stantec, 2019, Recon Environmental, 2008a). Within the Proposed Permit Area, vegetation type EIEsuMpEiiSaOm covered an area of 5.41ha, representing 3.72% of the Proposed Permit Area.

Table 5-5: Vegetation types representing the Parker Range vegetation complexes PEC within the Survey Area.

Vegetation type description	Parker Range vegetation community type	Extent within Survey Area		Extent within the Proposed Permit Area	
		Hectares (ha)	Proportion (%)	Hectares (ha)	Proportion (%)
EIEsuMpAv <i>Eucalyptus longicornis</i> , <i>Eucalyptus salubris</i> woodland over <i>Melaleuca pauperifolia</i> tall shrubland over <i>Atriplex</i> <i>vesicaria</i> low open shrubland	Community type 2: generally dominated by <i>Eucalyptus longicornis</i> . Other eucalypts that occur as co-dominants included <i>E. corrugata</i> and <i>E. salubris</i> (occasionally dominated by <i>E. myriadena</i>). This community occupies the broad flats	178.45	67.85	104.04	71.57
EIEsuMpEiiSaOm <i>Eucalyptus longicornis</i> and <i>Eucalyptus salmonophloia</i> and <i>Eucalyptus salubris</i> open forest over <i>Melaleuca pauperiflora</i> and <i>Eremophila interstans</i> subsp. <i>interstans</i> tall open shrubland over <i>Santalum</i> <i>acuminatum</i> scattered shrubs over <i>Olearia muelleri</i> scattered herbs	Community Type 3: occurs on the broad flats within the greenstone belt. Usually dominated by <i>Eucalyptus salmonophloia</i> and <i>E. salubris</i> . Typical understorey species include <i>Eremophila oppositifolia</i> , <i>Acacia concolorans</i> ms, <i>Dodonaea stenozyga</i> and <i>Scaevola spinescens</i>	27.29	10.37	5.41	3.72

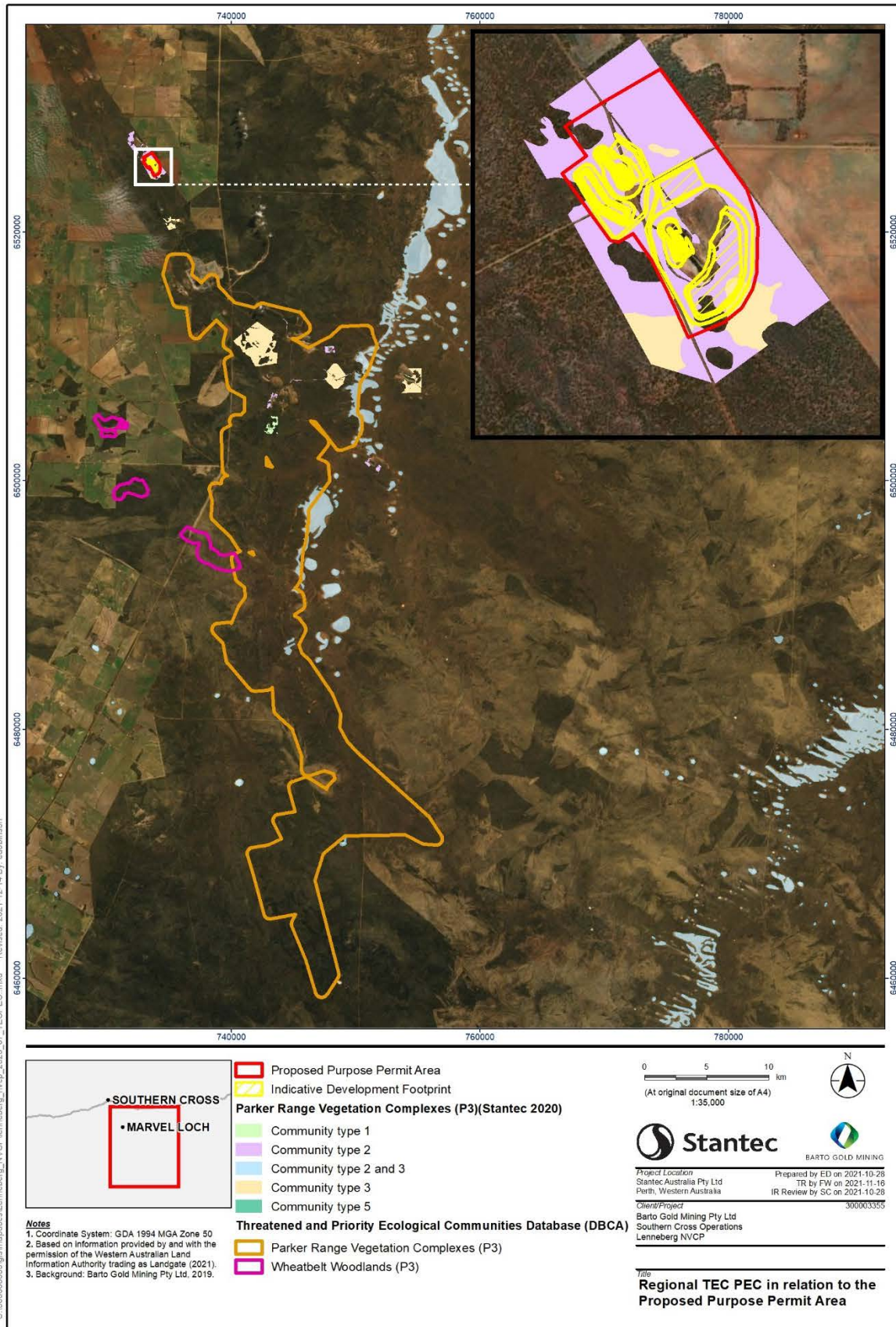


Figure 5-4 PEC within and surrounding the Survey Area

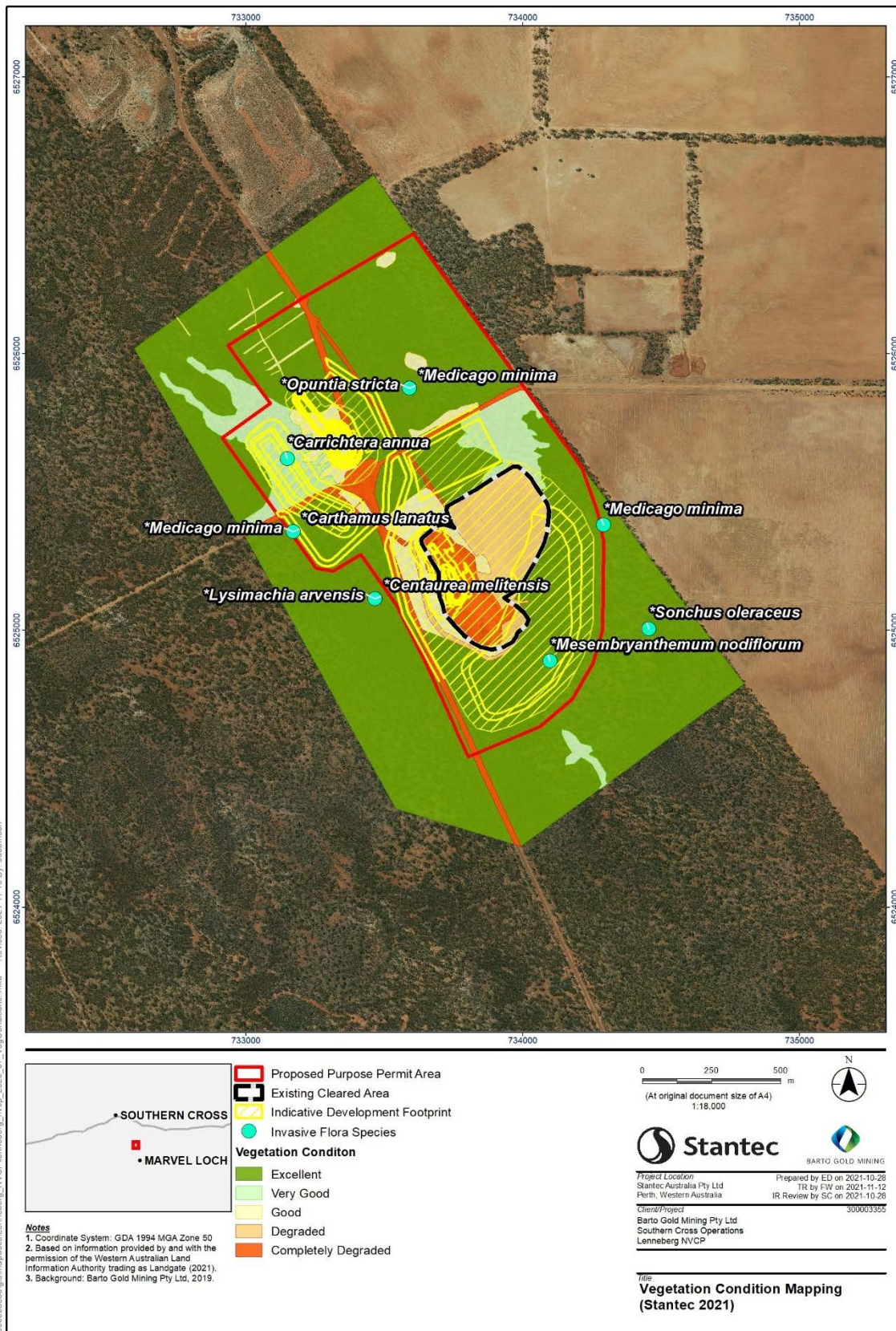
5.2.3 Vegetation Condition

Vegetation condition within the Survey Area ranged from 'Excellent' to 'Completely Degraded', with the majority in 'Excellent' condition (approximately 77%) (Table 5-6). These areas represented intact vegetation with minimal disturbance. Approximately 43 ha (16.33%) of the Survey Area was mapped as 'Completely Degraded' through to 'Good', due to the varying presence of weed species, and the presence of access tracks and exploration drill lines. Within the Proposed Permit Area, the majority of vegetation was classified as in Excellent condition (62.3%), with the remainder mapped as 'Completely Degraded' through to 'Very Good'.

