

LOT 287 SOUTH WESTERN HIGHWAY, GWINDINUP
SAND AND GRAVEL PIT
DEVELOPMENT APPROVAL AND
EXTRACTIVE INDUSTRY LICENCE APPLICATION

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MARCH 2024

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LOT 287 SOUTH WESTERN HIGHWAY, GWINDINUP DA AND EIL APPLICATION

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EXECUTIVE SUMMARY

Mario Michele Giacci is applying for a Development Approval (DA) and Extractive Industry License (EIL) for the extraction of sand and gravel on Lot 287 (Plan 100056) on South Western Highway in Gwindinup. The applicant, who is also the landowner, currently holds a DA and EIL for an active extraction site on the property, but these approvals are due to expire in September 2024. The new DA and EIL applications propose a 15.31 ha extension to the current EIL area, a change in maximum final batter slopes from 1:10 (vertical:horizontal) to 1:6, an addition of half-day operations on Saturdays, and to introduce a maximum number of trucks per day.

The application covers a total area of 32.58 ha, which will include the currently approved pit (17.27 ha) that is undergoing rehabilitation and a proposed expansion area to the east (15.31 ha). DA/EIL was first granted for the property in 2013, with subsequent five year DA/EILs granted in 2018 and 2019. The proposed expansion area is expected to extend the life of the pit by approximately 10 years.

Access to the pit will remain off Lowrie Road, which connects to South Western Highway. The number of truck movements per day will vary depending on market demand for the resource; however, it is estimated that during large hauling campaigns the number of trucks could potentially reach a maximum of 75 return trips per day. In between contracts, quiet periods with no truck movements are expected. A traffic assessment was conducted in August 2023 for the extraction operations on neighbouring Lot 393 (also owned by Mario Michele Giacci), which also applies to traffic from Lot 287 due to the combined nature of the operations. The assessment determined that the existing roads and associated intersections are suitable for accommodating the proposed vehicle movements.

The proposed 15.31 ha expansion area will involve the clearing of 9.70 ha of native vegetation, which will require a Clearing Permit from the Department of Water and Environmental Regulation (DWER). The remainder of the proposed expansion area is already cleared or contains blue gum plantation that will be harvested prior to extraction. Following the staged extraction, it is proposed that rehabilitation will return a mixture of native vegetation (3.14 ha) and pasture (29.45 ha) to the extraction area. Further to this, 15.57 ha of harvested blue gums will be rehabilitated to native vegetation, which means that in total 18.71 ha of native vegetation is proposed to be established on the property as part of the proposed works. Further 9.31 ha of existing remnant native vegetation on Lot 287 is proposed to be retained and improved (e.g. via weed control and infill plantings). It is noted that the proposed vegetation clearing and rehabilitation areas may be modified as part of the Clearing Permit application process through DWER.

The post-excavation landform is designed with maximum batter slopes of 1:6, though the majority of the pit floor will be closer to 1:10. Maximum excavation depth will be 5 m from the natural ground surface. The pit floor level will remain at least 2 m above maximum groundwater levels.

The closest residence is located approximately 155 m to the north of the proposed expansion area. A noise assessment has been undertaken for the proposed operations and the proponent will implement the recommended management measures to reduce noise emissions and achieve compliance with the relevant regulations. A Dust Management Plan has also been prepared to minimise impacts on surrounding residences. Additional management plans are in place for weeds and dieback, stormwater, and rehabilitation.

The proponent has operated numerous extractive industries (formerly as Giacci Brothers Pty Ltd and currently as MGM Bulk) and is very experienced in the basic raw material industry. The pit on Lot 287 is securely fenced and signed, and will continue to operate in a safe and efficient manner.

Overall, it is expected that the proposed extraction operations can be managed in a way that avoids and minimises adverse environmental and social impacts and delivers a net positive outcome for the environment through facilitating the conversion of blue gum plantation to native vegetation.

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1. INTRODUCTION

Mario Michele Giacci (the applicant), owner of Lot 287 (Plan 100056) (the property) on South Western Highway in Gwindinup, is applying for a Development Approval (DA) and Extractive Industry Licence (EIL) for the expansion of sand and gravel extraction operations on the property. An initial DA and EIL were granted for the property in 2013, with subsequent DAs and EILs granted in 2018 and 2019. The approvals for the current extraction area are due to expire in September 2024.

This 2024 DA and EIL application incorporates the following changes compared to the previously approved DA/EIL:

- Extension of the EIL area in an easterly direction for an additional 15.31 ha.
- Increase in the maximum final batter slopes from 1:10 (vertical:horizontal) to 1:6 to align with the batters approved for adjacent Lot 393.
- Setting the maximum number of truck movements to 75 trips per day (150 one-way trips).
- Addition of half days operations on Saturdays from 7 am to 1 pm.

This report provides supporting information for the DA and EIL applications submitted to the Shire of Capel (the Shire). This report describes the project site and surrounds, the planning context, works completed to date, and works proposed to be undertaken. Further, potential environmental and social impacts of the project and their management are addressed.

2. BACKGROUND INFORMATION

2.1 LOCATION, AREA, AND OWNERSHIP OF PROPERTY

Lot 287 is located on South Western Highway approximately 3.5 km south of Boyanup, as shown in Figure 1. The property covers total area of 60.01 ha (Figure 2) and is owned by the applicant (Certificate of Title is provided as Appendix 1). Access to the site is gained off Lowrie Road via an easement on adjacent Lot 393, which is also owned by the applicant.

2.2 DETAILS OF APPLICANT

The applicant – Mario Michele Giacci (PO Box 1263, Bunbury WA 6231) – is the landowner of Lot 287. The applicant has extensive experience in the extractive industry through previous directorship of Giacci Brothers Pty Ltd and current directorship of MGM Bulk. This has included several EILs within the Shire, including the current EILs for Lot 287 and adjacent Lot 393 (Plan 159607). MGM Bulk operates out of Picton and maintains a sizable fleet of machinery and trucks.

2.3 LAND USE AND ZONING

Lot 287 is zoned 'Rural' under the Shire's Local Planning Scheme (LPS) No.8 and intercepts three Special Control Areas (SCA) (Figure 2):

- SCA4 - Transport Corridors.
- SCA6 - Strategic Minerals and Basic Raw Materials.
- SCA8 - Regional Ecological Linkages.

SCA6 is associated with mineral sand deposit further to the west and Lot 287 intersects the buffer zone to the deposit. SCA8 is associated with axis lines of ecological linkages running along the Preston River and the Whicher Scarp. Lot 287 is not on the axis line but in close vicinity to it.

SCA4 is associated with the South Western Highway and covers approximately 40 m wide strip along the eastern property boundary. SCA4 is well outside the extraction area. The eastern edge of Lot 287 is also reserved for 'Transport Corridors' (Shire of Capel 2023c) (Figure 2). A 'Highway Protection Line' straddles the property along its eastern highway road frontage and delineates an area (100 m distance from either side of the centre line of the road), which is defined as the 'Highway Protection Area'. The purpose of the 'Highway Protection Area' is to protect the function, amenity, and visual character of the Highway. The proposed extraction area is well outside the 'Highway Protection Area'.

Lot 287 contains no buildings. In addition to the current extraction area, Lot 287 contains blue gum (*Eucalyptus globulus*) plantation with pockets of remnant native vegetation (Figure 3). Blue gums within the currently approved extraction area have been harvested with the remainder of the application area to be harvested prior to extraction commencing.

The land surrounding Lot 287 is zoned either 'Rural', 'State Forest', 'Regional Open Space', or 'Primary Regional Road' (Figure 2). Lot 287 has a Mineral Sands Caveat (in favour of Cristal Mining Limited) to protect mineral sand mining rights on the property. Extensive mineral sands mining has been undertaken to the west of Lot 287. The mining operations are now complete with some rehabilitation activities remaining.

Zoning and land use of adjacent properties are further described in Table 1 and shown in Figure 2.

Table 1: Zoning and Land Use of Properties Adjacent to Lot 287

Property	Zoning	Landuse
Lot 393 (Plan 159607)	Rural	Active sand and gravel extraction, one shed.
Lot 107 (Plan 232802)	Rural	Covered in remnant native vegetation. No residences.
Lot 478 (Plan 34760)	State Forest	Reserve 18237 - for the purpose of Landscape Protection. Contains remnant native vegetation. No residences.
Lot 477 (Plan 34756)	State Forest	Reserve 2307 - for the purpose of Landscape Protection. Contains remnant native vegetation. No residences.
Lot 31 (Plan 214856)	Regional Open Space	Reserve 25500 - for the purpose of Landscape Remnant native vegetation. No residences.
Lot 26 (Plan 143766)	Rural	Remnant native vegetation. Dwelling, outbuildings, and a dam. Dwelling located 157 m from proposed extraction area boundary.
Lot 100 (Plan 44666)	Rural	Some remnant native vegetation. Dwelling and outbuildings. Dwelling located 272m from the proposed extraction area boundary.
Lot 6 (Plan 130054)	Rural	Some remnant native vegetation.
Lot 7 (Plan 130054)	Rural	Some remnant native vegetation. Dwelling and outbuildings. Dwelling located 362 m from the proposed extraction area boundary.
Lot 8 (Plan 130054)	Rural	Some remnant native vegetation. Outbuildings attached to dwelling on Lot 9 (Plan 130054).
Lot 9 (Plan 130054)	Rural	Some remnant native vegetation. Dwelling and outbuildings. Dwelling located 310 m from the proposed extraction area boundary.



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 Original Size: A4
 Image: ESRI World Imagery
 Grid: GDA94 / MGA zone 50

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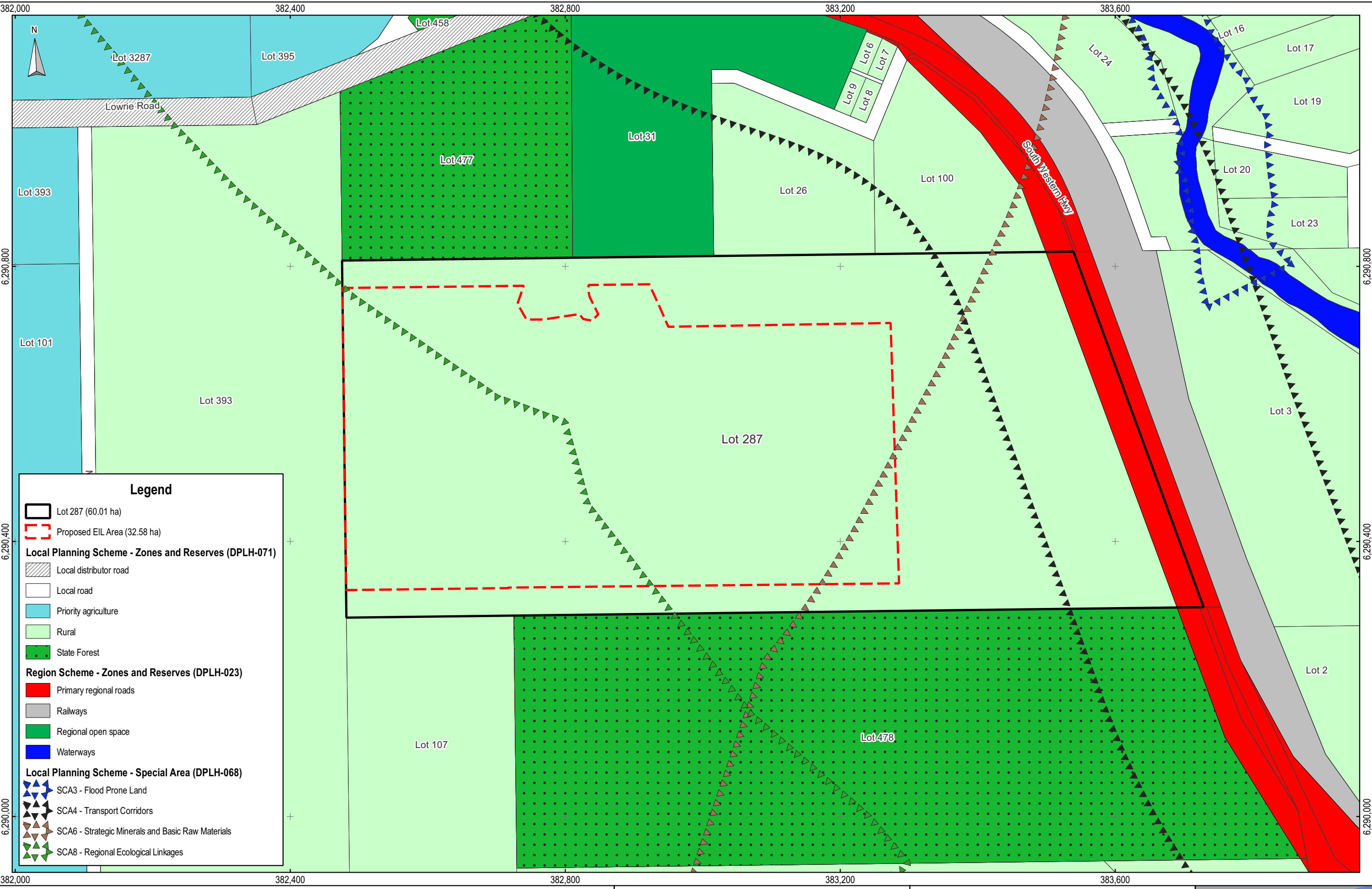
Mario Michele Giacci
 Lot 287 South Western Highway,
 Gwindinup

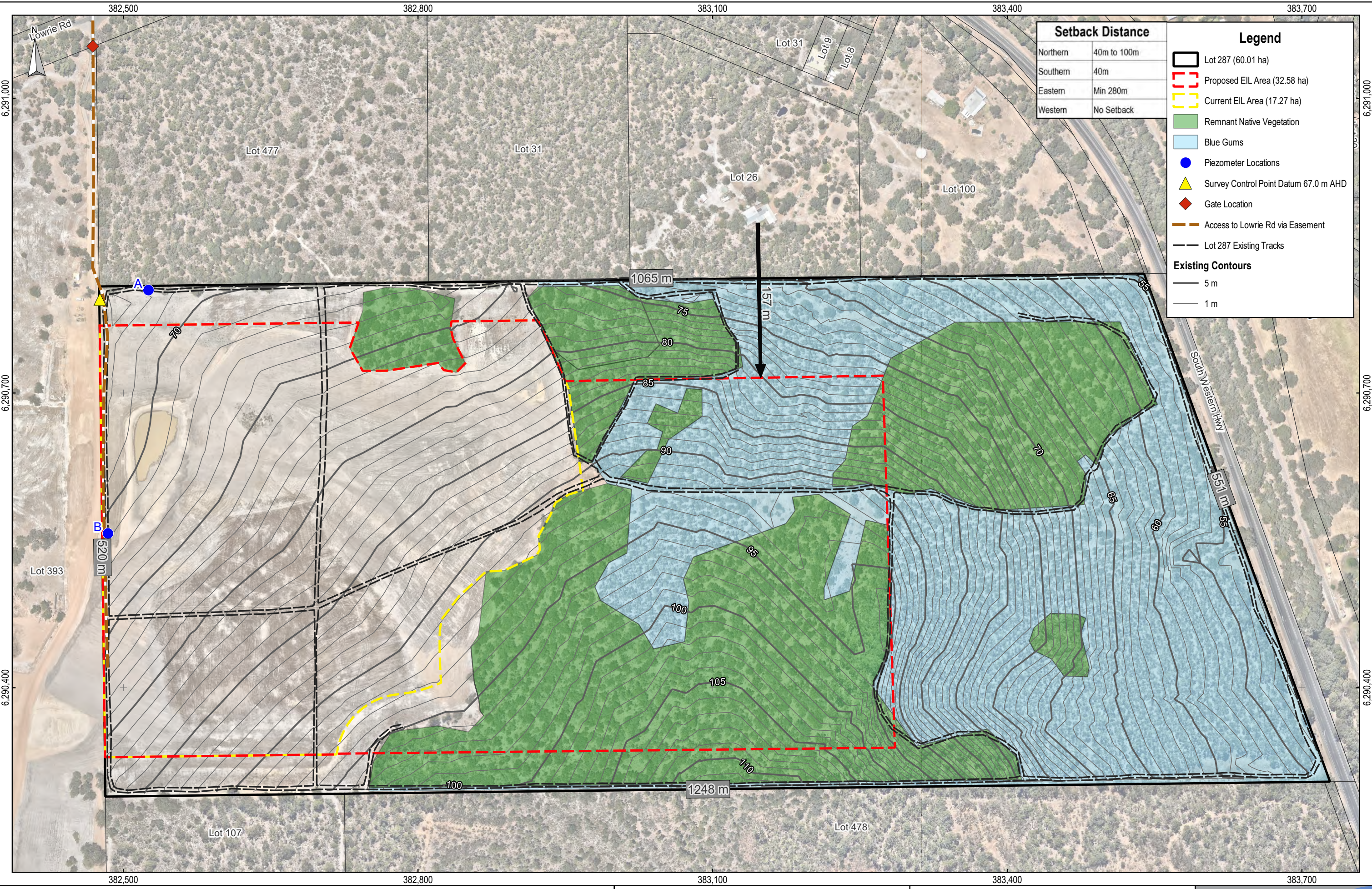
Figure 1

Location

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Setback Distance	
Northern	40m to 100m
Southern	40m
Eastern	Min 280m
Western	No Setback

Legend

Lot 287 (60.01 ha)

Proposed EIL Area (32.58 ha)

Current EIL Area (17.27 ha)

Remnant Native Vegetation

Blue Gums

Piezometer Locations

Survey Control Point Datum 67.0 m AHD

Gate Location

Access to Lowrie Rd via Easement

Lot 287 Existing Tracks

Existing Contours

5 m

1 m

2.4 SOILS AND TOPOGRAPHY

The highest point on Lot 287 is situated approximately halfway along the southern boundary and has an elevation of 111 m Australian Height Datum (AHD) (Figure 3). From this point, the land to the west and north slopes and undulates downward at gradients between approximately 1:10 and 1:20. Near the northern boundary there are steep areas of approximately a 1:6 slope. To the east of the proposed extraction area lies the steepest gradients on the property, which slope towards the South Western Highway at gradients up to 1:6 within the proposed extraction area and 1:4 further east, beyond the proposed extraction area. Natural landform within the proposed extraction area on Lot 287 ranges from 109 m AHD in the south to 67 m AHD in the northwest.