Weed diversity and density within the Survey Area was considered low, with only eight weed species recorded, all of which were noted as having less than one percent cover. Weed species were recorded in areas which had been previously disturbed. Of the weeds recorded one weed, **Opuntia stricta* is listed as a Weed of National Significance, and also a Declared Pest (s22(2)) in Western Australia under the Biosecurity and Agriculture Management Act 2007 (BAM Act). Only one specimen was found and removed by Stantec botanists so the vegetation condition in the locality was left unchanged (excellent). Weeds in the Survey Area were predominately found in areas with historic disturbance or near drilling activity.

Table 5-6: Vegetation condition recorded in the Survey Area and Proposed Permit Area.

Vegetation condition	Extent within Survey Area		Extent within Proposed Permit Area	
	Hectares (ha)	Proportion (%)	Hectares (ha)	Proportion (%)
Excellent	201.80	76.72	90.57	62.315
Very Good	18.26	6.94	13.33	9.17
Good	13.36	5.08	13.09	9.01
Degraded	13.06	4.96	13.05	8.98
Completely Degraded	16.54	6.29	15.1	10.39
Total	263.02	100	145.36	100



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Figure 5-5 Vegetation condition throughout the Survey Area.

5.2.4 Pre-European Vegetation

Vegetation mapping of Western Australia was completed on a broad scale (1:1,000,000 and 1:250,000) by Beard (1975), classifying vegetation into broad vegetation associations. These vegetation associations were re-assessed by Shepherd et al. (2002a), to account for clearing in the intensive land use zone, and to divide some larger vegetation units into smaller units. In addition, Shepherd et al. (2002a) developed a series of systems to assist in the removal of mosaics; however, some mosaics still occur.

The Survey Area is situated within a single vegetation association (Yilgarn 1068.1) (**Table 5-4**). The significance of clearing a particular vegetation association can be determined by comparing current and pre-European extents. A 30% threshold level of the pre-European extent of a vegetation type is designated by the EPA's Position Statement No. 2 (EPA, 2000), as a required retention threshold; below which clearing is considered to compromise species diversity at an ecosystem level. The current extent of the vegetation associations is above the 30% threshold across all four scales of assessment (**Table 5-4**) (State, bioregion, subregion and Local Government Area; LGA) (Government of Western Australia, 2020). Given the small size of the proposed Purpose Permit Area, it is also unlikely that additional clearing on such a small scale will significantly reduce the overall extent.

Table 5-4: Extent of pre-European vegetation associations remaining across four scales (State, Bioregion, and Subregion) and within the Survey Area. Vegetation system associations described by Shepherd et al (2002) correspond with that of Beard (1975a).

System/ System code	Description	Extent in Proposed Permit Area (ha)	Scale	Pre- European extent (ha)	Current extent (ha)	Proportion remaining (%)	Current extent within IUCN Class I- IV reserves (ha)	Proportion of current extent protected within IUCN Class I-IV reserves (%) ¹
Yilgarn 1068.1	Medium woodland; salmon gum, morrel, gimlet & <i>Eucalyptus sheathiana</i>	145.36	State-wide	268,900	142,088	52.8	16,761	6.2
			Coolgardie bioregion	193,988	104,804	54.0	14,154	7.3
			Southern Cross subregion	193,988	104,804	54.0	14,154	7.3
			Shire of Yilgarn LGA	268,900	142,088	52.8	16,761	6.2

¹: includes existing National Parks, Nature Reserves, Conservation Parks, 5(g) Reserves (DBCA Conservation Reserves), DBCA conservation estate, Bush Forever on DBCA managed lands and Bush Forever in regional Parks.

Note: Area values have been rounded to the nearest whole number.

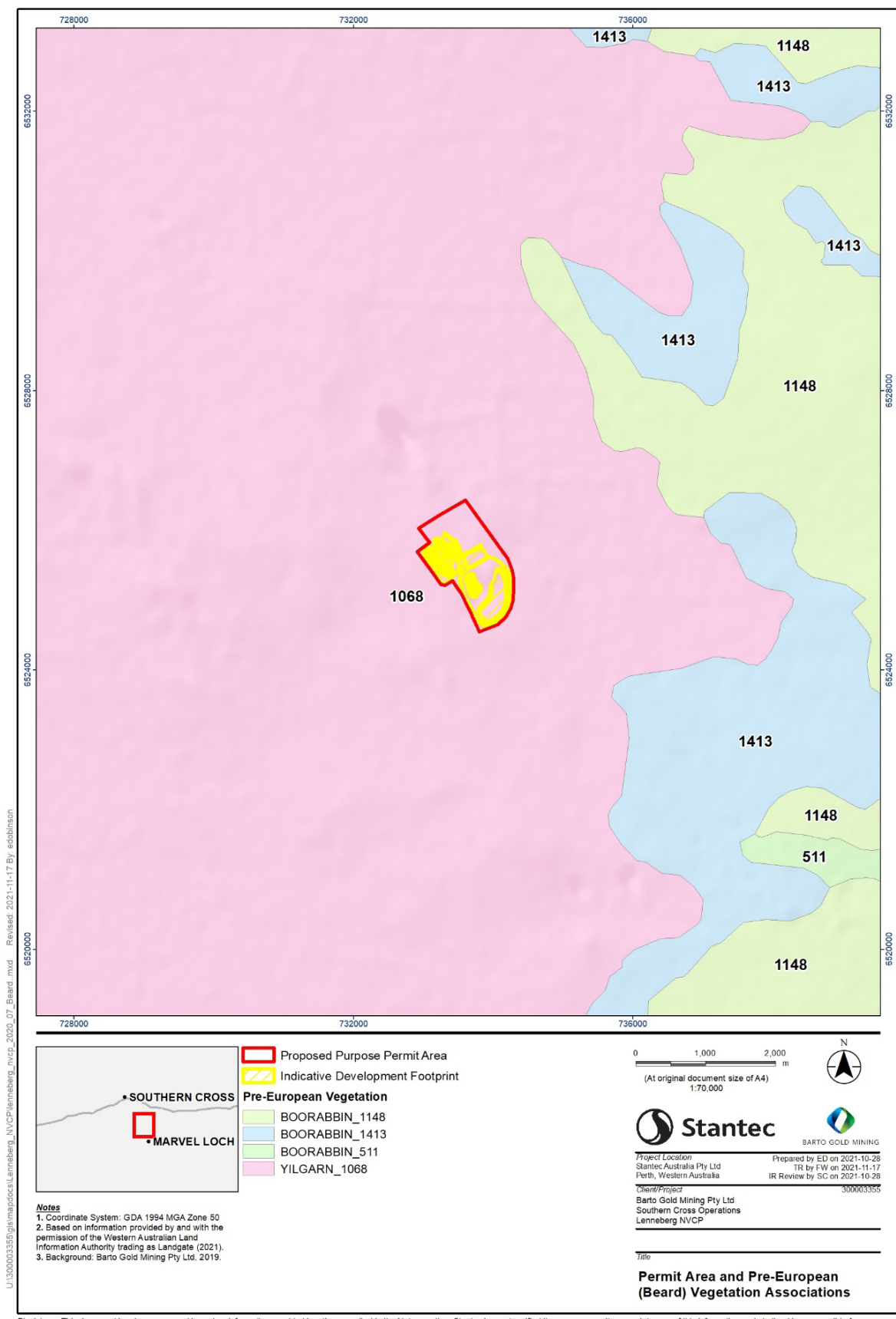


Figure 5-6: Pre-European Vegetation

5.3 Terrestrial Fauna

The Fauna Survey was combined with the Flora and Vegetation Survey and conducted by Stantec in October 2020 and March 2021 (**Appendix B**). The Survey Area encompasses and extends beyond the proposed Purpose Permit Area (Stantec, 2021b).

5.3.1 Survey Objectives and Methods

The objective of the Survey was to assess the fauna values of the Survey Area, including fauna of significance and significant fauna habitat.

The recommended timing for fauna surveys to be undertaken in the South-Western Interzone is between October-December (Primary survey) and February-March (Secondary survey) for reptiles; May-June, July-August and November-December for amphibians; September-December and November-March for birds and September-December for mammals (EPA 2020).

5.3.1.1 Desktop Assessment

Database searches were completed to generate a list of terrestrial fauna previously recorded within, and in the vicinity of, the Survey Area, with an emphasis on species and communities of conservation significance and introduced species.

A literature review considered four publicly available survey reports of relevance to the Survey Area, comprising two flora and fauna, one biodiversity and one fauna survey.

5.3.1.2 Field Survey

Field surveys were undertaken by Stantec in April and September 2020 (Stantec, 2021b), and comprised a terrestrial fauna habitat assessment, opportunistic records, and motion-sensing cameras. The objectives were to verify the accuracy of the desktop study, and document specific terrestrial fauna habitat types and species of conservation significance within the Survey Area.

The Survey Area was traversed on foot with major fauna habitat types being described and delineated based on landforms and vegetation types. Fauna habitat assessments were undertaken at each quadrat within the Survey Area, with the key habitat parameters recorded. Opportunistic records were made to document fauna assemblages and species of significance within the Survey Area. Any evidence of species encountered, including secondary signs such as the presence of tracks, diggings, scats, burrows and nests were recorded using the Survey123 in-field (electronic) data collection application.

Within the Study Area three motion-sensing cameras were deployed between June-July 2021 (29 nights) to record fauna species unlikely to be sighted opportunistically during field surveys. This timeframe is considered effective at capturing the presence of native mammal taxa within the area (Stantec Unpublished Data, 2021b). Cameras were placed in areas likely to support fauna of significance and in areas displaying fauna activity, e.g., burrows, mounds, and foraging evidence.

5.3.2 Fauna Habitats

One broad fauna habitat type was identified and delineated from fauna habitat assessments across the Survey Area, in conjunction with landforms and vegetation types. This fauna habitat was described as 'Eucalyptus Woodlands', comprising 88.74% of the Survey Area, while cleared/disturbed areas represented the remaining 11.26%.


The fauna habitat is described in **Table 5-5** and the extent of this habitat has been mapped in **Figure 5-7**. This habitat was defined in terms of distribution and significance according to the following criteria:

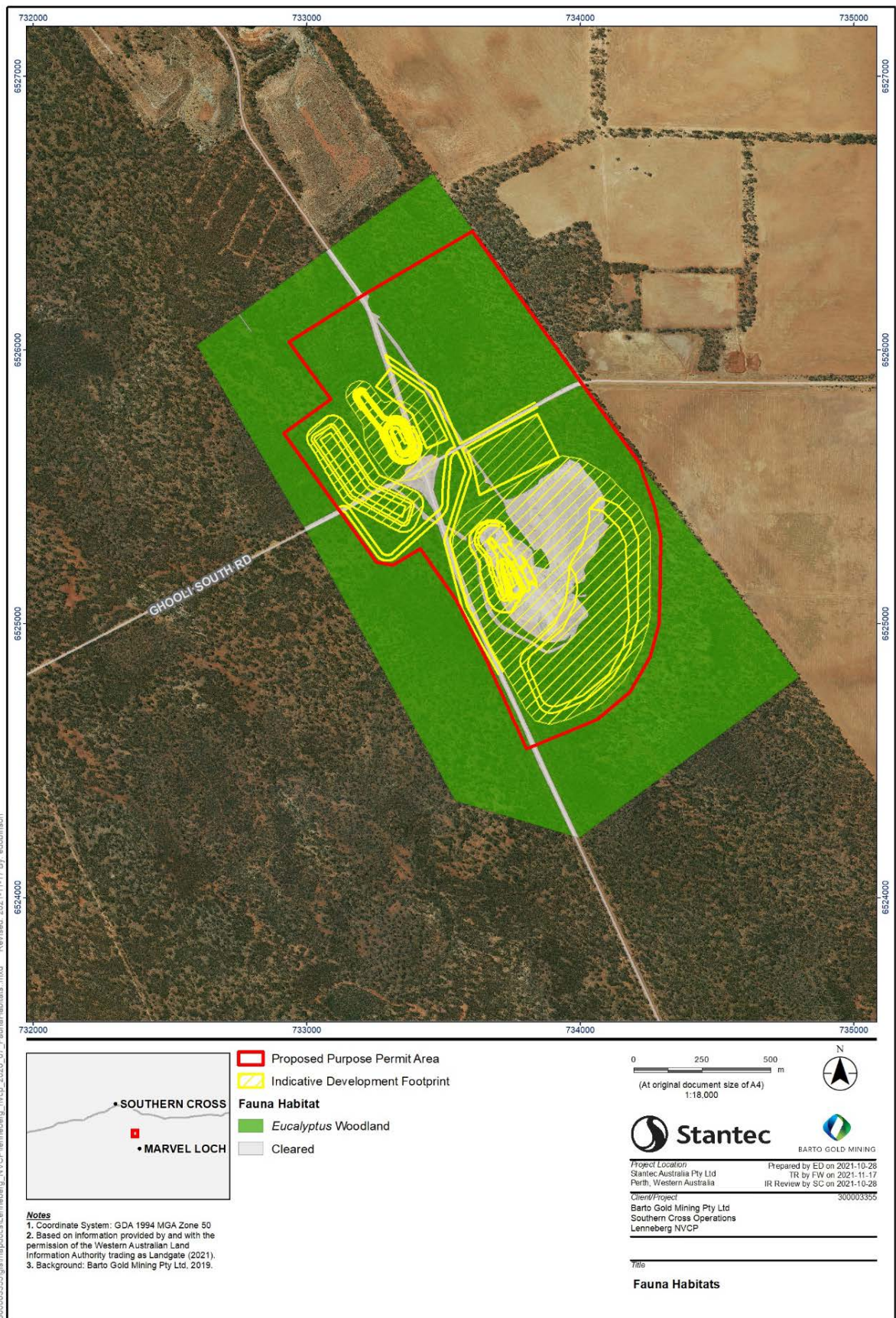
- **Distribution:** Habitats that are widespread and common throughout the Survey Area are categorised as Widespread; otherwise, they are categorised to have 'Limited Extent'. The single habitat category within the Survey Area (*Eucalyptus Woodlands*) was 'Widespread' (**Table 5-5**).
- **Significance:** Habitats considered important to species of significance that were confirmed or likely to occur, or distinct fauna assemblages that were deemed Significant; otherwise, they were categorised as being of 'Limited Significance'. The *Eucalyptus woodlands* habitat category was considered 'Significant' and may support significant fauna, particularly listed threatened species or distinct assemblages (**Table 5-5**).

The *Eucalyptus Woodlands* fauna habitat was identified as important to species of significance. The large hollow bearing trees provide important habitat for the Western Rosella (*Platycercus icterotis xanthogenys*) (inland pop.) (P4) and the Peregrine Falcon (*Falco peregrinus*) (OS). In addition, the thick vegetation at some

sites may also serve as suitable foraging habitat for the Western Rosella within this habitat type. Large woody debris and logs present in the *Eucalyptus* Woodlands habitat may provide denning habitat for the Chuditch (*Dasyurus geoffroyi*) (Vu; Vu).

Table 5-5: Fauna habitats recorded within the Survey Area.

Habitat and Category	Extent within Survey Area		Extent within Proposed Permit Area		Vegetation Codes	Broad Description and Value to Fauna	Reference Photographs
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)			
Eucalyptus Woodlands Widespread Significant	233.39	88.74	116.99	80.49	EIEsEsuMpEiISaOm EIEsp.EyMpTcOm EIEsuMpAv EIIAcMhAaBssDb	<p>Gently undulating terrain dominated by a woodland of <i>Eucalyptus longicornis</i>, <i>Eucalyptus salmonophloia</i>, <i>Eucalyptus salubris</i> and <i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i> over <i>Melaleuca</i> spp. tall shrubland over low open shrubland. The habitat ranged from relatively open areas dominated by mature tall Eucalypts to densely vegetated areas with immature Eucalypts, regenerating after fire. Mallee forms of the Eucalypts also occurred within the Eucalypt Woodland habitat.</p> <p>This habitat supports high levels of leaf litter and large woody debris, forming shelter for a range of fauna such as the Chuditch (<i>Dasyurus geoffroi</i>). While mature Eucalypt trees may contain hollows and provide suitable nesting and/or roosting habitat for a range of avifauna, including the Western Rosella (P4) and Peregrine Falcon (OS) (however the species preferentially nests in cliff faces (Menkhorst et al., 2017). Areas of mature Eucalypt woodland with thick vegetation may serve as suitable foraging habitat for the Western Rosella which has been recorded within this habitat outside the Survey Area. This habitat may also support Malleefowl mound building and the Western Brush Wallaby, which have been recorded in the vicinity of the Survey Area.</p>	
Cleared	29.63	11.26	28.16	19.37	-	Degradation associated with infrastructure and clearing for exploration. Habitat considered of little to no value to fauna.	N/A
Total	263.02	100	145.36	100	-	-	-



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Figure 5-7: Fauna Habitat Mapping.

5.3.3 Fauna Assemblage

Stantec has undertaken extensive surveys in the throughout the SXO mining tenements. In total, 31 vertebrate fauna species were recorded within or in the vicinity of the Lenneberg Survey Area (**Table 5-6**). Three of the fauna species were introduced species: the Rabbit (*Oryctolagus cuniculus*), Feral Cat (*Felis catus*) and Red fox (*Vulpes vulpes*) (**Table 5-6**). Of these species only the Red Fox was captured on one of the motion-sensing cameras installed within the current Survey Area (**Plate 5-2**).