A grid of test holes was dug on the site in May 2011 to estimate material depths. A layer of sand (0.3 to 1.5 m thick) was found to overlay gravel. Subsequent extraction has confirmed this and found that the gravel layer is typically 1 to 1.5 m thick (thicker in some areas) and overlies clay.

Three soil and landform mapping systems are present within and surrounding the proposed extraction area (DPIRD 2022, DPIRD-064):

- Whicher Scarp System: Low scarp and raised platform, on the northern edge of the Donnybrook Sunkland. Sandy gravel and pale deep sands, loamy gravel and non-saline wet soils. Jarrah-marri forest and woodland.
- Goodwood Valleys System: Valleys of the Donnybrook Sunkland. Sandy gravel, loamy gravel, and deep sands. Jarrah-marri forest and woodland.
- Blackwood Plateau System: Lateritic plateau in the Donnybrook Sunkland. Sandy gravel, loamy gravel, and deep sand. Jarrah-marri forest.

Lot 287 is located away from wetlands and waterways on well-draining soils, making the risk of acid sulfate soil (ASS) low.

2.5 GROUNDWATER

Two piezometers were installed on Lot 287 in September 2012, and their locations are shown in Figure 3. Readings taken on 20 September 2012 are shown in Table 2. The results show that groundwater is approximately 7.8 m from the surface. Groundwater level data is also available from two piezometers on adjacent Lot 393 from October-December 2016 (Table 3). This data supports the results from Lot 287 and further also indicates that depth to groundwater increases as moving up the hill. The extractive operations on the site since 2013 have not intersected the groundwater table.

The lowest point of excavation on Lot 287 is the stormwater retention pond (at 65 m AHD) in the northwestern part of the property (Figure 6). This pond will remain approximately 2 m above maximum groundwater levels. Landform in the rest of the extraction area will be higher than the pond and depth to maximum groundwater will be more than 2 m.

Table 2: Groundwater Levels on Lot 287

Piezometer	Ground Level (AHD)	Groundwater Depth from Natural Ground Level	Groundwater Level (AHD)	Sampling Date
A	68.20 m	7.85 m	60.35 m	20 Sep 2012
B	70.90 m	7.84 m	63.06 m	20 Sep 2012

Table 3: Groundwater Levels on Lot 393

Piezometer	Ground Level (AHD)	Groundwater Depth from Natural Ground Level	Groundwater Level (AHD)	Sampling Date
1 (southeast)	94.30 m	More than 8.8 m as bore dry	Bore dry at 85.50 m	18 Oct 2016
		More than 8.8 m as bore dry	Bore dry at 85.50 m	2 Nov 2016
		More than 8.8 m as bore dry	Bore dry at 85.50 m	14 Dec 2016
2 (northwest)	45.80 m	5.25 m	40.55 m	18 Oct 2016
		5.35 m	40.45 m	2 Nov 2016
		5.74 m	40.06 m	14 Dec 2016

2.6 SURFACE WATER

The extraction area is mostly situated at the eastern edge of the catchment of Gynudup Brook, a tributary of the Capel River, which discharges into the Indian Ocean at Geographe Bay. A small area (approximately 2.3 ha) at the eastern limit of the extraction area is within the Preston River catchment and drains east toward the Preston River, approximately 800 m away.

There are no watercourses on Lot 287 due to the well-draining soil and lack of upstream catchment area. Surface flow is only likely to occur during intense or prolonged rainfall events. Any surface flow leaving the extraction areas of Lot 287 does so across the western boundary into Lot 393 Lowrie Road, with the exception of the 2.3 ha in the Preston River catchment. Lot 393 is also owned by the applicant and is being used for extraction of gravel and sand in conjunction with operations on Lot 287 under a separate EIL. Management of stormwater runoff for these two sites has been combined and is described further in Section 5.2.

The location of the proposed extraction area is compliant with the advice of *Water Quality Protection Note no. 15* (DWER 2019). It is not within a proclaimed Public Drinking Water Supply Area, land subject to seasonal flooding or defined floodplain and is well separated from all waterways, the nearest being Gynudup Brook approximately 1 km west of the extraction area, and Preston River 0.8 km to the east.

2.7 VEGETATION AND FAUNA

Lot 287 has approximately 19 ha of native vegetation, split into several patches. A reconnaissance flora and vegetation survey conducted by Daniel Marsh Botanical Consulting in 2019 (Appendix 2) identified three native vegetation types and an introduced vegetation type in the proposed extraction area:

- VT1: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low woodland of *Banksia grandis* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii*.
- VT2: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea gracilis*.
- VT3: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low sparse shrubland of *Xanthorrhoea preissii* and *Hibbertia hypericoides*.
- D: Disturbed: Blue gum plantations, tracks, and clearings.

The native vegetation communities vary in condition from Degraded to Very Good - Good (using condition scale by Keighery 1994) and show signs of multiple historical disturbances including selective logging, fire, weeds, and

Phytophthora cinnamomi (dieback). Currently there is disturbance in the form of cleared tracks and bare areas. The blue gum plantation areas have been completely cleared of native vegetation in the past.

No Threatened or Priority Ecological Communities or Threatened or Priority flora species have been recorded at Lot 287. Several weed species have been recorded but no Declared Pest species or weeds of national significance (Marsh 2019).

In 2019, Greg Harewood was engaged to conduct a Fauna Assessment for Lot 287 (Appendix 3). The Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), Baudin's Cockatoo (*Calyptorhynchus baudinii*), and Western Ringtail Possum (*Pseudocheirus occidentalis*) were recorded within the proposed clearing area. A Black Cockatoo habitat tree assessment identified 405 trees with diameter at breast height (DBH) > 50 cm, of which 26 contained hollows potentially large enough for black cockatoo nesting. This assessment was based on approximate size of hollow entrance only, no conclusive evidence of use by black cockatoos was recorded. Within the proposed extraction area there are 215 trees with DBH > 50 cm proposed to be cleared, including 12 with hollows potentially large enough for black cockatoo nesting. None of these hollows showed signs of occupancy or chew marks. The impact of this clearing and associated mitigation and offset measures will be addressed as part of the Clearing Permit application process through the Department of Water and Environmental Regulation (DWER).

2.8 DIEBACK

Dieback assessment of Lot 287 was undertaken by Bark Environmental in 2020 (the report is provided as an appendix to Appendix 10). Approximately 15 ha of the native vegetation on Lot 287 was found to be infested with *Phytophthora cinnamomi* (dieback) with just under 1 ha surveyed as uninfested. The remainder of the native vegetation, the blue gum plantation areas and cleared areas were mapped as 'excluded' due to the lack of indicator species to determine the occurrence of dieback; however, the presence of dieback in these areas cannot be ruled out. The areas of bushland surrounding Lot 287 are considered dieback infested with moderate confidence based on publicly available dieback mapping (Project Dieback 2024). Dieback management as part of the proposed extraction works is further addressed in Section 5.7.

2.9 CROWN LAND AND RESERVES

There are three reserves in close vicinity to the application area as shown in Figure 2:

- Reserve 2307 (Lot 477) – "Landscape Protection" (to the northeast).
- Reserve 25500 (Lot 31) – "Landscape Protection" (to the northeast).
- Reserve 18237 (Lot 478) – "Landscape Protection" (to the east).

2.10 HERITAGE

There are no registered Aboriginal Heritage Sites or Other Heritage Places within the application area or immediate surrounds (DPLH 2024) (Appendix 4). Lot 287 is close to the Preston River, which is a registered site of 'Mythological' type, but the river is approximately 800 m east of the extraction area and is buffered by the South Western Highway and rural property, therefore, the proposed operations will have no impact on this site. The property falls within the South West Native Title Settlement Area; however, this does not preclude development from taking place on this privately owned property.

2.11 EXISTING PUBLIC UTILITIES AND SERVICES

No utilities (water, power, or telecommunications) traverse Lot 287 (Figure 3). Existing extractive operations access the site from Lowrie Road in the north via an easement across Lot 393 and this access will be maintained for the duration of the proposed operations on Lot 287.

3. PLANNING AND POLICY SETTING

3.1 STATE PLANNING STRATEGY (2050)

The strategy identifies the Greater Bunbury Area as 'Regional Urban Area'. This includes the subject land and identifies the need for further strategic and structure planning in the area. Since the time of this strategy, a number of more detailed studies have been undertaken, including the majority of the policies and plans described throughout Section 3.

The State Planning Strategy identifies the Greater Bunbury Area progressing towards becoming a continuous urban area with the Perth and Peel regions. It highlights the importance of mining growth in the region, noting that: "*Mining and downstream processing continues to be a key economic driver for the South West sector*" (WA Gov 2021). The strategy identifies six key principles to guide land use planning and development, of which the following relate to the proposal:

- Economy: Facilitate trade, investment, innovation, employment, and community betterment.
- Environment: Conserve the State's natural assets through sustainable development.
- Regional Development: Build the competitive and collaborative advantages of the region.

3.2 GREATER BUNBURY REGION SCHEME

The majority of Lot 287, including the proposed extraction area is zoned 'Rural' under the Greater Bunbury Region Scheme (GBRS) 2014. The purpose of the 'Rural' zone is:

"for the sustainable use of land for agricultural purposes, to assist in the conservation and the wise use of natural resources including water, flora, fauna and minerals. These areas can also provide a distinctive rural landscape unique to the region and accommodate carefully planned rural living developments."

The proposal is consistent with this purpose of the rural zoning as the use of the natural resources on the property is proposed to be balanced with rehabilitation to a mixture of pasture and native vegetation that will maintain the rural landscape and environmental values in the long term.

Under the GBRS *Strategic Minerals and Basic Raw Materials Resource Policy* (DPLH 2018), the extraction area in the western portion of Lot 287 is located within a buffer area for Titanium-Zircon mineralisation. Minerals are protected on site via an existing Caveat in favour of Cristal Mining Limited. Extractive operations on Lot 287 have to date not encountered mineral strata. In the unlikely event that minerals are encountered, work will be stopped to ensure protection of this resource and contact will be made with the relevant authority. On this basis, the proposal is consistent with the strategic resource area as it will enable the extraction of basic raw materials while ensuring appropriate measures are in place to protect mineral deposits should they be encountered.

The eastern portion of Lot 287 is partly reserved 'Primary Regional Roads'. The proposed extractive operations do not intersect this zoning.

3.3 GREATER BUNBURY STRATEGY (2013)

The Greater Bunbury Strategy (DPLH 2013) is the primary strategic document and Structure Plan prepared by the Department of Planning – now Department of Planning, Lands and Heritage (DPLH) – to guide urban, industrial, and regional land use within the City of Bunbury and Shires of Capel, Dardanup, and Harvey. The subject site is located within the area classified as "Residual of study area: rural (no change to land use)". Under the strategy:

"Rural land is to be retained for primary production, natural resource management and its landscape characteristics that define the rural character of the Greater Bunbury sub-region."

The strategy outlines challenges for sustainable Greater Bunbury, which specifically include the lack of suitable fill for new greenfield developments with drainage issues. The Department of Planning response to this challenge was to identify and safeguard the resources required for extractive industries, future fill requirements and construction. The proposal is consistent with the intent of the strategy as it makes use of the basic raw material available in the region while retaining the rural landscape values of the property in the long term through rehabilitation to pasture and native vegetation.

3.4 SHIRE OF CAPEL LOCAL PLANNING STRATEGY

The Shire's Local Planning Strategy (LPS) (Shire of Capel 2023b) is a vision for the development and long-term planning within the Council boundary over the next 15 years and was endorsed in June 2023. It is a two-part strategy, with part 1 focused on overall vision including strategies and actions and part 2 addressing background, relevant policies and the justification for the LPS. The LPS has replaced the Shire's Land Use Strategy 1999.

The LPS Part 1 sets strategies under six key Future Directions: community, environment, economy, leadership, infrastructure, and communication. Whilst all of the six have some relevance to the proposal, the most relevant is the environment as it covers natural resources (Shire of Capel 2023b):

Environment: natural resources – such as soil, water, rivers, wetlands, coastline, minerals, basic raw materials, and biodiversity are managed in a sustainable way that does not degrade the environment or reduce the quality of life within the Shire.

The proposal is consistent with the intent of the environmental and other strategies and actions as it will enable the use of increasingly rare basic raw materials in accordance with the GBRS and Basic Raw Materials Policy while ensuring that the end landform and landscape outcomes are benefiting the 'Rural' values and improved environmental outcomes. In particular:

- The property has been mostly cleared in the past and the required clearing of 9.30 ha of native vegetation can be mitigated and offset by revegetation and improvement works on the property.
- As part of the proposal, 18.71 ha of native revegetation will be undertaken (3.14 ha within extraction area and 15.57 ha outside extraction area), resulting in net gain in native vegetation on the property and improvement in ecological connectivity in the local area. Further 9.31 ha of existing native vegetation will be retained and improved through weed control and infill plantings.
- After extraction, 29.45 ha will be returned to pasture. This will support local rural and agricultural pursuits.
- To minimise the impact of extraction activities on sensitive receptors (Figure 4), plans to manage dust, noise, stormwater, weeds, and dieback have been developed (see Section 5).
- This site provides local employment opportunities within the Shire.
- Resources from this site are being used in local and regional developments, which provides further local employment opportunities, and reduces transport costs.

3.5 SHIRE OF CAPEL LOCAL PLANNING SCHEME NO. 8

The LPS No.8 came into effect in July 2023 (Shire of Capel 2023c). Under LPS No.8, Lot 287 is zoned as 'Rural', the objectives of which are:

- To provide for the maintenance or enhancement of specific local rural character.
- To protect extensive agricultural activities such as cropping and grazing and intensive uses such as horticulture as primary uses, with other rural pursuits and rural industries as secondary uses in circumstances where they demonstrate compatibility with the primary use.
- To maintain and enhance the environmental qualities of the landscape, vegetation, soils and water bodies, in order to protect sensitive areas especially the natural valley and watercourse systems from drainage.

- To provide for the operation and development of existing, future and potential rural land uses by limiting the introduction of sensitive land uses in the Rural zone.
- To provide for a range of non-rural land uses where they have demonstrated benefit and are compatible with surrounding rural uses.

Extractive industry on rural zoned land is subject to a development approval from the Shire. Once extraction of sand and gravel is completed, the final landform will consist of 29.45 ha of pasture, which aligns with preserving the local rural character of the area and will provide for a range of potential future rural uses (Figure 6). Additionally, 18.71 ha of native vegetation is proposed to be established and 9.31 ha of existing native vegetation to be retained and improved across the property (Figure 6). A range of plans to manage dust, noise, stormwater, weeds, dieback and rehabilitation have been developed (see Section 5) to avoid, minimise, mitigate and offset potential impacts.

Lot 287 also falls within three SCAs, as detailed in Table 4.

Table 4: LPS No.8 Special Control Areas on Lot 287

SCA	Purpose	Within Extraction Area
SCA 4	Transport Corridors: To protect the function and safety of the key travel routes within the Scheme area, along with the amenity and visual character of adjacent land and to ensure that the requirements of State Planning Policy 5.4 – Road and Rail Noise (SPP 5.4) are satisfied by all proposed development and land use.	No
SCA 6	Strategic Minerals and Basic Raw Materials: To identify areas where basic raw materials and strategic mineral resources need to be protected from incompatible land uses in line with the Greater Bunbury Region Scheme Strategic Minerals and Basic Raw Materials Resource Policy 2018.	Yes
SCA 8	Regional Ecological Linkages: To identify significant ecosystems on the Scheme Map as a Special Control Area and to provide measures to ensure that land use and development within its boundaries are regulated and managed to protect significant ecological linkages, foreshore environments, biodiversity, and environmental quality.	Yes

The proposed EIL is aligned with the purpose of SCA6 as it is a compatible land use in line with the Greater Bunbury Region Scheme, see in Section 3.2 for more detail. The proposal also aligns with SCA 8 as there are no priority or threatened ecological communities, or priority or threatened flora species present and whilst significant fauna habitat is present (Section 2.7), the impacts can be mitigated and offset so that the proposal will result in net gain in native vegetation on the property (from current 19.02 ha to 28.03 ha after extraction), improving connectivity through the local area.

3.6 SHIRE OF CAPEL EXTRACTIVE INDUSTRIES LOCAL LAW 2016

This DA/EIL application has been prepared in accordance with the Shire's *Extractive Industry Local Law* (Shire of Capel 2016).

3.7 SHIRE OF CAPEL LOCAL PLANNING POLICY 6.2

Local Planning Policy 6.2 Extractive Industries (LPP6.2) was implemented by the Shire in 2023 with the objective to sustainably manage extractive industries and regional supply needs without causing disruption to the amenity, environment, or function of transport networks within the Shire, as follows:

- Ensure extractive industries do not adversely affect the environment or the amenity of the locality during or after extraction.

- Ensure extractive industries are in the most appropriate locations.
- Ensure volumes of extraction occurs where the available haulage routes and road hierarchy are satisfactory or can be upgraded to support an extractive industry without affecting the safety of road users and the sustainability of the transport network.
- Achieve a high level of staged rehabilitation to native vegetation where required or where clearing of remnant native vegetation is proposed and approved.
- Achieve a high level of groundwater resource protection.
- Clearly outline matters required to be addressed by proponents.
- To provide clarity of the development assessment process for proponents and the broader community.
- Inform the community and stakeholders of the importance of a rigorous assessment process and the reasoning for the Shire's policy stance.

The LPP6.2 applies to all extractive industry proposals for properties zoned 'Rural' under the LPS No.8, which includes Lot 287. The proposal and associated supporting documentation is consistent with the purpose of LPP6.2 as it is within an appropriate location with available haulage routes, addresses potential amenity issues to nearby residences, addresses stormwater management for the operations, proposes a high level of staged rehabilitation to native vegetation and pasture, will increase local ecological connectivity after extraction, will support future rural use, and will not impact on groundwater resources. Further detail on the proposed operations and their management is provided in Section 4 and Section 5.

3.8 STATE PLANNING POLICY 2.4 - PLANNING FOR BASIC RAW MATERIALS

State Planning Policy 2.4 - Planning for Basic Raw Materials (2021a) (SPP2.4) was prepared under the *Planning and Development Act 2005*. The intent of SPP2.4 is to ensure basic raw materials (BRM) and extractive industries matters are considered during planning and development decision-making, to facilitate the responsible extraction and use of the State's BRM resources. The objectives of this policy are to:

- Ensure BRM and its regional importance is considered at the earliest stages of the planning process.
- Protect BRM in SGS areas and ES by avoiding encroachment from incompatible land uses.
- Ensure BRM resources are used efficiently in land use planning and development.
- Identify BRM extraction opportunities through sequential land use without compromising the final intended land use.
- Ensure the extraction of BRM avoids, minimises, or mitigates any adverse impacts on the community, water resources, and biodiversity values.

The proposed extractive operations are in line with the objectives of SPP2.4 as follows:

- The proposed operations facilitate sequential land uses without compromising planned post-extraction landuse (rural) or other potential future landuses.
- The proposed extension to the previously approved operations ensures that the sand/gravel resource available on the property is used efficiently.
- Potential adverse impacts on community (nearby residences) have been considered and addressed through appropriate management measures (see Section 5).
- The potential biodiversity impacts of the expansion area will be mitigated and offset by retaining and improving 9.31 ha of native vegetation and by establishing 18.71 ha of native vegetation as part of the

operations, achieving a net gain in the amount of native vegetation on the property from pre to post development.

SSP2.4 is associated with a guideline document *State Planning Policy 2.4 - Planning for Basic Raw Materials Guidelines* (DPLH 2021b). Section 4 of this guideline lists a number of factors that should be considered in the assessment of proposals to establish, extend, or expand an extractive industry operation, as well as managing the potential impacts of the operation. Information to address these factors has been included in this supporting document to the DA and EIL application.

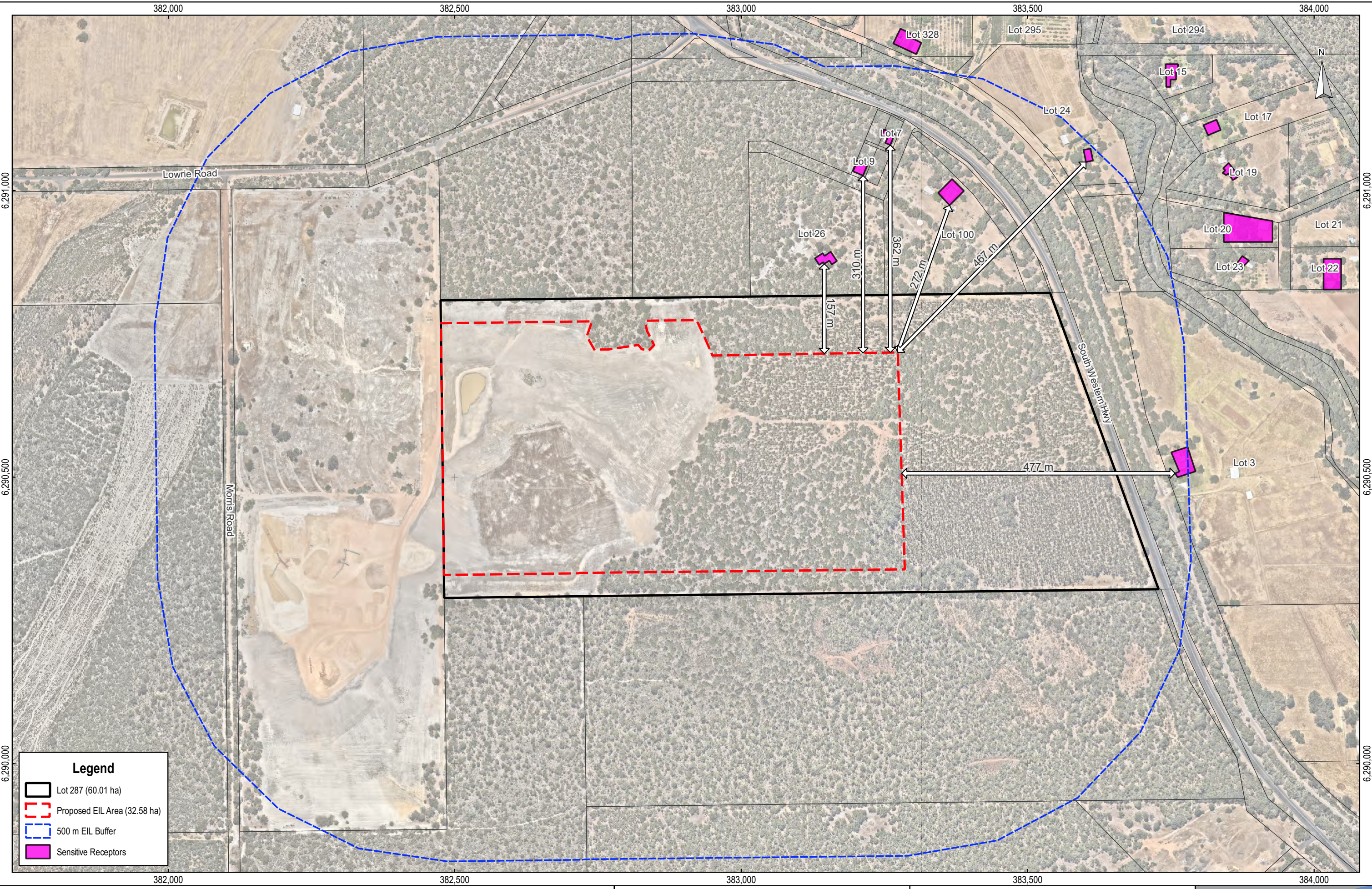
3.9 STATE PLANNING POLICY 3.7 - PLANNING IN BUSHFIRE PRONE AREAS

State Planning Policy 3.7 - Planning in Bushfire Prone Areas (2015) (SPP3.7) directs how land use should address bushfire risk management in Western Australia. It applies to all land that has been designated as bushfire prone by the Department of Fire and Emergency Services. While parts of Lot 287 are designated as bushfire prone, the proposed extraction operation does not involve intensification of land-use and does not increase the threat of bushfire. Therefore, exemptions from the requirements of SPP3.7 are expected to apply (similarly to previous applications).

3.10 SEPARATION DISTANCES BETWEEN INDUSTRIAL AND SENSITIVE LAND USES

Guidance for the Assessment of Environmental Factors No.3: Separation Distances between Industrial and Sensitive Land Uses, was prepared by Environmental Protection Authority in 2005. It sets generic separation distances for various types of industrial operations and sensitive land uses. For 'Extractive Industry - Sand and Limestone', the main potential impacts are identified as noise and dust and the generic separation distance to sensitive land uses is set at 300-500 m depending on the size of the operations.

The proposed sand extraction operations are at least 300 m from sensitive landuses apart from two residences that are 155 m and 250 m from the proposed EIL boundary (Figure 4). A site specific noise assessment has been undertaken (Appendix 5) that found that the proposed operations can achieve compliance with the noise regulations as long as specific management measures are put in place (further detail in Section 5.3). A range of dust management measures are also proposed to be implemented (as per Section 5.4). Therefore, based on site specific technical analysis and proposed management measures, the separation distances between the proposed operations and sensitive land uses are considered sufficient.



Legend

- Lot 287 (60.01 ha)
- Proposed EIL Area (32.58 ha)
- 500 m EIL Buffer
- Sensitive Receptors

Scale: 1: 6,000
Original Size: A3
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 100 200 m

Mario Michele Giacci
Lot 287 South Western Highway, Gwindinup

Figure 4

Sensitive Receptors

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4. DEVELOPMENT PROPOSAL

4.1 SUMMARY OF WORKS

In summary, the extraction operations will proceed in stages and comprise the following:

- Harvest blue gums and clear native vegetation.
- Remove and stockpile topsoil, litter, and any overburden.
- Extract sand and gravel material in stages (in accordance with the Works and Excavation Plan, shown in Figure 5).
- Crush and screen gravel with a mobile crusher.
- Load trucks and transport sand and gravel off site.
- Form final landform in accordance with the Finished Development Plan (Figure 6).
- Rip pit floor, respread topsoil and other overburden, and rehabilitate.

Further information on the proposed operations is provided below.

4.2 EXTRACTION AREA AND SETBACKS

The current application area (32.58 ha) is larger than the previously approved extraction area (17.27 ha) with a 15.31 ha extension of the pit to the east. The proposed extension area is a mix of remnant native vegetation and blue gum plantation. Native vegetation clearing is proposed to be limited to 9.70 ha.

Setbacks from property boundaries are as follows (Figure 3):

- Western boundary: no setback from Lot 393 as previously approved (to connect the two adjacent pits).
- Northern boundary: 40 m to 100 m setback.
- Southern boundary: 40 m setback that was previously approved for the existing pit, has been applied to the extension as well.
- Eastern boundary: Minimum 250 m setback.

4.3 NATURE AND DURATION OF PROPOSED EXCAVATION

In situ resource volumes within the proposed extraction area are estimated at approximately 445,000 m³ of sand and gravel. Assuming an extraction rate of 50,000 m³ per year, the pit has potential resource for approximately 10 years; however, the rate of extraction is subject to market forces. In recent years, the amount of sand and gravel removed from site has varied from more than 100,000 m³ per annum to less than 20,000 m³ annum.

4.4 STAGES AND TIMING

Extraction has concluded and rehabilitation activities are underway in the previously approved Stages 1 through 11. For the proposed extension, the operations will proceed gradually from Stage 12 to Stage 21 (up to 2 ha each), commencing in the southwest corner of the proposed extension area (Figure 5). Depending on market demand for product, the life of the pit may extend past the licence period of five years and, if so, a renewal application will be made in the future. Once a stage is completed it will be rehabilitated in accordance with the Rehabilitation and Decommissioning Programme (see Section 5.10).

4.5 CLEARING METHODOLOGY

The stages will be pegged and flagged to demarcate the extent of clearing and excavation. The blue gums within the extraction area will be harvested ahead of other works. Proposed native vegetation clearing is limited to 9.70 ha and will be subject to any conditions DWER will set on a Clearing Permit (yet to be determined). Vegetation will be cleared with a bulldozer or similar. Some of the cleared vegetation will be mulched and used in the native rehabilitation areas. Some logs and larger branches may also be salvaged and relocated to buffer zones along boundaries or into native vegetation rehabilitation areas to add to habitat formation.

4.6 TOPSOIL AND OVERBURDEN

Thickness of topsoil is expected to be approximately 100-150 mm with minimal other overburden. Topsoil will be removed with a bulldozer and stockpiled in windrows to a maximum height of 4 m for later use in rehabilitation. Any overburden will be similarly stockpiled. Whenever possible, stripped topsoil will be directly transferred into native revegetation areas and spread across finalised land surfaces to avoid stockpiling, thus maximising seed and microbial benefits. All movement and stockpiling of topsoil and overburden will be conducted in accordance with dieback requirements (Section 5.7). Topsoil from native vegetation areas will be stockpiled separately from topsoil from blue gum plantation areas.

4.7 EXCAVATION METHODS

Sand and gravel extraction will mostly proceed from southwest to northeast (Figure 5). The crushing and screening of gravel rock (by way of a mobile rotary impact crusher and/or jaw crusher) will be undertaken on the floor of the previously approved extraction area, more than 500 m from the closest residence to maximise noise amelioration. Where necessary, a noise bund will be constructed (Section 5.3). Face batters will be maintained at no steeper than 1:2 and no higher than 4 m. Material will be stockpiled as required prior to loading onto trucks (by loader). Final batters (maximum 1:6 slopes) and pit floor (approximately 1:10 slope) will be formed with a bulldozer and/or loader in accordance with the Finished Development Plan (Figure 6) prior to revegetation (see Section 5.10).

4.8 DEPTH AND EXTENT OF EXCAVATION

The extent of excavation is detailed on the Works and Excavation Plan (Figure 5) and the Finished Development Plan (Figure 6). Natural landform within the proposed extraction area ranges from 109 m AHD in the south to 67 mAHD in the northwest, whereas the proposed final landform ranges from 109 mAHD in the south to 65 mAHD in the northwest. Maximum depth of excavation will be up to 5 m below the natural ground surface level to cater for areas of deeper gravel.

The lowest point of excavation is the stormwater retention pond (at 65 mAHD) in the northwestern part of the property (Figure 6). This pond will remain approximately 2 m above maximum groundwater levels. Landform in the rest of the extraction area will be higher than the pond and depth to maximum groundwater will be more than 2 m.

The proposed maximum final batter slope has been changed from previously approved 1:10 to 1:6 to maximise the utilisation of the available resource. The proposed 1:6 slope is within the range of natural slopes present on the property and has also been approved for the pit on adjacent Lot 393.

It is noted that while maximum final batter slopes are proposed to change from 1:10 to 1:6 this does not mean that all slopes will be 1:6. As shown in the Finished Development Plan (Figure 6), the steepest final slopes (1:6) will occur along the edges of the extraction area, with the majority of the final slopes in the pit being much gentler. It is also noted that while the proposed maximum depth of excavation is 5 m, the excavation in most areas will be shallower as indicated by the Finished Development Plan (Figure 6).

4.9 ACCESS TO SITE

Access to site is off sealed Lowrie Road via the easement on the adjoining Lot 393 (Figure 3). The crossover from Lowrie Road to the site track has been sealed and caters for road train truck configuration take-off and radii. The site has easy access to South Western Highway as Lowrie Road connects to it approximately 500 m east of the crossover. A traffic impact assessment has been undertaken (Stantec 2023) (Appendix 6) and the findings are described further in Section 4.10.

Within the property, adequate unsealed access to the individual stages will be established as needed. This will include loading and turnaround facilities for all required plant and vehicles, which will be temporary in nature.

4.10 NUMBER AND SIZE OF TRUCKS

It is expected that several truck configurations will be used to haul material from the proposed extraction site, primarily in gauge semi-trucks and RAV Pocket Road Trains. The traffic assessment (Appendix 6) considered truck configurations of up to 27.5 m long.