Table 5-6: Vertebrate fauna species recorded within the vicinity of the Survey Area.

Species	Common name	Conservation Status	
		WA	EPBC
Aves			
<i>Leipoa ocellata</i>	Malleefowl	Vu	Vu
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar		
<i>Barnardius zonarius</i>	Australian Ringneck		
<i>Cacatua roseicapilla</i>	Galah		
<i>Cinclosoma clarum</i>	Copper-backed Quail-thrush		
<i>Climacteris rufus</i>	Rufous Treecreeper		
<i>Corvus coronoides</i>	Australian Raven		
<i>Drymodes brunneopygia</i>	Southern Scrub-robin		
<i>Malurus pulcherrimus</i>	Blue-breasted Fairy-wren		
<i>Oreoica gutturalis</i>	Crested Bellbird		
<i>Ocyphaps lophotes</i>	Crested Pigeon		
<i>Pachycephala occidentalis</i>	Western Whistler		
<i>Pomatostomus superciliosus</i>	White-browed Babbler		
<i>Rhipidura leucophrys</i>	Willie Wagtail		
<i>Strepera versicolor</i>	Grey Currawong		
<i>Cracticus tibicen</i>	Australian Magpie		
<i>Dromaius novaehollandiae</i>	Emu		
<i>Grallina cyanoleuca</i>	Magpie-lark		
Mammalia			
<i>Dasyurus geoffroii</i>	Chuditch	Vu	Vu
<i>Notamacropus irma</i>	Western Brush Wallaby	P4	
<i>Osphranter robustus</i>	Euro		
<i>Notomys mitchellii</i>	Mitchell's Hopping Mouse		
<i>Felis catus</i>	*Feral Cat		
<i>Oryctolagus cuniculus</i>	*Rabbit		
<i>Vulpes vulpes</i>	*Red Fox		
<i>Sminthopsis dolichura</i>	Little Long-tailed Dunnart		
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna		
Reptilia			
<i>Ctenophorus cristatus</i>	Bicycle Dragon		
<i>Moloch horridus</i>	Thorny Devil		
<i>Tiliqua occipitalis</i>	Western Blue-tongue		
<i>Varanus gouldii</i>	Sand Monitor		

* Denotes introduced fauna species.



Plate 5-2: The Red Fox (*Vulpes vulpes*), captured by motion-sensing camera within the Survey Area

5.3.4 Fauna of Significance

Of the 247 species of vertebrate fauna identified during the desktop assessment, 20 species are listed as being of significance, comprising six mammals, 12 birds, and two reptiles. Of these:

- seven are listed as Threatened under the EPBC Act and/or BC Act.
- five are recognised by DBCA as priority fauna (DBCA recognises several species that are not listed under the BC Act or the EPBC Act, but for which there is some conservation concern, and has produced a supplementary list of priority fauna).
- one species, the Peregrine Falcon (*Falco peregrinus*) is recognised by the State (BC Act), as being in need of special protection.
- one species, the Red-tailed Phascogale (*Phascogale calura*), is recognised by the State (BC Act) to be conservation dependent.
- seven species are listed as Migratory under the EPBC Act or listed as under International Agreement under the BC Act: and
- one species, the Bilby (*Macrotis lagotis*), is considered to be extinct in the Coolgardie and Avon Wheatbelt bioregions (Woinarski et al., 2014) and are therefore unlikely to occur within the Survey Area.
- three invertebrates of significance were recorded as potentially occurring within the Survey Area, two of which are aquatic and the remainder terrestrial.

Some of the species, listed as threatened, migratory and/or priority fauna, may be included in multiple categories. The likelihood for species of significance occurring in the Survey Area was assessed and ranked based on the following definitions:

- Likely: There is a medium to high likelihood that the species occurs in the Study Area as it occurs within the known distribution of the species, contains suitable habitat (either year round or intermittently, such as temporary water sources or features that are only relied upon during certain times of the year e.g. breeding caves, for fauna) and the species has been recorded recently nearby.
- Possible: There is a potential for the species to occur in the Study area, as:

- o The species has been recorded recently nearby, however; the species may not have been detectable during current or previous studies (e.g. rare, patchily distributed, highly mobile (fauna), non-optimal study timing).
- o the species is known to be cryptic and may not have been detectable despite extensive studies.
- o The species has been recorded recently nearby and species presence cannot be ruled out due to factors such as species ecology or distribution, however;
 - doubt remains over taxonomic identification.
 - the majority of habitat does not appear suitable.
 - coordinates are doubtful.
- Unlikely: The species is unlikely to occur in the Study Area as:
 - o the species has not been recorded locally through DBCA database searches;
 - o the Study Area lacks potential or critical habitat, supporting at best marginally suitable habitat, and/or being severely degraded;
 - o only recorded from a few historic record/s and no other collections in the area; and
 - o the species has not been recorded in the Study Area despite adequate Study efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.

Seven species were considered likely to occur within the Proposed Permit Area, comprising the Chuditch (*Dasyurus geoffroyi*) (Vu, Vu), Western Brush Wallaby (*Notamacropus irma*) (P4), Malleefowl (*Leipoa ocellata*) (Vu, Vu), Western Rosella (*Platycercus icterotis xanthogenys*) (P4), Peregrine Falcon (*Falco peregrinus*) (OS), Woma Python (southwest pop) (*Aspidites ramsayi*) (P1) and the Tree-stem trapdoor spider (*Aganippe castellum*) (P4). One species, the Lake Cronin Snake (*Paroplocephalus atriceps*) (P3), was considered to possibly occur. The remaining 12 species were considered 'Unlikely' to occur within the Survey Area based on a lack of recent records, unsuitable habitat and/or the Survey Area occurring outside the known species range, with specific details presented in **Appendix B**.

5.3.4.1 Red Tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) and Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)

Database search results confirm that the Red-Tailed Black-Cockatoo species *Calyptorhynchus banksii* was recorded recently nearby, with several records along Coolgardie Road 19 km from the Survey Area (Birdlife Australia, 2019). Based on the location of the Survey Area, these are likely to represent the *Calyptorhynchus banksii* subsp. *samuelli* (Menkhorst et al., 2019), which is not a listed species.

The closest records of Threatened Black Cockatoos to the Survey Area are approximately 100 km to the south of the Survey Area (DBCA 2020b). The closest breeding site (confirmed, buffered 12 km) is approximately 125 km south south-west of the central point coordinates. There were no roost sites (buffered 6 km) within a 200 km radius of the coordinates. Based on the distributions, the Western Australian threatened Black Cockatoo species (DotEE, 2017), Red-Tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) (Vu, Vu) and Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) (En, En) do not occur within the Survey Area. Therefore, they have not been considered any further in this assessment (and were subsequently excluded from significant species numbers).

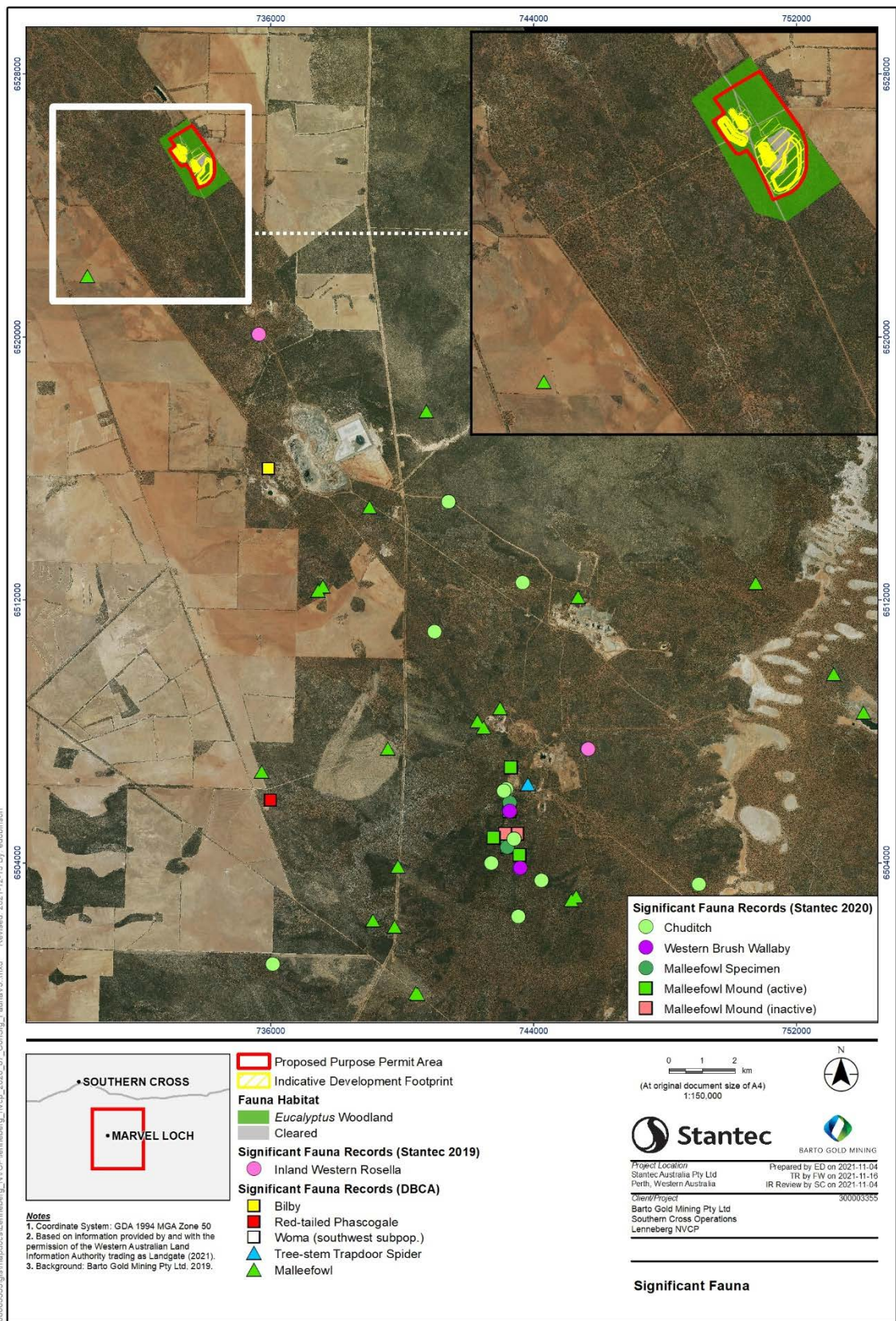
5.3.4.2 Malleefowl (*Leipoa ocellata*)