It was previously estimated that the number of truck movements would be on average 10 to 20 per day over the lifetime of the pit. However, the number of truck movements per day will be variable depending on market demand. During large hauling campaigns the number of trucks could potentially reach maximum of 75 per day (150 one-way trips). In the quiet periods between contracts, no truck movements are expected (as has occurred in the past) and these can last for several months. The overall number of trucks over the lifetime of the pit is limited by the finite sand and gravel resource available in the pit. Therefore, the higher the number of trucks per day, the faster the pit will be exhausted and the operations will cease permanently.

Lowrie Road currently has permit status for road train configuration vehicles and forms part of the Shire's regional road network. Cristal Mining hauled mineral sands from their operations via Lowrie Road and South Western Highway to Bunbury Port. Primary industry in the local area also makes use of this route. Further, the existing sand and gravel extraction operations on Lot 287 and Lot 393 use this route. Therefore, the route is expected to be well suited for the proposed scale of operations.

A traffic impact assessment was undertaken in 2023 by Stantec Australia Pty Ltd (Stantec 2023) that assessed the impact of the development on the adjacent road network and also focused on access arrangements to and from the access track leading into Lot 393 and Lot 287 (Appendix 6). The analysis was conducted on a maximum scenario of 14 truck movements per hour (seven trucks in and seven out), equating to a maximum of 150 movements over an 11 hour operational day (75 trucks in and out). It was concluded that the existing access to and from site on Lowrie Road is sufficient and the existing basic right turn and the auxiliary left turn lanes already in place where Lowrie Road exits onto South Western Highway provide good Safe Intersection Sight Distance, which will significantly reduce the risk of major crashes. Therefore, the additional truck movements in and out of the intersection are less likely to contribute to additional crashes (Appendix 6). It is noted that the assessment was undertaken on a maximum scenario and on average the truck volumes are likely to be much lower than assessed and are unlikely to have a substantial long-term impact on traffic operations and the overall safety of the road network around it.

4.11 OPERATING HOURS

The operating hours of the site are proposed to be limited to between 7 am and 6 pm Monday to Friday and between 7 am to 1 pm on Saturdays, with no operations on Sundays or Public Holidays. The current DA permits operations Monday to Friday and the addition of half day on Saturday is necessary to cater for clients who also operate on Saturdays. There are other extractive sites within the Shire that are approved to operate half days on Saturdays and it is also common practice in other local government areas.

4.12 PROPOSED INFRASTRUCTURE

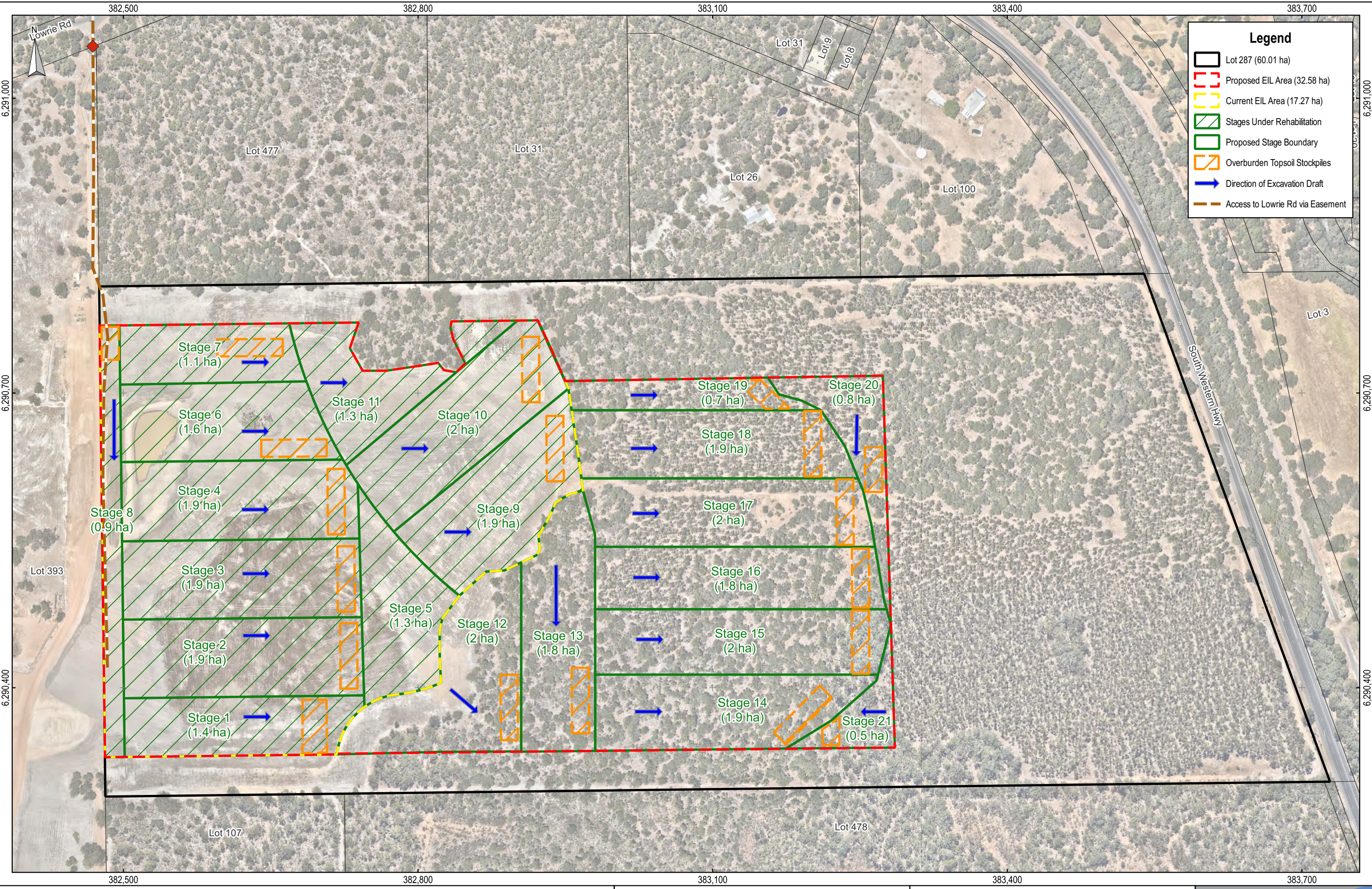
No permanent buildings or other infrastructure are proposed to be constructed on Lot 287. A portable toilet may be located on site.

4.13 PUBLIC DANGER

The site access gate is located at the start of the access track off Lowrie Road on Lot 393 and is locked when there is no personnel on site. Entry signage is in place and will be maintained warning the public of potential dangers. Warning signs (no more than 200 m apart) will also be placed along the property boundary. The property is securely fenced.

4.14 SURVEY INFORMATION

Verification of the original survey information (feature and contour survey) by BCE Surveying is provided in Appendix 7. Further, a copy of the Existing Contour and Feature Plan (Figure 3), including the location of the datum peg as requested by the Shire, is provided in size A1 in Appendix 12. A copy of the Finished Development Plan (Figure 6) is also provided in size A1 in Appendix 13.



Scale: 1: 3,500
Original Size: A3
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 100 200 m

W:\MGM\South West Hwy\GIS-Common\2024 Management Plans\MGM Lot 287 South West Hwy 2024.qgz 07/03/2024 F4 Works and Excavation Plan

Mario Michele Giacci
Lot 287 South Western Highway, Gwindinup

Figure 5

Works and Excavation Plan

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Legend

Lot 287 (60.01 ha)

Proposed EIL Area (32.58 ha)

Proposed Final Contours

5 m

1 m

Remnant Native Vegetation (retained)

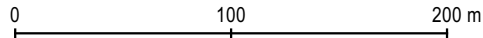
Revegetation to Native Vegetation

Revegetation to Pasture

Proposed Attenuation Basin

Gate Location

Scale: 1: 3,500
Original Size: A3
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)



Mario Michele Giacci
Lot 287 South Western Highway, Gwindinup

Figure 6

Finished Development Plan

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5. ENVIRONMENTAL MANAGEMENT

5.1 BIODIVERSITY

The proposed extraction involves clearing of 9.70 ha of native vegetation that provides habitat for significant fauna species and also contributes to ecological connectivity of the local area. The impacts of this clearing and appropriate mitigation and offset measures will be addressed in detail as part of the Clearing Permit application process through DWER. At this stage, it is proposed that the impacts of the clearing will be mitigated and offset on the property by following key measures:

- Revegetation to native vegetation within the extraction area - 3.14 ha.
- Converting blue gum plantation to native vegetation outside the extraction area - 15.57 ha.
- Retaining and improving 9.31 ha of native vegetation.

This will result in net gain in the amount of native vegetation on the property from current 19.02 ha to 28.03 ha post-extraction. It is noted that the proposed extraction would provide the funding for converting some of the blue gum plantation to native vegetation and without that funding the blue gum areas will return to cleared land after harvesting.

5.2 DRAINAGE

Lot 287 shares a Stormwater Management Plan with neighbouring Lot 393, which allows for appropriate management of stormwater across the combined sites. A revised Stormwater Management Plan (Rev 7) is included in this DA/EIL application package (Appendix 8).

5.3 NOISE

A noise assessment for the proposed operations on Lot 287 was undertaken by Lloyd George Acoustics in April 2022 (Appendix 5) and involved modelling of anticipated noise levels on surrounding properties (Figure 4), firstly without and then with noise control measures. This assessment took into consideration that the proposed operations are located 155 m from the closest residence (Lot 26). The assessment showed that extraction operations can be undertaken in compliance with all applicable regulatory requirements subject to appropriate management measures being in place.

In accordance with the assumptions and recommendations of the noise assessment, the following measures will be put in place to ensure compliance with regulatory requirements and to minimise noise for the surrounding area:

- Operating hours of the site will be limited to between 7 am and 6 pm Monday to Friday, with Saturday operations limited to between 7 am and 1 pm.
- The crushing and screening plant will remain more than 500 m from the closest resident.
- For excavation operations within 200-450 m of receiver on Lot 26:
 - Provide a 4 m high noise bund within 6 m of the top edge of the pit at all times.
- For excavation operations within 150-200 m of receiver on Lot 26:
 - Provide a 4 m high noise bund within 6 m of the top edge of the pit at all times.
 - Provide a 3.5 m high bund to the north east of the crushing and screening plant.
 - The dozer will not to be operated at the same time as the loader.
- For excavation operations at the eastern extents:
 - Provide a 5 m high noise bund within 6 m of the top edge of the pit at all times.

- Provide a 3.5 m high bund to the north east of the crushing and screening plant.
- CAT 972 loader will be used as this item is 2 dB quieter than e.g. CAT 980.
- The dozer will not to be operated at the same time as the loader and will not be operated for more than 24 minutes in any 4 hour period.

5.4 DUST

The Dust Management Plan (Appendix 9) describes potential sources of dust generation and associated management measures. Dust management on the property will include prevention actions, monitoring and mitigation measures, and reporting and complaints procedures.

5.5 HYDROCARBONS AND CHEMICALS

No fuel or lubricant storage will take place on site. A refuelling vehicle, fitted with appropriate spill prevention and mitigation equipment, will visit site as required to refuel on site plant. No major repairs or maintenance will take place on site.

5.6 WEEDS

Weed control will be conducted during the extraction works on an as-needed basis to minimise weed occurrence in the operational and stockpiling areas. In addition to broad spectrum herbicides, weed specific herbicides will be used where appropriate to target broadleaf, grass, geophyte, and woody weeds. Targeted control will be undertaken for any identified pest weed species. Management of weeds is addressed in more detail in the accompanying Weed and Dieback Management Plan (Appendix 10). Weed control will also be undertaken during rehabilitation works as described in the Rehabilitation and Decommissioning Programme (Appendix 11).

5.7 DIEBACK

The majority of the native vegetation on Lot 287 is dieback infested (15 ha) with just under 1 ha uninfested (Bark Environmental 2020). The remainder of the native vegetation, the blue gum plantation areas, and cleared areas are mapped as 'excluded' due to the lack of indicator species to determine the occurrence of dieback. However, the presence of dieback in these areas cannot be ruled out and, because of this, the areas will be treated as if they are dieback infested. Information on dieback prevention and management is detailed in the Weed and Dieback Management Plan (Appendix 10). The Weed and Dieback Management Plan includes the site assessment and management recommendations from Bark Environmental. Dieback management will also adhere to any relevant conditions of a future Clearing Permit from DWER.

5.8 ABORIGINAL HERITAGE

As noted in Section 2.10, there are no registered Aboriginal heritage sites on the property. The applicant shall have due respect to the Aboriginal heritage of the area and all workers will be briefed accordingly prior to commencement of works on site. Should any potential artifacts or remains be discovered during operations, any works in the vicinity will stop immediately and the matter will be referred to the Department of Planning, Lands and Heritage. If bones are discovered, then the police will also be advised. The applicant notes that it is an offence to knowingly cause damage to an Aboriginal cultural heritage site under the *WA Aboriginal Cultural Heritage Act 1972*.

5.9 SCREENING OF VISUAL IMPACTS

The majority of the extraction works are screened from public roads or residences in the vicinity due to the presence of screening vegetation. The proposal consists of staged extraction and some of the stages are higher in the

landscape meaning they may be partly visible, mostly to the west and north. The eastern side the proposed operations is screened by a mixture of native vegetation and blue gums, and the clearing of the blue gums can be controlled to minimise potential visual impacts.

The gradual nature of the clearing and rehabilitation measures will ensure that any visual impacts will be as short in duration as possible. Rehabilitation of the extraction area will create a mixture of pasture and native vegetation that will blend the site into the surrounding landscape.

5.10 REHABILITATION AND DECOMMISSIONING

A Rehabilitation and Decommissioning Programme (R&D Programme) is provided in Appendix 11. The objectives of the R&D Programme are as follows:

- Establish stable and safe landform post-extraction.
- Remove temporary infrastructure, rubbish, and debris.
- Establish a mixture of pasture and native vegetation (Figure 6) that will maintain the rural character of the property but also mitigate for the impacts of native vegetation clearing.

At this stage it is proposed that within the extraction area, 29.46 ha will be rehabilitated to pasture and 3.14 ha to native vegetation. Outside the extraction area, it is proposed that 15.57 ha of blue gum plantation will be converted to native vegetation and that 9.31 ha of existing native vegetation will be retained and improved. Please see the R&D Programme (Appendix 11) for further information. The proposed rehabilitation areas and rehabilitation measures may change as part of the Clearing Permit application process with DWER.

6. OTHER APPROVALS

The applicant holds an Environmental Licence (L9267/2020/1) for the crushing of gravel on both Lot 287 and Lot 393. A renewal application for this licence is currently being prepared which will be consistent with this DA/EIL application and incorporate the expansion area. The applicant is also in the process of preparing a Clearing Permit application to DWER. DWER is not expected to finalise processing of the application until the DA and EIL have been granted.

Abstraction of groundwater, if necessary, will be subject to a licence from DWER. The operations so far, have not required groundwater abstraction.

7. CONCLUSION

Lot 287 provides a valuable sand and gravel resource for the local construction industry. It has an established, active pit with good access to a major regional road and nearby communities. The proposed expansion will extend the life of the operations and provide a secure supply of sand and gravel at a time of high demand. Two thirds of the extraction area contain no native vegetation and the proposed clearing of 9.70 ha of native vegetation will be mitigated and offset as rehabilitation efforts will result in a greater area of native vegetation on the property after the extraction project than what is currently present. Historical clearing and disturbance and the presence of blue gum plantation make the site more suitable for extraction than other more densely vegetated sites. The removal of blue gums and progressive rehabilitation to pasture and native vegetation will ensure that in the long-term the rural character and environmental values of the area are maintained.

Potential noise and dust impacts on the closest residences have been addressed by incorporating recommendations of a noise assessment and by developing a management plan for dust. Parts of the pit may be visible from surrounding areas but the progressive rehabilitation to pasture and native vegetation will ensure that any visual impacts are temporary and that in the long-term the rural character of the area is maintained. The proposed changes to truck numbers and operational hours are not expected to result in significant additional impacts compared to the currently approved operations. Additional management plans are in place for weeds and dieback, stormwater, and rehabilitation.

Overall, it is expected that the proposed extraction operations can be managed in a way that avoids and minimises adverse environmental and social impacts and delivers a net positive outcome for the environment through facilitating the conversion of blue gum plantation to native vegetation.

8. REFERENCES

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APPENDICES

APPENDIX 1: CERTIFICATE OF TITLE

WESTERN



AUSTRALIA

REGISTER NUMBER

287/DP100056DUPLICATE
EDITION**2**

DATE DUPLICATE ISSUED

31/7/2002**RECORD OF CERTIFICATE OF TITLE**

UNDER THE TRANSFER OF LAND ACT 1893

VOLUME
1245FOLIO
936

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

**LAND DESCRIPTION:**

LOT 287 ON DEPOSITED PLAN 100056

**REGISTERED PROPRIETOR:
(FIRST SCHEDULE)**

MARIO MICHELE GIACCI OF POST OFFICE BOX 1263, BUNBURY
(T L764187) REGISTERED 20 OCTOBER 2011

**LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)**

1. TITLE EXCLUDES THE LAND SHOWN ON LTO PLAN 18912.
2. *L764188 MORTGAGE TO AUSTRALIA & NEW ZEALAND BANKING GROUP LTD REGISTERED 20.10.2011.
3. *L764189 CAVEAT BY CABLE SANDS (WA) PTY LTD LODGED 20.10.2011.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1245-936 (287/DP100056).
PREVIOUS TITLE: This Title.
PROPERTY STREET ADDRESS: LOT 287 SOUTH WESTERN HWY, GWINDINUP.
LOCAL GOVERNMENT AREA: SHIRE OF CAPEL.

- NOTE 1: A000001A LAND PARCEL IDENTIFIER OF BOYANUP AGRICULTURAL AREA LOT 287 (OR THE PART THEREOF) ON SUPERSEDED PAPER CERTIFICATE OF TITLE CHANGED TO LOT 287 ON DEPOSITED PLAN 100056 ON 02-MAY-02 TO ENABLE ISSUE OF A DIGITAL CERTIFICATE OF TITLE.
- NOTE 2: THE ABOVE NOTE MAY NOT BE SHOWN ON THE SUPERSEDED PAPER CERTIFICATE OF TITLE OR ON THE CURRENT EDITION OF DUPLICATE CERTIFICATE OF TITLE.
- NOTE 3: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING L764188

Superseded - Copy for Sketch Only

EASEMENTS AND ENCUMBRANCES REFERRED TO

Mortgage C21237 to Bank of New South Wales, Registered 6th November, 1980 at 9.02 o'clock.

DISCHARGED

Discharge C242258 of Mortgage C21237.
Registered 28th October 1981 at 10.08 o'clock.

As to portion only:
Country Doc. F22200. Notice of Intention to Resume. Registered 23rd October, 1992 at 15.30 hrs.

Caveat F188776. As to portion only: Lodged 13.5.93 at 14.37 hrs.

As to portion only:
Country F347673. Notice of Intention to Resume. Registered 22nd October, 1993 at 15.30 hrs.

Country F713348 Notice of Intention to Resume. Registered 21st October 1994 at 15.30 hrs.

ACTION COMPLETE

Withdrawal G7981 of Caveat F188776. Lodged 18.10.95 at 14.47 hrs.

Caveat H903105 by Cable Sands (W.A.) Pty. Ltd. Lodged 19.10.2001 at 15.17 hrs.

CT 1245 0936 B



CROWN GRANT

Vol. 1245 Fol. 936



APPENDIX 2: FLORA AND VEGETATION SURVEY

**DESKTOP STUDY AND RECONNAISSANCE FLORA AND
VEGETATION SURVEY
LOT 287 SOUTH WEST HWY, GWINDINUP, WA

FOR MARIO MICHELE GIACCI**

JANUARY 2019

Daniel Marsh ▲ Botanical Consulting



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Appendices

Appendix A: Summary of Vascular Plants Recorded within Survey Area

Appendix B: Relevé and Opportunistic Data

Appendix C: NatureMap Search Results for Threatened and Priority Species that have Potential to Occur within Survey Area

Appendix D: EPBC Protected Matters Search Report for Threatened and Priority Species that have Potential to Occur within Survey Area

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Figure 1: Survey Area Location

Figure 2: Aerial Photograph of Survey Area

Figure 3: Conservation Coded Flora within 10km of Survey Area

Figure 4: Vegetation Complexes of Survey Area

Figure 5: Threatened and Priority Ecological Communities within 10km of Survey Area

Figure 6: Vegetation Types Recorded within Survey Area

Figure 7: Vegetation Condition within Survey Area

Figure 8: Location of Relevé Sites

Figure 9: Photograph of Site 06 (VT1, very good/good condition)

Figure 10: Photograph of Site 09 (VT2, very good/good condition)

Figure 11: Photograph of Site 21 (VT3, very good/good condition)

Tables

Table 1: Summary of the Conservation coded flora that were identified in the desktop study as having potential to occur within the survey area

Table 2: Description and extent of vegetation complexes in the survey area

Table 3: Potential limitations of the desktop study and reconnaissance survey

Table 4: Native vegetation types defined within the survey area

Table 5: Vegetation condition within the survey area

1. SUMMARY

Daniel Marsh Botanical Consulting undertook a desktop study and reconnaissance survey of Lot 287 South Western Hwy, Gwindinup, Western Australia in November 2018. The survey area was approximately 46ha of which 19ha was covered with native vegetation. The survey area was traversed by car and on foot and a total of 8 relevé survey sites plus opportunistic recordings and collections were conducted. The sample intensity and time of survey was considered adequate for a reconnaissance survey.

A total of 55 native vascular plant taxa representative of 47 plant genera and 29 plant families were recorded within the survey area. Seven introduced species were recorded, none of which are listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (DPIRD 2018).

No Threatened flora species as listed under section 178 of the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded within the survey area (SPRAT 2018).

No Threatened flora species pursuant to the Western Australian *Biodiversity Conservation Act 2016* and listed by the Department of Biodiversity, Conservation and Attractions (DBCA 2018a) were recorded within the survey area. No Priority flora species listed by the Department of Biodiversity, Conservation and Attractions (WAH 2018) were recorded within the survey area.

Three vegetation types were defined within the survey area, all consisting of variations of *Eucalyptus marginata* and *Corymbia calophylla* woodlands over *Xanthorrhoea preissii*. No Threatened Ecological Communities (TEC) or Priority Ecological Communities (PEC) were inferred to occur within the survey area (DBCA 2018b, DBCA 2018c) and the vegetation complexes mapped by Matiske and Havel (1998) for the survey area are all regarded as well-conserved.

The DBCA database search indicated that the survey area mapped within the buffer of Priority 1 Whicher Scarp Paluslope Wetlands / Swan Coastal Plain Paluslope Wetlands. “These wetlands are very wet all year round and are associated with areas of groundwater seepage from the sandy low hills at the base of the Whicher Scarp” (DBCA 2018c). Wetland habitats were not encountered within the survey area and the vegetation types recorded in this survey were not structurally or floristically similar to the mapped PEC. Statistical analysis was not performed.

Most of the remnant areas of native vegetation ranged in condition from very good to good (40.2%). Vegetation condition was variable due to the fragmented nature of the remnant areas and the impacts of disturbances such as old tracks, logging, cleared areas and weeds. The remainder of the survey area consisted of bluegum plantations, tracks and cleared areas and was considered completely degraded (58.7%).

2. INTRODUCTION

2.1 Background

The survey area was located on Lot 287 (Plan 100056) approximately 10km north-west of the town of Donnybrook along the South Western Highway (Figure 1). The survey area was 46ha of which approximately 19ha was covered with native vegetation. The remainder of the survey area consisted of bluegum plantations, cleared areas and tracks (Figure 2).

Donnybrook experiences a Mediterranean-type of climate, with warm dry summers and cool wet winters. The average annual rainfall for Donnybrook is 973.1 mm and the mean minimum / maximum temperatures for Donnybrook range from 14.1 °C to 30.6 °C in January, and from 5.7 °C to 16.5 °C in July (Bureau of Meteorology 2018).

Lot 287 is situated on the Darling Fault which delineates the eastern periphery of the southern Perth basin and separates the Archaean granitic rocks of the Yilgarn Block to the east from sediments in the Bunbury Trough, a structural sub-division of the Perth Basin (Wilde and Walker 1982).

2.2 Scope and objectives

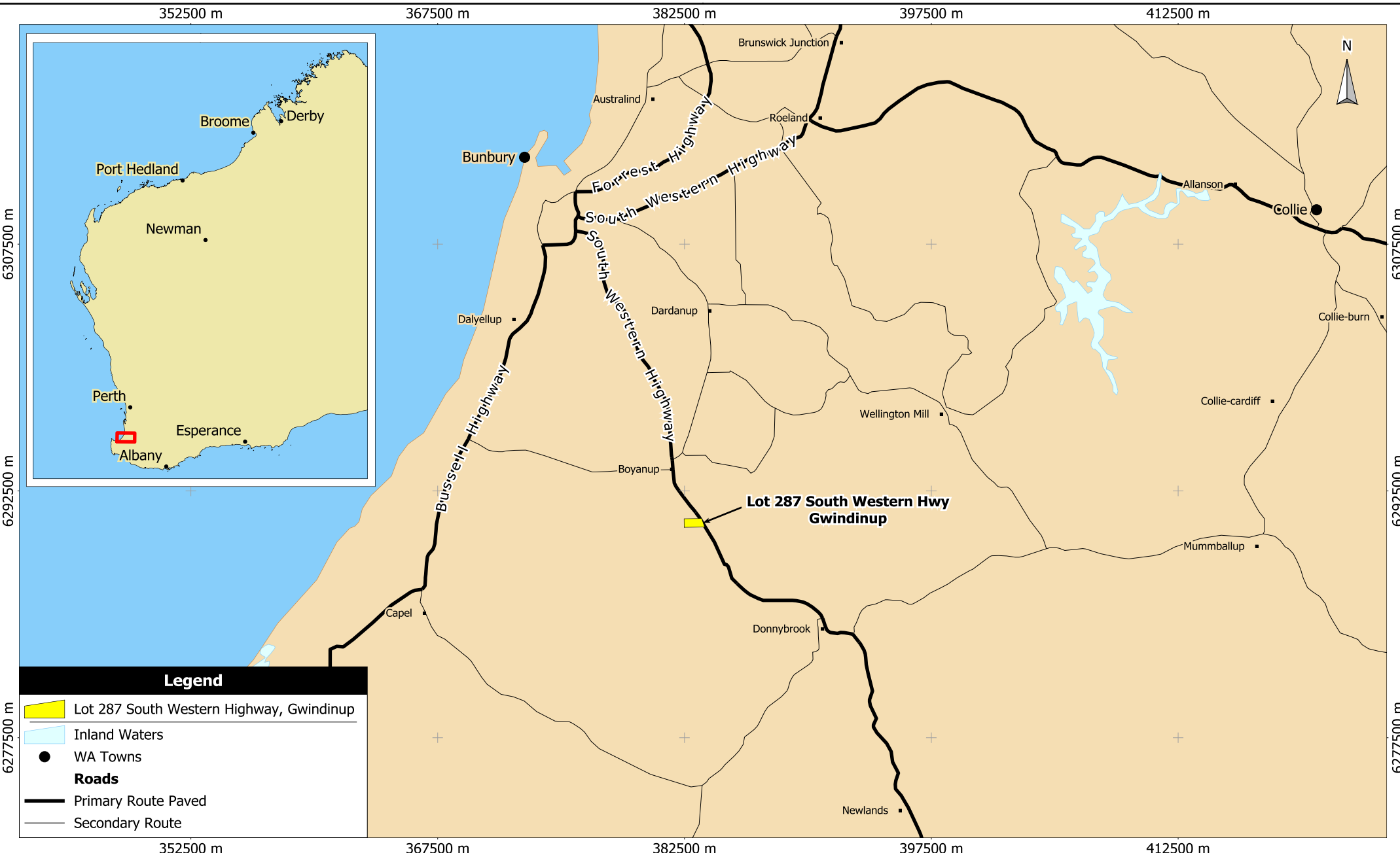
The scope and objectives of the flora survey were to carry out a desktop study and reconnaissance survey of the survey area on Lot 287 South Western Hwy, Gwindinup. The survey scope included the following requirements:

- Review contextual information on the survey area from previous surveys, literature, aerial imagery, database searches and spatial information to summarise the values of flora and vegetation significance in the project area;
- Conduct a field assessment to:
 - Identify the vascular flora species present;
 - Determine the presence or absence of Threatened flora, Priority or significant species and to record the abundance and distribution if present;
 - Assess the conservation significance of vegetation and flora;
 - Define and map vegetation communities using the relevés method;
 - Define and map vegetation condition;
 - Determine the presence or absence of Threatened and Priority ecological communities and map their extent if present.

2.3 Desktop Study Findings

2.3.1 Flora

Database searches identified eight plant taxa declared as rare flora under the state *Biodiversity Conservation Act 2016* that have been recorded within 10km of the survey area. In addition, seven P1 taxa, six P2, eleven P3 and six P4 taxa have been recorded within 10km of the survey area. The EPBC protected matters search tool identified two Critically Endangered taxa, eleven Endangered and six Vulnerable taxa that have the potential to occur within 10km of the survey area. These taxa are listed in Table 1 that also includes details on preferred habitat characteristics and the flowering period as well as the likelihood of occurrence in the survey area, assessed on the basis of distribution and habitat availability.





Scale: 1:5000
 Original Size: A4
 Air Photo Date: Feb 2017
 Grid: MGA94(50)

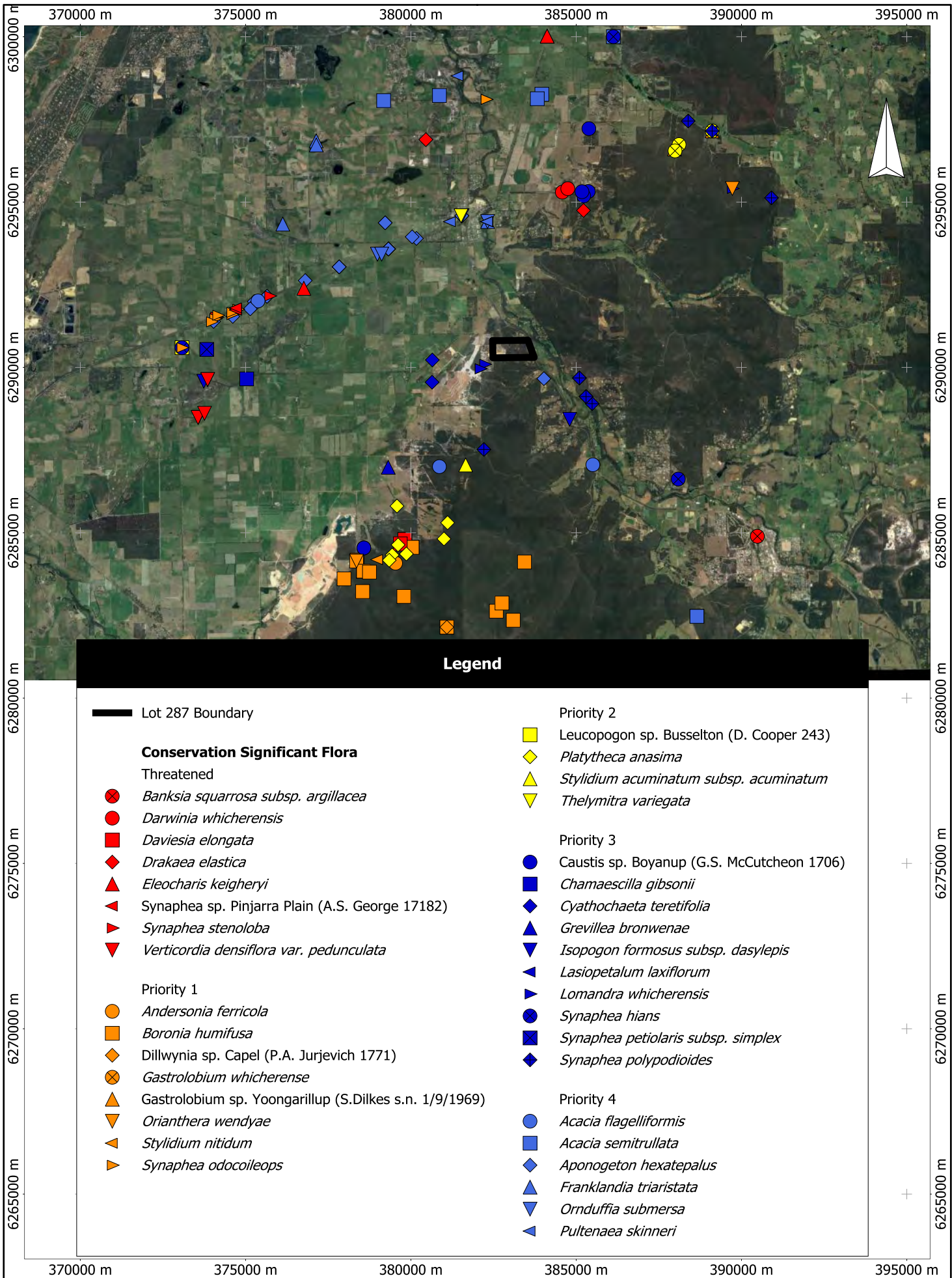
0 200 m

Mario Michele Giacci
 Lot 287 South Western Hwy, Gwindinup
 Flora and Vegetation Survey