Malleefowl have been recorded recently in the surrounds on numerous occasions, including sightings and active mounds. Seven active mounds were recorded within 25 km of the Survey Area in the Phoenix, Bronco, Brumby Zeus and Windmills areas in Shrubland and *Eucalyptus* Woodland habitats (Stantec, 2021c, Stantec, in prep), and one historic species record occurs within 15 km of the Survey Area (DBCA, 2020b) (**Figure 5-8**). In addition, Botanica (2016b) recorded seven inactive Malleefowl mounds, one individual and one set of tracks within different areas, though predominantly in the Sandplain Shrublands (recorded over 50 km from this Survey Area).

5.3.4.3 Chuditch (*Dasyurus geoffroyi*)

Chuditch (*Dasyurus geoffroyi*) have been recorded within the SXO area, predominantly to the southeast. The closest have been recorded via motion cameras approximately 14 km south, with the greatest abundance of Chuditch recorded at three locations approximately 22 km south in the Phoenix, Bronco, Brumby Zeus Survey Area (Stantec, 2021a). Of these locations one occurred within the Eucalypt Woodland habitat and the remaining two within Shrubland habitat. The Western Brush Wallaby (*Notamacropus irma*) was recorded

once via motion-sensing camera within Shrubland habitat in the Phoenix, Bronco, Brumby Zeus Survey Area, approximately 23 km south of the Survey Area.



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Figure 5-8: Significant Fauna Records

6. Environmental Management Measures and Rehabilitation

6.1 Approved Policies and Planning Instruments

The clearing of native vegetation in Western Australia is regulated under Part V of the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations).

In addition to the matters considered in accordance with section 51O of the EP Act, Barto has also had regard for the below statutes, policies and guidelines:

Other Legislation of relevance for assessment of native vegetation clearing:

- *Biodiversity Conservation Act 2016 (WA) (BC Act)*;
- *Conservation and Land Management Act 1984 (WA) (CALM Act)*;
- *Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act)*;
- *Soil and Land Conservation Act 1945*;
- *Rights in Water and Irrigation Act 1914*; and
- *Aboriginal Heritage Act 1972*.

Other Relevant policies and guidance documents:

- Environmental Offsets Policy (Government of Western Australia, 2011);
- A guide to the assessment of applications to clear native vegetation (DEC, December 2014);
- Procedure: Native vegetation clearing permits (DWER, October 2019);
- Technical guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016);
- Technical guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020); and
- Approved Recovery Plans for threatened species.

6.2 Avoidance Measures - Proponent-led Modifications of design to avoid impacts to Priority Species

Barto is committed to appropriately managing its activities and ensuring any potential impacts to the environment are managed appropriately.

Biological surveys identified a number of priority flora species clustered within the Survey Area and original alignment of the Project's indicative footprint of the mining infrastructure, of particular concern being impacts to *Rinzia fimbriolata* (P1). The recording of these priority species resulted in Barto implementing a number of proponent-led avoidance measures to avoid and minimise impacts to significant flora species. These measures included:

- Modification of the Project's infrastructure location and design to avoid all occurrences of *R. fimbriolata* and the associated 50 m buffer so that no direct impacts will occur. The proposed Purpose Permit Area has been designed to avoid any direct impact to *R. fimbriolata* and the associated 50 m buffer.
- The proponent will take additional measures to avoid impacts to *R. fimbriolata* through dust management and minimalization, prohibit any unauthorised entry.
- The southwestern boundary of the proposed Purpose Permit Area has been adjusted to minimise the interactions with *Stenanthemum bremerense* (P4) population associated with a stoney rise feature in the landscape.

Furthermore, Barto are commitment to undertaking all compliance functions stipulated by applicable laws and regulations, and the operation will require all employees to exercise appropriate environmental practices. Environmental management includes, but is not limited to:

- identifying risk and hazards;
- operational environmental management plans;
- training and competencies;
- monitoring programs;
- auditing and inspections;
- incident investigation; and
- reporting requirements.

6.3 Measures to Minimise and Manage

6.3.1 Land Clearing and Flora Management

Barto will ensure all clearing and ground disturbance is carried out in accordance with their Surface Disturbance and Clearing Procedures. Noting this, the following methods of vegetation clearing will be implemented during the construction phase of the Project. The following actions will be implemented to minimise and manage land disturbance impacts:

- prior to clearing, an internal Surface Disturbance Permit (SDP) will be completed and signed off by the Environment Department;
- the disturbance permit will identify any conditions that apply to the clearing area (including any protected areas / species to be avoided where practicable);
- delineating the clearing area will be walked and marked with survey pegs and flagging tape to ensure only the surveyed area is cleared;
- clearing will not be undertaken until construction is imminent, thus minimising erosion and dust risks;
- environmental awareness training is completed by personnel involved in clearing activities (including identification of flora of conservation significance);
- use of a spotter during clearing of external boundaries to ensure clearing remains within surveyed area;
- implementation of fire management practices;
- no burning of vegetation spoil will occur on site; and
- all cleared vegetation will be stockpiled for later use in rehabilitation activities.

6.3.2 Weed Management

Barto will aim to prevent the introduction of weeds and limit the spread of weeds in the proposed Purpose Permit Area as far as practicable. The following management actions will be implemented to minimise the risk of introduced flora within the Project area:

- Weed, Seed and Hygiene Certificates (Doc No. SX-EN-FO-0031) will be presented as verification prior to mobilisation;
- all vehicles and equipment will be cleaned before mobilisation to the proposed Purpose Permit Area, to remove all dirt and vegetative materials;
- vehicle and equipment washdown will only occur at an appropriate facility;
- off-road vehicle use will be strictly controlled with no driving permitted off designated roads; and
- any new weed outbreaks will be recorded in the operation's Incident Reporting system and managed in accordance with site environmental procedures.

6.3.3 Fauna

Barto will aim to ensure fauna species are not adversely affected, via either direct impacts or impacts to habitat as far as practicable. The following management actions will be implemented to minimise the potential impacts on fauna:

- Pre-clearance surveys within areas designated to be cleared will be undertaken in the morning of clearing to search for the presence of significant fauna species within the specified clearing areas;
- Engagement of Fauna Spotter to be present during clearing activities to ensure the site is clear of significant fauna species, and stop work orders will be implemented if significant fauna species are spotted within 50 m of an active site. Work will only commence 15 minutes after the significant fauna species has been determined to have exited the area;
- No night time clearing to avoid nocturnal species;
- Awareness training will outline the appropriate behaviour and responses in the event of contact with native fauna;
- Native fauna will not be captured, fed, harmed or disturbed. If relocation is required, the site Environmental Department will be contacted;
- All significant fauna deaths will be reported through the site Incident Reporting system;
- SDP will be required for all clearing, in accordance with **section 6.3.1**;
- Open excavations will be monitored regularly to ensure that any trapped fauna are rescued and released as quickly as possible;
- Water holding infrastructure, including any turkey's nests will have fauna egress matting installed as required;
- Rehabilitation will be conducted progressively where possible;
- No pets or other animals will be brought to the Project site; and
- All bores will be capped.

6.3.4 Dust Deposition on Vegetation

Barto will aim to minimise the fugitive dust emissions and other air quality issues created during construction and operation of the site, by:

- Use of water to suppress dust emissions from unsealed roads, stockpiles and work areas as required;
- Reducing vehicle speeds as appropriate, if dust emissions from roads are visually excessive;
- Where possible, schedule operational activities to avoid activities that may generate excessive dust during high winds;
- Ensure dust suppression activities keep saline water spray within the haul road and infrastructure footprints;
- Implement water truck operating procedures and train water cart operators of the potential impacts of saline water on vegetation;
- Construct and / or maintain roadside drainage so that water run-off from the haul road will be contained during rainfall events;
- Not use saline water for dust suppression during topsoil / subsoil harvesting or rehandling;
- Report any community complaints regarding dust levels or any dust levels that are deemed as excessive as an incident; and
- Not burn any materials on site, unless specifically authorised by the General Manager.