Figure 2
Aerial Photograph of Survey Area

4 Cook St
 West Perth WA 6005
 Ph: (08) 9226 3166
 Fax: (08) 9226 3177
 info@mbsenvironmental.com.au
 www.mbsenvironmental.com.au

MBS
 ENVIRONMENTAL



Scale: 1:150000
Original Size: A4
Air Photo Date: 2017
Grid: MGA94(50)

0 5 km

Mario Michele Giacci
Lot 287 South Western Hwy,
Gwindinup
Flora and Vegetation Survey

Figure 3

**Conservation Coded Flora
within 10km of Survey Area**

Martinick Bosch Sell Pty Ltd
4 Cook St
West Perth WA 6005
Ph: (08) 9226 3166
Fax: (08) 9226 3177
info@mbsenvironmental.com.au
www.mbsenvironmental.com.au

MBS
ENVIRONMENTAL

Table 1: Summary of the Conservation coded flora that were identified in the desktop study as having potential to occur within the survey area

NM = Naturemap with 10km buffer

EPBC = EPBC Act Protected Matters Search Tool with 10km buffer (CE=Critically Endangered,

E=Endangered, V=Vulnerable)

PW = DBCA database search with 10km buffer

Species	NM	EPBC	PW	Flowering	Habitat	Likelihood
Apiaceae						
<i>Brachyscias verecundus</i> (SPRAT 2018)		V		Dec (Annual)	Winter-wet clay over ironstone. In a moss sward on a granite outcrop.	Unlikely (Habitat)
Aponogetonaceae						
<i>Aponogeton hexatepalus</i> (WAH 2018)	P4		P4	July - Oct	Aquatic plant found in freshwater	Unlikely (Habitat)
Asparagaceae						
<i>Lomandra whicherensis</i> (WAH 2018)	P3		P3	Nov – Dec (Perennial)	Shallow sand over laterite on ridgelines	Possible
Cyperaceae						
<i>Caustis</i> sp. <i>Boyanup</i> (WAH 2018)	P3		P3	No information found	White or grey sand	Possible
<i>Cyathochaeta teretifolia</i> (WAH 2018)	P3		P3	No information found	Grey sand and sandy clay in swamps, creek edges	Unlikely (Habitat)
<i>Eleocharis keigheryi</i> (WAH 2018)	T	V	T	Aug - Nov	Emergent in freshwater: creeks, claypans	Unlikely (Habitat)
Elaeocarpaceae						
<i>Platytheca anasima</i> (Butcher 2008)	P2		P2	Oct-Dec	Gentle slopes of white-grey sand or brown sandy loam	Possible
Ericaceae						
<i>Andersonia ferricola</i> (WAH 2018)	P1		P1	Oct	White sand or red-brown loam over ironstone. Seasonally wetlands	Unlikely (Habitat)
<i>Andersonia gracilis</i> (WAH 2018)		E		Sep – Nov	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps	Unlikely (Distribution)
<i>Leucopogon</i> sp. <i>Busselton</i> (Ecoedge 2016)	P2		P2	Aug - Sep	<i>Pericalymma ellipticum</i> wet shrubland, Marri-Jarrah woodland	Possible
Fabaceae						
<i>Acacia drummondii</i> subsp. <i>affinis</i> (WAH 2018)	P3			Jul – Aug	Lateritic gravelly soils	Unlikely (Distribution)
<i>Acacia flagelliformis</i> (WAH 2018)	P4		P4	May – Sep	Sandy soils. Winter-wet areas	Possible
<i>Acacia semitrullata</i> (WAH 2018)	P4		P4	May – Oct	White/grey sand, sometimes over laterite, clay. Sandplains, swampy areas.	Possible
<i>Daviesia elongata</i> (WAH 2018)	T	V	T	Sep or Dec or Jan to Feb	Sand, laterite	Possible
<i>Dillwynia</i> sp. <i>Capel</i> (WAH 2018)	P1		P1	Sep-Oct	Littered grey loamy sand, rocky soils. Valleys, rangelands.	Possible
<i>Gastrolobium</i> sp. <i>Yoongarillup</i> (DBCA 2017)	P1		P1	Oct Perennial	No information found	Possible

Species	NM	EPBC	PW	Flowering	Habitat	Likelihood
<i>Gastrolobium papilio</i> (WAH 2018) (SPRAT 2018)		E		Oct – Dec Perennial	Sandy clay over ironstone and laterite. Flat plains	Unlikely (Distribution)
<i>Gastrolobium whicherense</i> (WAH 2018)	P2		P2	Oct Perennial	Red-grey sandy clay over quartzite. Steep westerly slopes	Unlikely (Habitat)
<i>Pultenaea skinneri</i> (WAH 2018)	P4		P4	Jul – Sep (Perennial)	Sandy or clayey soils. Winter-wet depressions	Unlikely (Habitat)
Loganiaceae						
<i>Orianthera wendyae</i> (DBCA 2017)	P1		P1	Oct	No information found	Possible
Malvaceae						
<i>Lasioptatum laxiflorum</i> (Shepherd and Wilkins 2015)	P3		P3	Oct-Jan (Perennial)	<i>Eucalyptus marginata</i> , <i>Corymbia</i> , <i>Allocasuarina</i> or <i>Banksia grandis</i> woodland or forest, in gravelly, brown clay over laterite, rarely in white sand	Possible
Menyanthaceae						
<i>Ornduffia submersa</i> (TBW 2013)	P4		P1	Sep-Oct	Surface of the shallow water	Unlikely (Habitat)
Myrtaceae						
<i>Chamelaucium</i> sp. S coastal plain (SPRAT 2018)		V		Nov – Dec (Perennial)	Swamp margins in open Dryandra shrubland in winter-wet sandy clay sites on a coastal plain	Unlikely (Habitat)
<i>Darwinia whicherensis</i> (SPRAT 2018)	T		T	Oct – Nov (Perennial)	winter-wet area of shrubland over shallow red clay over ironstone	Unlikely (Habitat)
<i>Verticordia densiflora</i> var. <i>pedunculata</i> (WAH 2018)	T	E	T	Dec – Jan (Perennial)	Grey/yellow sand, sandy loam. Winter-wet low- lying areas.	Unlikely (Habitat)
Orchidaceae						
<i>Caladenia hoffmanii</i> (WAH 2018)		E		Aug – Oct (Perennial)	Clay, loam, laterite, granite. Rocky outcrops and hillsides, ridges, swamps and gullies.	Unlikely (Distribution)
<i>Diuris micrantha</i> (WAH 2018)		V		Sep – Oct (Perennial)	Winter-wet swamps, in shallow water	Unlikely (Habitat and distribution)
<i>Diuris purdiei</i> (WAH 2018)		E		Sep – Oct (Perennial)	Grey-black sand, moist. Winter-wet swamps.	Unlikely (Habitat and distribution)
<i>Drakaea elastica</i> (WAH 2018) (SPRAT 2018)	T	E	T - CR	Oct - Nov (Perennial)	White or grey sand. Low- lying situations adjoining winter-wet swamps	Unlikely (Habitat and distribution)
<i>Drakaea micrantha</i> (WAH 2018) (SPRAT 2018)		V		Sep – Oct (Perennial)	Cleared firebreaks or open sandy patches that have been disturbed. White-grey sand. In Jarrah or Sheok woodland	Unlikely (Distribution)
<i>Thelymitra variegata</i> (WAH 2018)	P2		P2	June – Sep (Perennial)	Sandy clay, sand, laterite	Possible

Species	NM	EPBC	PW	Flowering	Habitat	Likelihood
Proteaceae						
<i>Banksia squarrosa</i> subsp. <i>Argillacea</i> (WAH 2018) (SPRAT 2018)	T		T	June – Nov (Perennial)	White/grey sand, gravelly clay or loam. Winter-wet flats, clay flats	Unlikely (Distribution)
<i>Banksia nivea</i> subsp. <i>uliginosa</i> (WAH 2018) (SPRAT 2018)		E		Aug – Sep (Perennial)	Sandy, clay, gravel	Unlikely (Distribution)
<i>Franklandia triaristata</i> (WAH 2018)	P4		P4	Aug – Oct (Perennial)	White or grey sand	Possible
<i>Grevillea bronwenae</i> (WAH 2018)	P3		P3	June – Dec (Perennial)	Grey sand over laterite, lateritic loam. Hillslopes.	Possible
<i>Isopogon formosus</i> subsp. <i>dasylepis</i> (WAH 2018)	P3		P3	Jun – Dec (Perennial)	Sand, sandy clay, gravelly sandy soils over laterite. Often swampy areas.	Possible
<i>Lambertia echinata</i> subsp. <i>occidentalis</i> (WAH 2018) (SPRAT 2018)		E		Feb, Apr, Dec (Perennial)	White sandy soils over laterite, orange/brown-red clay over ironstone. Flats to foothills, winter-wet sites.	Unlikely (Distribution)
<i>Petrophile latericola</i> (WAH 2018) (SPRAT 2018)		E		Nov (Perennial)	Red lateritic clay. Winter-wet flats.	Unlikely (Habitat and distribution)
<i>Sphenotoma drummondii</i> (WAH 2018) (SPRAT 2018)		E		Sep – Dec (Perennial)	Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks.	Unlikely (Habitat and distribution)
<i>Synaphea hians</i> (WAH 2018)	P3		P3	July, Sep, Nov (Perennial)	Sandy soils. Rises.	Possible
<i>Synaphea odocoileops</i> (WAH 2018)	P1		P1	Aug – Oct (Perennial)	Brown-orange loam & sandy clay, granite. Swamps, winter-wet areas.	Unlikely (Habitat)
<i>Synaphea petiolaris</i> subsp. <i>simplex</i> (WAH 2018)	P3		P3	Sep – Oct (Perennial)	Sandy soils. Flats, winter-wet areas.	Possible
<i>Synaphea polypodioides</i> (WAH 2018) (DBCA 2017)	P3		P3	Sep – Oct (Perennial)	Light brown loam, red-brown sandy loam, gravelly, brown sandy clay over laterite. In undulating areas.	Unlikely (Habitat)
<i>Synaphea</i> sp. Fairbridge Farm (WAH 2018) (SPRAT 2018)		CE		Oct (Perennial)	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Possible
<i>Synaphea</i> sp. Pinjarra Plain (WAH 2018) (SPRAT 2018)	T		T	Sep – Nov (Perennial)	Grey sandy loam or clay, grey-brown clayey sand, brown clayey loam, laterite. Flats, seasonally wet areas, railroad reserves often with wet depressions or drains.	Unlikely (Distribution)
<i>Synaphea</i> sp. Serpentine (SPRAT 2018)		CE		Aug – Nov (Perennial)	No information found	Unlikely (Distribution)

Species	NM	EPBC	PW	Flowering	Habitat	Likelihood
<i>Synaphea stenoloba</i> (WAH 2018)	T	E	T - CR	Aug - Oct	Sandy or sandy clay soils. Winter-wet flats, granite.	Unlikely (Habitat)
Rhamnaceae						
<i>Stenanthemum sublineare</i> (WAH 2018)	P2			Oct – Dec (Perennial)	Littered white sand. Coastal plain.	Unlikely (Habitat and distribution)
Rutaceae						
<i>Boronia humifusa</i>	P1		P1	Jun – Sep (Perennial)	Gravelly clay loam over laterite. Jarrah-marri open forest	Possible
Stylidiaceae						
<i>Stylidium acuminatum subsp. acuminatum</i> (Wege 2010)	P2		P2	Oct – Nov	Lateritic soils on hillslopes and in valleys, in <i>Eucalyptus marginata</i> and/or <i>Corymbia calophylla</i> forest.	Possible
<i>Stylidium nitidum</i> (Lowrie and Kenneally 2017)			P1	Oct - Nov	Occurs in the southern Jarrah Forest growing in grey sand mostly under <i>Casuarina</i> and <i>Baeckea</i> species	Possible
Xanthorrhoeaceae						
<i>Chamaescilla gibsonii</i> (WAH 2018)	P3		P3	Sep	Clay to sandy clay. Winter-wet flats, shallow water-filled claypans.	Unlikely (Habitat)

Many of the conservation coded taxa in Table 1 are restricted to habitats or soils and landforms that are not found within the survey area. They are therefore unlikely to occur within the survey area. On the basis of habitat characteristics and known distribution, 21 taxa are considered to have potential to occur within the survey area (Table 1).

Within the survey area boundary there are no past records of Threatened or Priority flora taxa (Figure 3). The closest records of Priority flora consist of two identical records of *Lomandra whicherensis*, however their location does not match the description of the location for the record. The described location is approximately 3km to the south of the survey area growing on a ridgeline in sandy clay over laterite. Several hundred of plants were recorded growing in *Eucalyptus haematoxylon* / *E. marginata* low woodland over *Xanthorrhoea acanthostachya* shrubland.

Other Priority flora taxa recorded near the survey area such as *Aponogeton hexatepalus*, an aquatic plant, and *Cyathochaeta teretifolia*, a sedge, are not expected in the survey area due to lack of suitable habitat.

2.3.2 Vegetation

The survey area occurs within the Jarrah Forest Bioregion as defined in the Interim Biogeographical Regionalisation for Australia (IBRA). DBCA has compiled a dataset that is a comprehensive coverage of pre-1750 distribution of vegetation complexes of the south west forest region of Western Australia based on 1:50,000 mapping of Matiske and Havel (1998). It has been reviewed and changes have been made to ensure the complexes of the Whicher Scarp reviewed by Webb et al. (2016) were a continuation of those defined by Matiske and Havel (1998).

The majority of the survey area is located in an area mapped as low valley slopes of the Rosa vegetation complex (Figure 4). The western edge of the survey area has been mapped as gentle slopes of the Whicher Scarp. A small section of the survey area is mapped as uplands of the Kingia complex. The soil is characterised by sandy gravels on broad lateritic crests over sedimentary rocks. The descriptions, percentage of survey area and reservation are listed in Table 2.

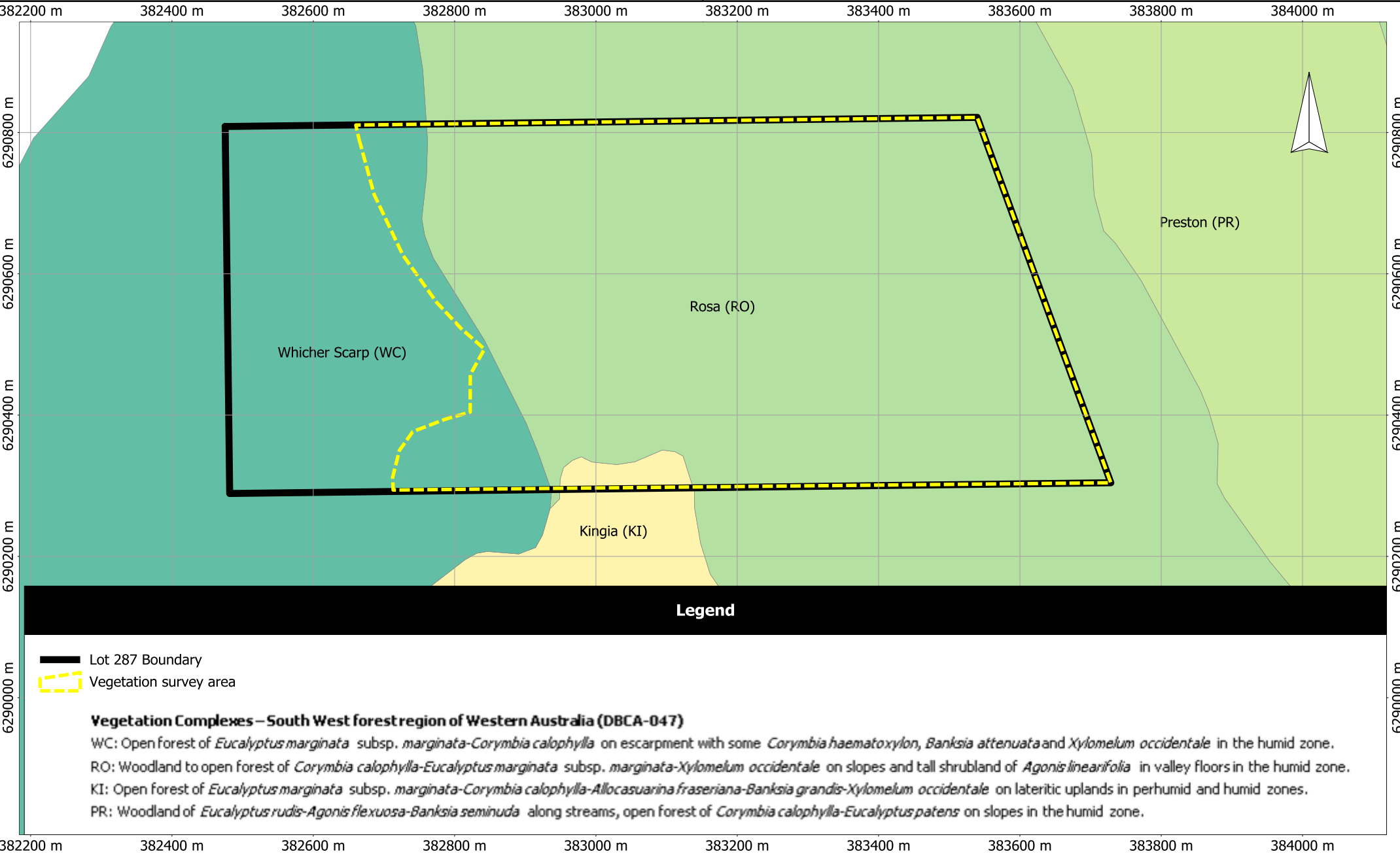
Table 2: Description and extent of vegetation complexes in the survey area (Government of Western Australia 2018).

Description	Portion of Total Survey Area (ha)	Current Extent Protected (IUCN I-IV) for Conservation (ha)	Current Extent in DBCA Managed Land (ha)	Pre-European Area Remaining (ha)
Rosa valleys (243) – Woodland to open forest of <i>Corymbia calophylla</i> - <i>Eucalyptus marginata</i> subsp. <i>marginata</i> - <i>Xylomelum occidentale</i> on slopes and tall shrubland of <i>Agonis linearifolia</i> in valley floors in the humid zone.	41.26 (89.6%)	2,093.61 (12.05%)	11,447.51 (66.4%)	12,979.04 (75.28%)
Whicher Scarp Uplands (290) - Open forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> - <i>Corymbia calophylla</i> on escarpment with some <i>Corymbia haematoxylon</i> , <i>Banksia attenuata</i> and <i>Xylomelum occidentale</i> in the humid zone.	4.08 (8.8%)	423.43 (9.39%)	2,417.31 (53.60%)	3,129.06 (69.39%)
Kingia Uplands (155) - Open forest of <i>Eucalyptus marginata</i> subsp. <i>marginata</i> - <i>Corymbia calophylla</i> - <i>Allocasuarina fraseriana</i> - <i>Banksia grandis</i> - <i>Xylomelum occidentale</i> on lateritic uplands in prehumid and humid zones.	0.73 (1.6%)	26,212.55 (25.69%)	94,478.07 (92.60%)	96,173.78 (94.26%)

The DBCA database search for TECs and PECs showed the survey area mapped within the buffer of Whicher Scarp Paluslope Wetlands - Swan Coastal Plain Paluslope Wetlands Priority 1 (Figure 5). This community is described as:

“These wetlands are very wet all year round and are associated with areas of groundwater seepage from the sandy low hills at the base of the Whicher Scarp. At times these wetlands are contiguous with areas of Pinjarra Plain wetlands, and the wetlands of the two landforms merge. Combinations of the following species are typically found in the type: *Melaleuca preissiana*, *Taxandria linearifolia*, *Taxandria fragrans*, *Melaleuca incana*, and *Cyathochaeta teretifolia*. Other species include: *Eucalyptus patens*, *Homalospermum firmum*, *Gahnia decomposita*, *Callistachys lanceolata*, *Hakea linearis*, *Melanostachya ustulata*, *Evandra aristata*, *Beaufortia sparsa*, *Calistemon glaucus* and *Pultenaea pinifolia*” (DPAW 2018c).

After a review of the spatial data and aerial imagery, no wetland habitat or vegetation communities are expected in the survey area.



372000 m 377000 m 382000 m 387000 m 392000 m

6302500 m

6297500 m

6292500 m

6287500 m

6282500 m

6277500 m

6302500 m

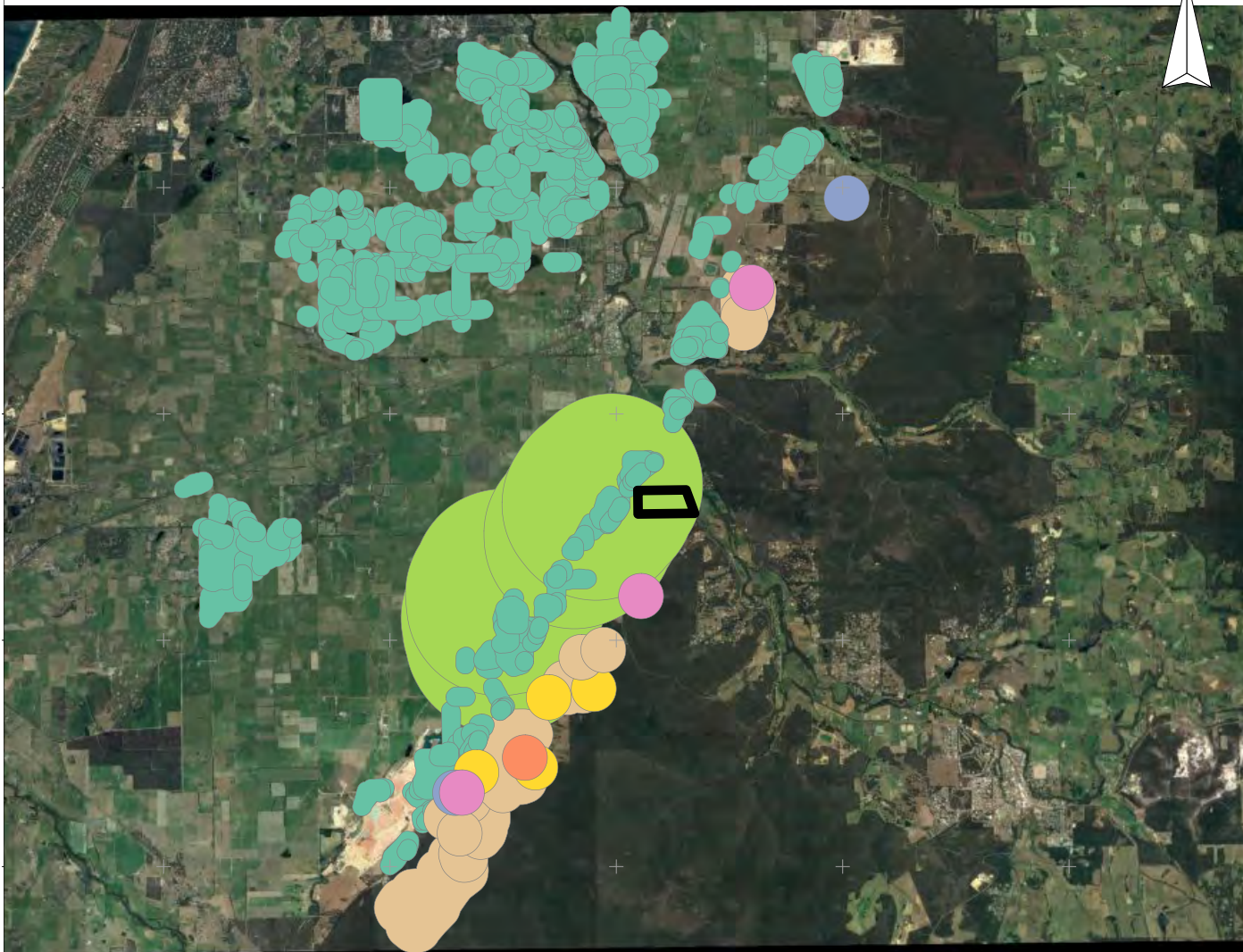
6297500 m

6292500 m

6287500 m

6282500 m

6277500 m



Legend



- Lot 287 Boundary
- Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region (P3)
- Central Whicher Scarp Mountain Marri woodland (P1)
- Eucalyptus haematoxylon* – *E. marginata* woodlands on Whicher foothills (P3)
- Southern *Banksia attenuata* woodlands (P3)
- Swan Coastal Plain Paluslope Wetlands (P1)
- West Whicher Scarp *Banksia attenuata* woodland (Swan Coastal Plain centred woodlands of grey/white sands community B2) (P1)
- Whicher Scarp Jarrah woodland of deep coloured sands (P1)

Scale: 1:150000
Original Size: A4
Air Photo Date: 2017
Grid: MGA94(50)
0 5 km

Mario Michele Giacci
Lot 287 South Western Hwy,
Gwindinup
Flora and Vegetation Survey

Figure 5

**Threatened and Priority
Ecological Communities
within 10km of Survey Area**

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3. METHODS

3.1 Desktop Study

The desktop study gathered contextual information on the survey area from previous surveys, literature, aerial imagery, database searches and spatial information. Resources used included:

- DBCA Threatened Flora Database;
- DBCA Threatened Ecological Communities Database;
- NatureMap (DBCAd);
- Florabase (Western Australian Herbarium);
- EPBC Act List of Threatened Flora;
- EPBC Act List of Threatened Ecological Communities;
- Australian Government's EPBC Act Protected Matters Search Tool (Department of the Environment and Energy);
- Spatial data available from the Government of Western Australia;
- Previous surveys and articles describing significant flora.

3.2 Field Assessment

The field assessment was conducted by one ecologist in November 2018. The vegetation was assessed using the relevé method according to standards set out in Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016). Relevé sites were selected using aerial imagery and field selection. Opportunistic collections were made when appropriate. The following parameters were recorded at unmarked survey sites.

- GPS location;
- Description of vegetation structure;
- Vegetation condition score (Keighery 1994);
- The height and percentage cover of dominant or important plant species of the differing strata layers;
- Presence and absence of all species other than the dominants within approximately 10m of the recorder;
- Soil type;
- Disturbance;
- Site photographs.

Plant taxa that could not be identified in the field were collected systematically, dried and fumigated before identification. Plant specimens collected were identified using keys or through comparisons with pressed specimens at the WA Herbarium. When necessary, plant taxonomists with specialist skills were consulted to confirm identification.

3.3 Vegetation Mapping

Vegetation types were defined based on structure and dominant species at each survey site and described in accordance to the standards set out in the National Vegetation Information System (NVIS) Australian Vegetation Attribute Manual Version 7.0 (ESCAVI 2017). Mapping polygons were developed using aerial photography interpretation in conjunction with field notes and co-ordinates recorded during the survey.

3.4 Limitations

Table 3 displays the evaluation of the flora and vegetation assessment against a range of potential limitations. Based on this evaluation, the assessment has not been subject to constraints that would affect the thoroughness of the assessment and the conclusions reached.

Table 3: Potential limitations and constraints

Potential Limitation	Impact of Constraint	Comment
Availability of contextual information at a regional and local scale	Not a constraint	The area of survey has been reasonably well surveyed and adequate data were available.
Competency/experience of the team carrying out the survey, including experience in the bioregion surveyed.	Not a constraint	Personnel have the appropriate training and extensive survey experience within the Jarrah Forest and Swan Coastal Plain.
Access restrictions within the survey area	Not a constraint	The survey area has numerous tracks and the survey area is small enough to be traversed by foot.
Intensity of survey	Not a constraint	For a desktop study and reconnaissance survey, the depth of investigation and data collection was considered sufficient.
Timing of the survey	Not a constraint	The field assessment was conducted in November. Flora and vegetation surveys are normally conducted following winter rainfall in the South-West Province, ideally during spring (EPA 2016).
Disturbance	Not constraints	Although the survey area has been subject to multiple disturbances, the flora and vegetation was adequately described.
Completeness	Not a constraint	The information collected during the survey was sufficient to assess the vegetation that was present during the time of the survey.

4. RESULTS

4.1 Native Flora

A total of 55 native vascular plant taxa representative of 47 plant genera and 29 plant families were recorded within the survey area (Appendix 1). The majority of the taxa recorded were representative of the Myrtaceae (7 taxa), Proteaceae (5 taxa) and Hemerocallidaceae (4 taxa) families.

4.2 Threatened and Priority Flora

No Threatened flora pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and as listed by the Department of the Environment and Energy (DEE 2018) were recorded within the survey area. No Threatened flora pursuant to the *Western Australian Biodiversity Conservation Act 2016* and as listed by the Department of Biodiversity, Conservation and Attractions (DBCA 2018a) were recorded within the survey area. No Priority flora species as listed by the Western Australian Herbarium (WAH 2018) were recorded within the survey area.

4.3 Introduced Species

Of the 62 plant taxa recorded within the survey area, 7 species were introduced (11%). None of these introduced taxa are listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (DPIRD 2018).

4.4 Vegetation Types

Three native vegetation types were defined within the survey area and are described in Table 4 and presented in Figure 6. The remainder of the survey consisted of disturbed areas (D).

Table 4: Native vegetation types defined within the survey area

Code	Vegetation Type Description	Area (ha)	% of survey area
VT1	Tall woodland of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over low woodland of <i>Banksia grandis</i> over tall sparse shrubland of <i>Kunzea glabrescens</i> over low sparse shrubland of <i>Xanthorrhoea preissii</i> .	0.79	1.7%
VT2	Tall woodland of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over tall sparse shrubland of <i>Kunzea glabrescens</i> over low sparse shrubland of <i>Xanthorrhoea preissii</i> and <i>Xanthorrhoea gracilis</i> .	0.84	1.8%
VT3	Tall woodland of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over low sparse shrubland of <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> .	17.39	37.8%
D	Disturbed: Bluegum plantations, tracks and clearings.	27.04	58.7%



Legend

Lot 287 Boundary

Vegetation survey area

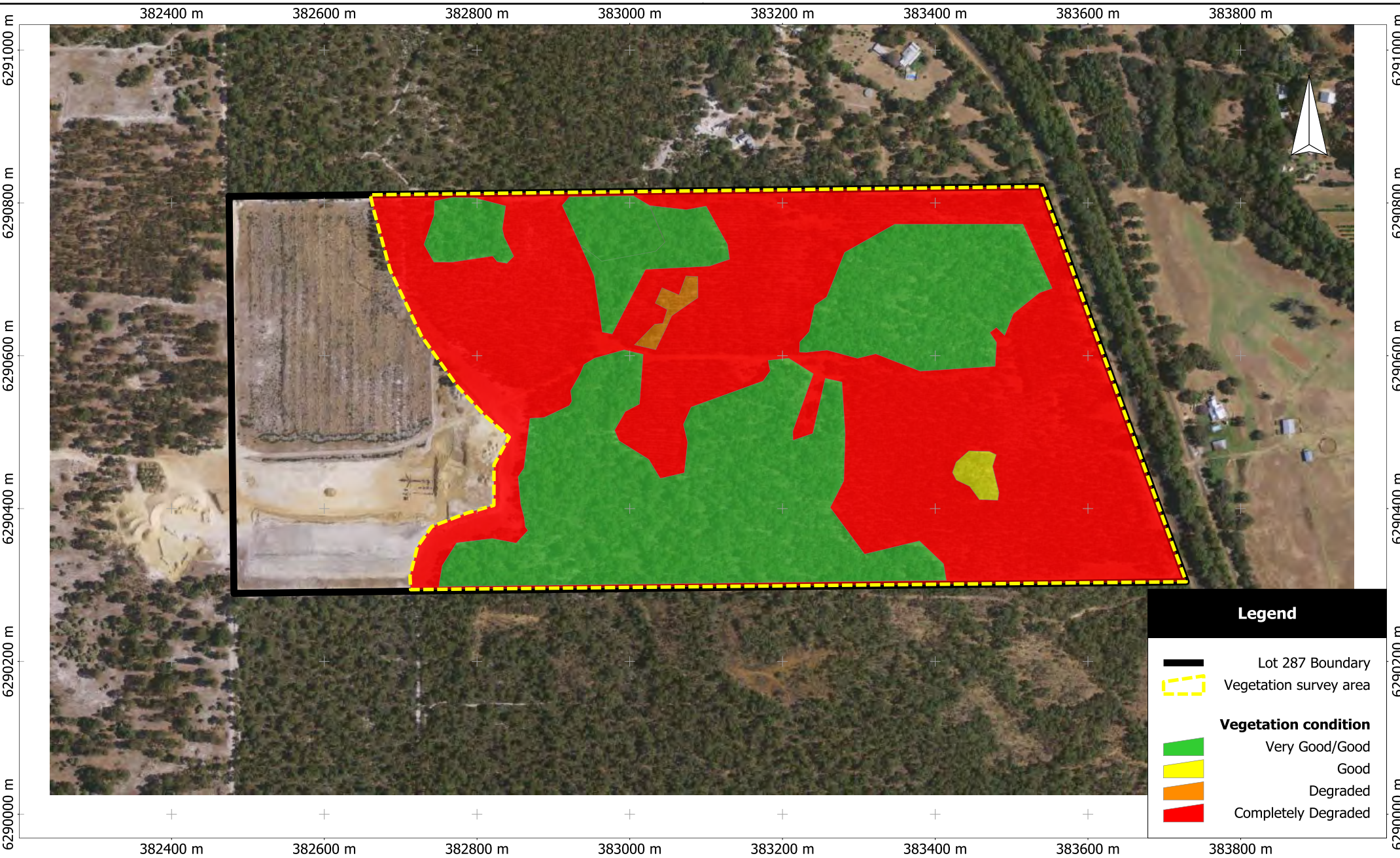
Vegetation type

VT1: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low woodland of *Banksia grandis* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii*.