6.3.5 Soil and Topsoil Management

Topsoil is an important resource for rehabilitation of disturbed sites, which need to be managed effectively. Incorrect management of topsoil can impact upon the soil structure and decrease its usefulness in rehabilitation. Topsoil will be managed by:

- vegetation, topsoil and subsoil will be stockpiled as per the SDP plan;
- topsoil will be stripped to required depth (maximum 250 mm);
- topsoil not to be used for windrows or surface water management;
- materials/equipment not to be stored on topsoil stockpiles;
- stockpiles to be marked out on maps/recorded on GIS with volumes; and
- weed, seed and hygiene requirements will be met.

6.3.6 Water Management

The proposed Purpose Permit Area is not located within any major drainage lines or watercourses; therefore, clearing is not expected to impact surface water flows. Additionally, the proposed clearing is not located in proximity to any Public Drinking water Source Areas.

Surface water management measures will be implemented if required to divert surface water flows from mining infrastructure.

Clearing is unlikely to impact on groundwater quality provided that groundwater contamination from use of hydrocarbons and chemicals is avoided, as per management actions detailed in **section 6.3.7**.

Barto will aim to minimise impacts on the quality of surface water and avoid unnecessary disturbance to natural surface drainage. There is potential for the proposed development to affect local surface water systems, however, direct impacts on surface water features are limited. General recommendations for surface water management that will be considered for all mine infrastructure areas include:

- diversions and drains – where there are potential risks of stormwater runoff impacts from upslope areas, i.e. excessive ponding or inundation to key infrastructure and operational areas and requirements to maintain flows to downstream areas;
- erosion and sediment control measures – where there is a risk of discharge of mine affected or sediment laden runoff to downstream environments; and
- culverts and road cross-drainage options – where there are risks of modification to downstream flow, particularly for linear infrastructure developments.

6.3.7 Hydrocarbon Management

Barto will actively manage the storage and use of hydrocarbon in machinery and vehicles to minimise and contain spillages and uncontrolled releases from impacting on vegetation causing death or health decline, as result of soil or water contamination. Increased vehicle activity during construction and development may result in hydrocarbon spills, however Barto aims to minimise such impacts by:

- ensuring hazardous materials are approved prior to site entry;
- ensuring hydrocarbons and chemicals are safely stored;
- ensuring that hydrocarbon and other hazardous wastes are collected, treated, transported and disposed of in an environmentally sound manner, in accordance with regulatory and legislative requirements;
- ensuring that the risk of hydrocarbons and hazardous waste spills is minimised; and
- making effective spill clean-up material readily available at each work site and on all mobile service trucks or vehicles, and where hydrocarbons and chemicals are stored and / or used.

6.4 Rehabilitation Management

The Mining Proposal and Mine Closure Plan for the Victoria, Vinto La and Glendower Open Pit Project (REG ID 94235) will be amended to capture the Lenneberg Project and mine closure activities. All clearing activities outlined in this NVCP Application will be addressed in the revised MCP.

Rehabilitation of the Lenneberg project area will be conducted at the end of the project life. Due to the short duration of the project progressive rehabilitation is unlikely, however will be undertaken if possible. Ongoing monitoring will be implemented during and post the life of the Project to ensure legal obligations and closure objectives are met. Rehabilitation activities will aim to meet post closure land use objectives. Barto will:

- continue to consult with key stakeholders throughout the life of the Project and at closure;
- ensure the rehabilitated land surfaces are safe and stable; and
- undertaken rehabilitation tasks detailed in the MCP.

7. Assessment Against the Clearing Principles

7.1 Scale of the Proposed Clearing

The proposed Purpose Permit Area covers an area of 145.36 ha, of which 62.31% (90.57 ha) is in 'excellent' condition, 9% (13.09 ha) is in good condition and 8.98% (13.06 ha) is degraded. The Project will require clearing of up to 55 ha of this 100.16 ha (78.38%) is within *Eucalyptus* Woodland. One Priority Ecological Community (PEC), the 'Parker Range vegetation complexes' PEC has also been identified approximately 6km south of the Survey Area.

7.2 Clearing Principles

The proposed clearing works were assessed against the 10 Clearing Principles for native vegetation as listed in Schedule 5 of the Environmental Protection Act (**Table 7-1**).

The 10 Clearing Principles, listed under Schedule 5 of the *Environmental Protection Act 1986*, stipulate when native vegetation should not be cleared. The proposal to clear native vegetation for Barto's Lenneberg project area, located within their Southern Cross Operations, is considered in terms of these principles, in accordance with the Department of Environment Regulation (now Department of Water and Environment Regulation) assessment guidelines (DER 2014).

As detailed design has progressed an indicative development footprint has been delineated to accommodate the mining infrastructure and is approximately 55 ha within the 145.36 ha proposed Purpose Permit Area (**Figure 2-1**). The clearing will not extend beyond the proposed Purpose Permit Area and will commit to avoiding and minimising impacts to Priority Flora as far as practical.

The following sections address each of the Ten Clearing Principles as specified in Schedule 5 of the *Environmental Protection Act (1986)* (EP Act). These assessments have been made using the information obtained from the Flora, Vegetation and Fauna Survey (Stantec, 2021b).

Table 7-1: Assessment of proposed clearing of native vegetation within the proposed Purpose Permit Area against the 10 Clearing Principles.

Clearing Principle	Justification of Variance	Reference	Variance
<p>Principle (a)</p> <p>Native vegetation should not be cleared if it comprises a high level of biological diversity.</p>	<p>The Survey Area is 263.02 hectares (ha) in size, of which 233.42 (88.7%) contains remnant vegetation. A total of 77 confirmed vascular flora taxa, representing 24 families and 41 genera were recorded during the field survey. No Commonwealth or State-listed threatened flora were recorded within the Survey Area. Two State-listed priority flora species were recorded during the survey, including:</p> <ul style="list-style-type: none"> • <i>Rinzia fimbriolata</i> (P1) – 6 individuals within the Survey Area, none within the proposed Purpose Permit Area. • <i>Stenanthemum bremerense</i> (P4) – 12 individuals within the Survey Area, none within the proposed Purpose Permit Area. <p>Both Priority species have been recorded within five kilometers of the Survey Area, either from database search results or previous surveys. However, neither have been recorded within the Proposed Permit Area.</p> <p>No Threatened Ecological Communities (TECs) are known to occur within the proposed Purpose Permit Area; however, one TEC, the 'Eucalypt Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)' has been mapped within 13km of the Survey Area. One Priority Ecological Community (PEC), the 'Parker Range vegetation complexes' PEC has also been identified approximately 6km south of the Survey Area.</p> <p>No conservation significant fauna have been recorded recently within the Proposed Purpose Permit area; however, malleefowl (<i>Leipoa ocellata</i>) (Vu, Vu) have been recorded recently in the surrounds (20 km south), including sightings and active mounds. Similarly, Chuditch (<i>Dasyurus geoffroi</i>) have been recorded at three locations via motion-sensing camera approximately 14 km south of the Survey Area. The desktop assessment identified seven terrestrial fauna species of significance as being 'likely' to occur within the Survey Area: Chuditch (<i>Dasyurus geoffroi</i>), Western Brush Wallaby (<i>Notamacropus irma</i>) (P4), Malleefowl (<i>Leipoa ocellata</i>) (Vu, Vu), Western Rosella (<i>Platycercus icterotis xanthogenys</i>) (P4), Peregrine Falcon (<i>Falco peregrinus</i>) (OS), Woma Python (southwest pop) (<i>Aspidites ramsayi</i>) (P1) and the Tree-stem trapdoor spider (<i>Aganippe castellum</i>) (P4).</p> <p>One fauna habitat was described for the proposed Purpose Permit Area and is considered important for significant species: <i>Eucalyptus</i> woodland. The large hollow bearing trees provide important habitat for the Western Rosella (<i>Platycercus icterotis xanthogenys</i>) (inland pop.) (P4) and the Peregrine Falcon (<i>Falco peregrinus</i>) (OS). In addition, the thick vegetation at some sites may also serve as suitable foraging habitat for the Western Rosella within this habitat type. Large woody debris and logs present in the <i>Eucalyptus</i> Woodlands habitat may provide denning habitat for the Chuditch (<i>Dasyurus geoffroi</i>).</p> <p>Based on the survey findings and the desktop assessment, the fauna habitat, biological diversity and occurrences of priority species within the proposed Purpose Permit Area are considered widespread throughout the surrounding regional environment and not considered restricted to the area of clearing. Although clearing in an area that support a high biodiversity of flora and fauna, due to the small scale of clearing, short duration of the project, proposed management controls and rehabilitation commitments, it can be concluded that the proposed clearing will not be at variance with this principle.</p> <p>The proposed clearing is unlikely to be at variance with this Principle.</p>	<p>DBCA (2019a) DBCA (2020f, 2020g) Commonwealth of Australia (2020a) DPIRD (2020) Cowan <i>et al.</i> (2001) Stantec (2019) Gibson and Lyons (1998) Recon Environmental (2008b)</p>	<p>Unlikely to be at variance</p>
<p>Principle (b)</p> <p>Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.</p>	<p>The proposed Purpose Permit Area contains one broad fauna habitat: <i>Eucalyptus</i> Woodland. This habitat is considered typical of the Southern Cross subregion and was broadly represented outside of the Survey Area.</p> <p>No conservation significant fauna have been recorded recently within the Proposed Purpose Permit area. The desktop assessment identified seven terrestrial fauna species of significance as being 'likely' to occur within the Survey Area: Chuditch (<i>Dasyurus geoffroi</i>) (Vu, Vu), Western Brush Wallaby (<i>Notamacropus irma</i>) (P4), Malleefowl (<i>Leipoa ocellata</i>) (Vu, Vu), Western Rosella (<i>Platycercus icterotis xanthogenys</i>) (P4), Peregrine Falcon (<i>Falco peregrinus</i>) (OS), Woma Python (southwest pop) (<i>Aspidites ramsayi</i>) (P1) and the Tree-stem trapdoor spider (<i>Aganippe castellum</i>) (P4).</p> <p>Based on the survey findings and the desktop assessment, significant fauna and their habitat are known to occur within the study area and across the surrounding environment and regional landscape, and not considered restricted to the area of clearing. Development of the proposed Purpose Permit Area is highly unlikely to fragment, restrict or isolate any populations of conservation significant fauna species.</p> <p>The proposed clearing is unlikely to be at variance with this Principle.</p>	<p>Cowan <i>et al.</i> (2001) Stantec (2019) GHD (2016) Botanica (2016b)</p>	<p>Unlikely to be at variance</p>
<p>Principle (c)</p> <p>Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.</p>	<p>No Commonwealth or State-listed threatened flora were recorded within the proposed Purpose Permit Area or were considered to have potential to occur. Two State-listed priority flora species, <i>Rinzia fimbriolata</i> (P1) and <i>Stenanthemum bremerense</i> (P4), were recorded from six and 12 locations, respectively. The nearest population of <i>S. bremerense</i> is recorded approximately >50m away from the Proposed Permit Area.</p> <p>is not at variance with this Principle.</p>	<p>DBCA (2020f, 2020g) DoAWE (2020)</p>	<p>Not at variance</p>
<p>Principle (d)</p> <p>Native vegetation should not be cleared if it comprises the whole or a part of or is necessary for the maintenance of a Threatened ecological community.</p>	<p>No TECs listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) or the <i>Biodiversity Conservation Act 2016</i> (BC Act) are known to occur within or adjacent to the proposed Purpose Permit Area. The closest TEC to the Survey Area is the <i>Eucalypt Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)</i>, located approximately 13 km of the Survey Area. This TEC is restricted to the Avon Wheatbelt region, outside of the Survey Area.</p> <p>The proposed clearing is not at variance with this Principle.</p>	<p>DBCA (2020d)</p>	<p>Not at variance</p>

Clearing Principle	Justification of Variance	Reference	Variance																		
<p>Principle (e)</p> <p>Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.</p>	<p>The Survey Area occurs within the Southern Cross subregion (COO2) of the Coolgardie (COO) IBRA bioregion and is under the jurisdiction of the Shire of Yilgarn. The proposed Purpose Permit Area occurs within one pre-European vegetation association: Yilgarn (1068.1)</p> <p>Table A outlines the pre-European vegetation extents (measured in 2018) remaining within the IBRA bioregion, subregion, and within the local government area (LGA). The remaining proportions of the vegetation association for the Bioregion, Subregion and Yilgarn LGA are above the 30% threshold considered to be required for maintaining ecological viability. The area of native vegetation proposed for potential clearing (55 ha) within the Survey Area (861 ha) will not significantly reduce the pre-European vegetation extent. The proposed 55 ha of clearing would equate to a 0.4% reduction in the Yilgarn LGA for Vegetation Association 1068.</p> <p>Table A: Extent of pre-European vegetation associations remaining across three scales (Bioregion, Subregion and Local Government Area).</p> <table border="1"> <thead> <tr> <th>Vegetation Association</th> <th>Scale</th> <th>Pre-European extent (ha)</th> <th>Current extent (ha)</th> <th>Proportion remaining (%)</th> </tr> </thead> <tbody> <tr> <td rowspan="3">1068</td> <td>Bioregion (COO)</td> <td>193,988</td> <td>104,804</td> <td>54</td> </tr> <tr> <td>Subregion (COO2)</td> <td>193,988</td> <td>104,804</td> <td>54</td> </tr> <tr> <td>LGA (Yilgarn)</td> <td>268,900</td> <td>142,088</td> <td>53</td> </tr> </tbody> </table> <p>The proposed clearing not at variance with this Principle.</p>	Vegetation Association	Scale	Pre-European extent (ha)	Current extent (ha)	Proportion remaining (%)	1068	Bioregion (COO)	193,988	104,804	54	Subregion (COO2)	193,988	104,804	54	LGA (Yilgarn)	268,900	142,088	53	<p>Shepherd <i>et al.</i> (2002b)</p> <p>Government of Western Australia (2019)</p> <p>Thackway and Cresswell (1995) Cowan <i>et al.</i> (2001)</p>	Not at variance
Vegetation Association	Scale	Pre-European extent (ha)	Current extent (ha)	Proportion remaining (%)																	
1068	Bioregion (COO)	193,988	104,804	54																	
	Subregion (COO2)	193,988	104,804	54																	
	LGA (Yilgarn)	268,900	142,088	53																	
<p>Principle (f)</p> <p>Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.</p>	<p>No internationally or nationally significant wetlands are located within the proposed Purpose Permit Area. The nearest nationally important wetland is Lake Cronin, located 113 km south of the Survey Area. Numerous ephemeral watercourses and lakes occur within proximity to the Survey Area; however, none of these intersect the Survey Area.</p> <p>The proposed clearing is not at variance with this Principle.</p>	<p>State of Western Australia (2020)</p> <p>Commonwealth of Australia (2020b)</p>	Not at variance																		
<p>Principle (g)</p> <p>Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.</p>	<p>Land degradation includes any alteration to land capability, soil erosion, salinity, nutrient export, acidification, waterlogging and flooding that affects the present or future use of land.</p> <p>The Survey Area lies outside the soil landscape land quality mapping and assessment of land capability, which extends to the edge of the wheatbelt. The Survey Area occurs within one land systems.</p> <p>The Greenmount land system includes gently undulating rises to rolling low hills in the eastern Zone of Ancient Drainage. The Survey Area occurs entirely within the Greenmount System. These areas may be prone to land degradation from clearing in the form of salinisation, water logging, soil erosion and acidity.</p> <p>The proposed clearing is not at variance with this Principle.</p>	<p>State of Western Australia (2020)</p> <p>(Purdie <i>et al.</i> 2004)</p> <p>(van Gool <i>et al.</i> 2005)</p> <p>(Cowan <i>et al.</i> 2001)</p> <p>(DPIRD 2015)</p>	Not at variance																		
<p>Principle (h)</p> <p>Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.</p>	<p>The Survey Area does not overlap with any reserves or ESAs. The nearest reserves are Wockallarry and Yellowdine, both located approximately 17 km from the Survey Area.</p> <p>The proposed clearing is not at variance with this Principle.</p>	<p>State of Western Australia (2020)</p>	Not at variance																		
<p>Principle (i)</p> <p>Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.</p>	<p>The proposed Purpose Permit Area does not intersect any surface water bodies. The nearest nationally important wetland is Lake Cronin, located 113 km south of the Survey Area. Numerous ephemeral watercourses and lakes occur within proximity to the Survey Area; however, none of these intersect the Survey Area.</p> <p>The proposed clearing is not at variance with this Principle.</p>	<p>Government of Western Australia (2020)</p>	Not at variance																		
<p>Principle (j)</p> <p>Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.</p>	<p>The proposed native vegetation clearing is unlikely to alter the hydrological regime of the area leading to an increase in the frequency or intensity flooding. As the proposed Purpose Permit Area does not intersect any drainage areas or watercourses, clearing is unlikely to cause or exacerbate the incidence of flooding.</p> <p>The proposed clearing is not at variance with this Principle.</p>	<p>State of Western Australia (2020)</p>	Not at variance																		

8. Stakeholder Consultation

Shire of Yilgarn CEO 7/12/2021	Key discussion points/outcomes: <ul style="list-style-type: none">• Query from Barto regarding a potential road reserve and requirements to relocate a Shire Road to accommodate the project.• Confirmation unknown road reserve is not vested with the shire. Application and plans would be required to be submitted to Shire and DPLH for approval to divert road.
DMIRS – Native Vegetation Branch 09/12/21	Key discussion points/outcomes: <ul style="list-style-type: none">• Brief discussion permit application submission imminent, no clearing of priority species required, existing mining area.

9. Conclusion

Barto proposes to clear no more than 55 ha of native vegetation within a 145.36 ha NVCP (Purpose Permit) area as part of developing the Lenneberg Project. The proposed clearing is not at variance to principles (c), (d), (e), (f), (g), (h), (i) and (j). Clearing is unlikely to be at variance to principal (a) or (b) based on the small scale of clearing, short duration of the project, proposed management controls and rehabilitation commitments. While development of the Lenneberg Project will result in the loss of some terrestrial fauna habitat, the fauna habitat, biological diversity and occurrences of priority species within the proposed Purpose Permit Area are regionally widespread and are not considered restricted to the area of clearing.

10. References

- AUSTRALIAN GOVERNMENT 2012. Australian Stratigraphic Units Database.
- BARTO 2017. Surface Disturbance and Clearing Procedure. *In*: LTD, M. G. M. P. (ed.) *Southern Cross Operations*.
- BARTO GOLD, B. G. M. P. L. 2020. Marvel Loch West Underground Mining Proposal. Barto Gold Pty Ltd
- BEARD, J. S. 1972. The Vegetation of the Southern Cross area, Western Australia: Map and Explanatory Memoir, 1:250,000 Series. *Vegmap Publications*. Perth.
- BEARD, J. S. 1975. *Map and Explanatory Notes to Sheet 5: The Vegetation of the Pilbara Area*, Nedlands, Western Australia, University of Western Australia Press.
- BEARD, J. S. 1990. *Plant Life of Western Australia*, Kenthurst, New South Wales, Kangaroo Press.
- BIDWELL, E. J. S. 2004. Description of Ecological Communities : Arid Eucalpyt Woodlands. *University of Melbourne*.
- BIRDLIFE AUSTRALIA 2019. Birdata: Custom Atlas Bird Lists (custom search).
- BOTANICA, BOTANICA CONSULTING 2016a. Level 1 Reconnaissance Flora & Vegetation Survey of the Martin's Prospect.
- BOTANICA, BOTANICA CONSULTING 2016b. Level 2 Flora & Fauna Survey: Redwing Project For Hanking Gold Mining Pty Ltd.
- COMMONWEALTH OF AUSTRALIA. 2020. *Weeds of National Significance* [Online]. Department of Agriculture, Water and Environment. Available: <https://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html> [Accessed 2020].
- COWAN, M., GRAHAM, G. & MCKENZIE, N. 2001. Coolgardie 2 (COO2 - Southern Cross subregion). A *Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Kensington, Western Australia: Department of Conservation and Land Management.
- DBC, DEPARTMENT OF BIODIVERSITY CONSERVATION AND ATTRACTIONS 2020a. Threatened and Priority Ecological Communities Database (custom search). Kensington, Western Australia.
- DBC, DEPARTMENT OF BIODIVERSITY CONSERVATION AND ATTRACTIONS 2020b. Threatened and Priority Fauna List. *In*: DBC, D. O. B. C. A. A. (ed.).
- DOTEE, DEPARTMENT OF THE ENVIRONMENT AND ENERGY 2017. Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo (Endangered) *Calyptorhynchus latirostris*, Baudin's Cockatoo (Vulnerable) *Calyptorhynchus baudinii*, Forest Red-tailed Black Cockatoo (Vulnerable) *Calyptorhynchus banksii naso*. Department of the Environment and Energy.
- DOTEE, DEPARTMENT OF THE ENVIRONMENT AND ENERGY. 2019. *Eucalypt Woodlands of the Western Australian Wheatbelt in Species Profile and Threats Database* [Online]. Canberra, Australian Capital Territory. Available: <http://www.environment.gov.au/sprat> [Accessed 24/08/2019 2019].
- DPAW, DEPARTMENT OF PARKS AND WILDLIFE 2013. Weed Prioritisation Process for DPaw (formerly DEC) – “An integrated approach to Weed Management on DPaw-managed lands in WA”.
- DPIRD, D. O. P. I. A. R. D. 2017. Managing Opuntoid Cacti. Best practice control manual for *Austrocylindropuntia*, *Cylindropuntia* and *Opuntia* species.
- DPIRD, D. O. P. I. A. R. D. 2021. Opuntoid cacti: declared pests.
- EPA, ENVIRONMENTAL PROTECTION AGENCY 2000. Environmental Protection of Native Vegetation in Western Australia. Clearing of native vegetation, with particular references to the agricultural area. Position Statement No. 2.
- EPA, ENVIRONMENTAL PROTECTION AUTHORITY 2016. Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment. Western Australia: Environmental Protection Authority.
- GEOSCIENCE AUSTRALIA. 2021. *LAN25 Grade of soil erosion for the physiographic provinces of Australia* [Online]. Available: <https://www.nationalmap.gov.au/> [Accessed 22/07/2021].
- GHD 2016. Yilgarn Star North Prospect Biological Assessment.
- GIBSON, N. & LYONS, M. N. 1998. Flora and Vegetation of the Eastern Goldfields Ranges: Part 3. Parker Range. *Journal of the Royal Society of Western Australia*, 81, 119-129.
- GIBSON, N. & LYONS, M. N. 2001. Flora and vegetation of the Eastern Goldfields Ranges: Part 4. Highclere Hills. *Journal of the Royal Society of Western Australia*, 84, 71-81.
- GOVERNMENT OF WESTERN AUSTRALIA. 2017. *Environmentally Sensitive Areas* [Online]. Available: <https://www.der.wa.gov.au/your-environment/environmentally-sensitive-areas> [Accessed].
- GOVERNMENT OF WESTERN AUSTRALIA 2020. 2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Perth: WA Department of Biodiversity, Conservation and Attractions.
- MENKHORST, P., ROGERS, D. I., CLARKE, R., DAVIES, J. N., MARSACK, P. & FRANKLIN, K. 2017. *The Australian Bird Guide*, Clayton, South Victoria, CSIRO Publishing.
- MENKHORST, P., ROGERS, D. I., CLARKE, R., DAVIES, J. N., MARSACK, P. & FRANKLIN, K. 2019. *The Australian Bird Guide, Revised Edition*, Clayton, South Victoria, CSIRO Publishing.

- MWH, AUSTRALIA 2014. Abydos DSO Project: 2014 Pilbara Leaf-nosed Bat and Ghost Bat Monitoring Program.
- PHEONIX, P. E. S. 2021. Baseline flora, vegetation and fauna surveys for the Parker Range Haul Road Project. Perth, Western Australia: Pheonix Environmental Sciences.
- PRINGLE, H. J. R., VAN VREESWYK, A. M. E. & GILLIGAN, S. A. 1994. *An inventory and condition survey of the north-eastern Goldfields, Western Australia*, Perth, W.A., Department of Agriculture Western Australia.
- RECON ENVIRONMENTAL 2008a. Burbidge Rare Flora Distribution & Impact.
- RECON ENVIRONMENTAL 2008b. Marvel Loch TSF Extension Vegetation Survey.
- SHEPHERD, D. P., BEESTON, G. R. & HOPKINS, A. J. M. 2002a. Native Vegetation in Western Australia. Extent, Type and Status. South Perth, Western Australia: Department of Agriculture.
- SHEPHERD, D. P., BEESTON, G. R. & HOPKINS, A. J. M. 2002b. Native Vegetation in Western Australia. Extent, Type and Status. South Perth, Perth Department of Agriculture.
- SPECTRUM ECOLOGY 2020. Leviathan Reconnaissance Flora & Vegetation and Targeted Fauna Survey.
- STANTEC 2020a. Achilles Targeted Significant Flora Surey - October 2020.
- STANTEC 2020b. Parker Range PEC, Flora and Fauna Reconnaissance Survey and Priority Flora Search. Perth, Western Australia Stantec.
- STANTEC 2021a. Targeted Chuditch (*Dasyurus geoffroi*) Survey Memorandum.
- STANTEC 2021b. Windmills Flora, Vegetation and Fauna Survey. Perth, Western Australia: Stantec.
- STANTEC, AUSTRALIA 2019. Parker Range PEC, Flora and Fauna Reconnaissance Survey and Priority Flora Search. Perth, Western Australia.
- STANTEC, A. 2021c. Phoenix, Bronco, Brumby and Zeus Targeted Malleefowl (*Leipoa ocellata*) Survey Memorandum.
- STANTEC, A. in prep. Windmills Flora, Vegetation and Fauna Survey.
- STANTEC UNPUBLISHED DATA 2021a. Barto Targeted Chuditch Survey.
- STANTEC UNPUBLISHED DATA 2021b. Pheonix, Bronco, Brumby and Zeus Flora, Vegetation and Fauna Surveys. *In*: STANTEC (ed.). Unpublished.
- THACKWAY, R. & CRESSWELL, I. D. 1995. An Interim Biogeographical Regionalisation for Australia. Canberra, Australian Capital Territory: Australian Nature Conservation Agency.
- TILLE, P. J. 2006a. Soil-landscapes of Western Australia's Rangelands and Arid Interior. Perth, Western Australia: Department of Agriculture and Food Resource Management
- TILLE, P. J. 2006b. Soil-landscapes of Western Australia's Rangelands and Arid Interior. Technical Report No. 313. Department of Agriculture and Food Resource Management, Perth, Western Australia.
- WAH, W. A. H. 2021. *FloraBase: the Western Australian Flora* [Online]. Kensington, Western Australia: Department of Biodiversity Conservation and Attractions. [Accessed].
- WOINARSKI, J. C. Z., BURBIDGE, A. A. & HARRISON, P. L. 2014. *The Action Plan for Australian Mammals 2012*, Collingwood, Victoria, CSIRO Publishing.

Appendices



Appendix A Targeted Chuditch Survey Report (Stantec 2021)

Appendix B Lenneberg Flora, Vegetation and Fauna Survey (Stantec 2021)

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