VT2: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea gracilis*.

VT3: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low sparse shrubland of *Xanthorrhoea preissii* and *Hibbertia hypericoides*.

Disturbed: Bluegum plantations, tracks and clearings.



Legend

Lot 287 Boundary

Vegetation survey area

Vegetation condition

Very Good/Good

Good

Degraded

Completely Degraded

Scale: 1:6500
Original Size: A4
Air Photo Date: February 2017
Grid: MGA94(50)

0

200 m

Mario Michele Giacci
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Flora and Vegetation Survey

Figure 7
Vegetation Condition within Survey Area

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Legend

Lot 287 Boundary

Vegetation survey area

Relevé sites

Scale: 1:6500
 Original Size: A4
 Air Photo Date: February 2017
 Grid: MGA94(50)

Mario Michele Giacci
 Lot 287 South Western Hwy, Gwindinup
 Flora and Vegetation Survey

Figure 8
Location of Relevé Sites

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 West Perth WA 6005
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 Fax: (08) 9226 3177
 info@mbsenvironmental.com.au
 www.mbsenvironmental.com.au

4.5 Vegetation Condition

Most of the remnant areas of native vegetation had a condition ranging from very good to good (Table 5; Figure 7). Vegetation condition was variable due to the fragmented nature of the remnant areas and the impacts of disturbances such as old tracks, logging, cleared areas and weeds. The remainder of the survey area consisted of bluegum plantations, tracks and cleared areas and was considered completely degraded.

Table 5: Vegetation condition within the survey area

Vegetation Condition	Area (ha)	% of survey area
Very Good/Good	18.51	40.2%
Good	0.27	0.6%
Degraded	0.24	0.5%
Completely Degraded	27.04	58.7%



Figure 9: Site 06 - VT1 - very good/good vegetation condition



Figure 10: Site 09 – VT2 – Very good/good vegetation condition



Figure 11: Site 19 – VT3 – Very good/good vegetation condition

5. DISCUSSION AND CONCLUSIONS

No significant flora species were recorded within the survey area. It was not possible to identify one taxon collected, *Lomandra* sp., to species level due to the lack of flowering parts. The sample was compared with specimens at the Western Australian Herbarium and it was confirmed that it was not *Lomandra whicherensis* (P3) which has flatter, thinner leaves with many more striations.

An Orchidaceae sp. was collected during the survey but its identification was not possible due to the deterioration of the sample. The only conservation significant Orchidaceae sp. that was considered possible to occur in the survey area after further investigation was *Thelymitra variegata* (P2). It flowers between June and September and has been recorded in sandy clay, sand and laterite (WAH 2018). There is only one record of this taxon within 10km and it is located approximately 4km to the north-west of the survey area. While it is possible that this taxon may occur within the survey area, it is unlikely due to the lack of nearby records.

Other conservation coded flora taxa identified in the desktop survey that were considered possible to occur within the survey area are either recorded as flowering during November or are perennial species that would have been observable during the survey, despite not flowering. Therefore, the sample intensity and time of survey was considered adequate, considering the size of the survey area and significant flora species identified in the desktop study.

The three native vegetation types defined in the survey area consist of variations of Jarrah/Marri woodlands over *Xanthorrhoea* and do not resemble any TECs or PECs. The vegetation types recorded in this survey were not structurally or floristically similar to the mapped PEC, Priority 1 Whicher Scarp Paluslope Wetlands / Swan Coastal Plain Paluslope Wetlands, and wetland habitats were not encountered within the survey area. The vegetation types recorded in this survey were also compared to TECs and PECs listed by DBCA but statistical analysis was not performed. The vegetation complexes mapped by Matiske and Havel (1998) for the survey area have relatively high pre-European extent and reservation (Government of Australia 2018).

The fragmented nature of the remnant vegetation has affected its condition. Vegetation was patchy due to the impacts of various forms of disturbance and was therefore mapped as a mosaic of very good and good condition. Edge effects from fragmentation are known to influence vegetation condition, in particular weed infestation (Stenhouse 2004).

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APPENDIX A: SUMMARY OF VASCULAR PLANTS RECORDED WITHIN SURVEY AREA

+ = Recorded on site

* = Introduced species

Family Name	Status	Species	Site 06	Site 09	Site 11	Site 14	Site 17	Site 19	Site 20	Site 21	Opp
Apiaceae		<i>Daucus glochidiatus</i>		+				+		+	
Asparagaceae		<i>Lomandra sericea</i>	+								
		<i>Lomandra</i> sp.	+	+	+	+	+	+			
		<i>Thysanotus arenarius</i>				+		+			
Asteraceae	*	<i>Hypochaeris glabra</i>	+	+		+	+		+		
		<i>Lagenophora huegelii</i>	+		+			+			
		<i>Rhodanthe citrina</i>	+								+
	*	<i>Ursinia anthemoides</i>	+		+	+	+	+			
Campanulaceae		<i>Lobelia tenuior</i>							+		
	*	<i>Wahlenbergia capensis</i>						+			
Caryophyllaceae	*	<i>Petrorhagia dubia</i>						+			
Celastraceae		<i>Stackhousia monogyna</i>									+
Colchicaceae		<i>Burchardia congesta</i>								+	
Cyperaceae		<i>Tetraria</i> sp. Jarrah Forest	+	+	+	+	+	+		+	
Dilleniaceae		<i>Hibbertia amplexicaulis</i>	+		+						
		<i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>	+	+	+	+	+	+	+	+	
		<i>Hibbertia mylnei</i>	+	+	+		+				
Droseraceae		<i>Drosera stolonifera</i>	+								
Elaeocarpaceae		<i>Tetratheca hirsuta</i> subsp. <i>viminea</i>			+	+					
Ericaceae		? <i>Conostephium pendulum</i>							+		
Fabaceae	*	<i>Acacia iteaphylla</i>								+	
		<i>Bossiaea eriocarpa</i>	+								
		<i>Gompholobium preissii</i>			+						
		<i>Hovea elliptica</i>	+	+			+				

[illegible]

[illegible]

APPENDIX B: RELEVÉ AND OPPORTUNISTIC DATA

Name: STY

Site: 06

Datum: GDA 94

Easting: 0382777

Date: 14/11/2018

Soil: Sandy loam

Northing: 6290769

Vegetation description

Time since fire: >3

Eucalyptus marginata and *Corymbia calophylla*, *Banksia grandis* and *Kunzea glabra*
over *Xanthorrhoea preissii*



Vegetation Condition: Very good

Disturbance type: Weeds

Dominants*Eucalyptus marginata*

Height (m)

%

cover

Comments

7.1

5

Corymbia calophylla

7.1

20

Kunzea glabrescens

3.5

2

Xanthorrhoea preissii

1.2

8

Banksia grandis

6

10

Additional Species*Hibbertia hypericoides**Hakea amplexicaulis**Briza maxima*

Weed

*Lagenophora huegelii**Hovea elliptica**Patersonia occidentalis**Hibbertia amplexicaulis**Lomandra sericea**Ursinia anthemoides*

Weed

*Bossiaea eriocarpa**Drosera stolonifera**Hypochaeris glabra*

Weed

*Levenhookia pusilla**Aira cupaniana*

Weed

*Hibbertia mylnei**Lomandra* sp.*Tetraria* sp. Jarrah Forest*Banksia dallanneyi* subsp. *dallanneyi**Rhodanthe citrina**Hypocalymma robustum**Scaevola calliptera**Boronia dichotoma*

Name: STY**Site: 09****Datum: GDA 94****Easting: 0383010****Date: 14/11/2018****Soil: Grey sandy loam****Northing: 6290749****Vegetation description****Time since fire: >3**

Eucalyptus marginata and *Corymbia calophylla* over *Kunzea glabra*
over *Xanthorrhoea preissii* and *Hibbertia hypericoides*

**Vegetation Condition:** Very good**Disturbance type:** Weeds,
tracks nearby, plantation nearby

<u>Dominants</u>	Height (m)	% cover	Comments
<i>Eucalyptus marginata</i>	>10	20	
<i>Corymbia calophylla</i>	>10	5	
<i>Kunzea glabrescens</i>	4	10	
<i>Xanthorrhoea preissii</i>	1.2	4	
<i>Hibbertia hypericoides</i>	0.3	2	
<u>Additional Species</u>			
<i>Hakea amplexicaulis</i>			
<i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i>			
<i>Hibbertia mylnei</i>			
<i>Desmocladius fasciculatus</i>			
<i>Hypochaeris glabra</i>			Weed
<i>Briza maxima</i>			Weed
<i>Lomandra</i> sp.			Sterile
<i>Boronia dichotoma</i>			
<i>Hakea amplexicaulis</i>			
<i>Daucus glochidiatus</i>			
<i>Levenhookia pusilla</i>			
<i>Xanthorrhoea gracilis</i>			
<i>Hovea elliptica</i>			
<i>Tetraria</i> sp. Jarrah Forest			
<i>Leschenaultia biloba</i>			
<i>Patersonia occidentalis</i>			
<i>Hybanthus calycinus</i>			
<i>Opercularia hispidula</i>			

Name: STY**Site: 12****Datum: GDA 94****Easting: 0383030****Date: 14/11/2018****Soil: Brown/grey sandy loam****Northing: 6290745****Vegetation description****Time since fire: >3**

Eucalyptus marginata and *Corymbia calophylla* over *Kunzea glabra*
over *Xanthorrhoea gracilis* and *Hibbertia hypericoides*



Vegetation Condition: Very good

Disturbance type: Weeds, tracks nearby, plantation nearby

<u>Dominants</u>	Height (m)	% cover	Comments
<i>Eucalyptus marginata</i>	15	25	
<i>Corymbia calophylla</i>	12	10	
<i>Kunzea glabrescens</i>	3.5	3	
<i>Xanthorrhoea gracilis</i>	0.8	2	
<i>Hibbertia hypericoides</i>	0.4	1	
<u>Additional Species</u>			
<i>Boronia dichotoma</i>			
<i>Leschenaultia biloba</i>			
<i>Hibbertia mylnei</i>			
<i>Hakea amplexicaulis</i>			
<i>Scaevola calliptera</i>			
<i>Hibbertia amplexicaulis</i>			
<i>Desmocladius fasciculatus</i>			
<i>Lagenophora huegelii</i>			
<i>Levenhookia pusilla</i>			
<i>Ursinia anthemoides</i>			Weed
<i>Lomandra sp.</i>			Sterile
<i>Hibbertia mylnei</i>			
<i>Tetraria sp.</i> Jarrah Forest			
<i>Briza maxima</i>			Weed
<i>Hybanthus calycinus</i>			
<i>Tetradlea hirsuta</i> subsp. <i>viminea</i>			
<i>Rytidosperma setaceum</i>			
<i>Pimelea sp.</i>			Needs flowers
<i>Gompholobium preissii</i>			
<i>Xanthorrhoea preissii</i>			
<i>Comesperma calymega</i>			

Name: STY

Site: 14

Datum: GDA 94

Easting: 0383097

Date: 14/11/2018

Soil: Brown loamy sand

Northing: 6290728

Vegetation description

Time since fire: >3

Eucalyptus marginata and *Corymbia calophylla* over *Xanthorrhoea preissii***Vegetation Condition:** Good**Disturbance type:** Plantation nearby, tracks, weeds

<u>Dominants</u>	Height (m)	% cover	Comments
<i>Eucalyptus marginata</i>	15	25	
<i>Corymbia calophylla</i>	14	10	
<i>Xanthorrhoea preissii</i>	0.9	6	
<u>Additional Species</u>			
<i>Hakea amplexicaulis</i>			
<i>Hibbertia hypericoides</i>			
<i>Tetraria</i> sp. Jarrah Forest			
<i>Lomandra</i> sp.			
<i>Boronia dichotoma</i>			
<i>Briza maxima</i>			Weed
<i>Hypochaeris glabra</i>			Weed
<i>Comesperma calymega</i>			
<i>Thysanotus arenarius</i>			
<i>Xanthorrhoea gracilis</i>			
<i>Poaceae</i> sp.			Sterile
<i>Agonis flexuosa</i>			1 only
<i>Ursinia anthemoides</i>			Weed
<i>Tetratheca hirsuta</i> subsp. <i>viminea</i>			

Name: STY**Site: 17****Datum: GDA 94****Easting: 0383406****Date: 14/11/2018****Soil: Brown loamy****Northing: 6290682****Vegetation description****Time since fire: >3***Eucalyptus marginata* and *Corymbia calophylla* over *Hibbertia hypericoides***Vegetation Condition:** Good**Disturbance type:** Tracks and plantation nearby

<u>Dominants</u>	Height (m)	% cover	Comments
<i>Eucalyptus marginata</i>	14	35	
<i>Corymbia calophylla</i>	12	5	
<i>Hibbertia hypericoides</i>	0.4	8	
<u>Additional Species</u>			
<i>Banksia grandis</i>			
<i>Hypocalymma robustum</i>			
<i>Lomandra</i> sp.			
<i>Desmocladius fasciculatus</i>			
<i>Xanthorrhoea preissii</i>			
<i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i>			
<i>Tetraria</i> sp. Jarrah Forest			
<i>Briza maxima</i>			
<i>Hovea elliptica</i>			
<i>Hypochaeris glabra</i>			
<i>Opercularia hispidula</i>			
<i>Goodenia eatoniana</i>			
<i>Agrostocrinum scabrum</i>			
<i>Tricoryne elatior</i>			
<i>Amphipogon amphipogonoides</i>			Sterile
<i>Ursinia anthemoides</i>			Weed
<i>Orchidaceae</i> sp.			Too dead to work out genus
<i>Hibbertia mylnei</i>			

Name: STY**Site: 19****Datum: GDA 94****Easting: 0382981****Date: 14/11/2018****Soil: Brown loamy****Northing: 6290568****Vegetation description****Time since fire: >3***Eucalyptus marginata* and *Corymbia calophylla* over *Xanthorrhoea preissii***Vegetation Condition: Good****Disturbance type: Tracks and
plantation**

<u>Dominants</u>	Height (m)	% cover	Comments
<i>Eucalyptus marginata</i>	15	20	
<i>Corymbia calophylla</i>	10	8	
<i>Xanthorrhoea preissii</i>	0.8	8	
<u>Additional Species</u>			
<i>Hibbertia hypericoides</i>			
<i>Scaevola calliptera</i>			
<i>Desmocladius fasciculatus</i>			
<i>Tetraria</i> sp. Jarrah Forest			
<i>Lomandra</i> sp.			
<i>Daucus glochidiatus</i>			
<i>Lagenophora huegelii</i>			
<i>Boronia dichotoma</i>			
<i>Levenhookia pusilla</i>			
<i>Thysanotus arenarius</i>			
<i>Lysimachia arvensis</i>			Weed
<i>Caesia micrantha</i>			
<i>Ursinia anthemoides</i>			
<i>Wahlenbergia capensis</i>			Weed
<i>Petrorhagia dubia</i>			Weed

Name: STY**Site: 20****Datum: GDA 94****Easting: 0382962****Date: 14/11/2018****Soil: Brown loamy****Northing: 6290365****Vegetation description****Time since fire: >3***Eucalyptus marginata* and *Corymbia calophylla* over *Xanthorrhoea preissii***Vegetation Condition:** Very good**Disturbance type:** Tracks, operations and plantations nearby

<u>Dominants</u>	Height (m)	% cover	Comments
<i>Eucalyptus marginata</i>	15	20	
<i>Corymbia calophylla</i>	11	5	
<i>Xanthorrhoea preissii</i>	0.8	4	
<u>Additional Species</u>			
<i>Hibbertia hypericoides</i>			
<i>Patersonia occidentalis</i>			
<i>Hakea amplexicaulis</i>			
<i>Boronia dichotoma</i>			
<i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i>			
<i>Leschenaultia biloba</i>			
<i>Amphipogon amphipogonoides</i>			
<i>Goodenia eatoniana</i>			
<i>Tricoryne elatior</i>			
<i>Hypochaeris glabra</i>			
<i>Comesperma calymega</i>			
? <i>Conostephium pendulum</i>			Sterile
<i>Lobelia tenuior</i>			
<i>Melaleuca thymoides</i>			
<i>Xylomelum occidentale</i>			
<i>Calothamnus sanguineus</i>			

Name: STY**Site: 21****Datum: GDA 94****Easting: 0383220****Date: 14/11/2018****Soil: Brown loamy****Northing: 6290473****Vegetation description****Time since fire: >3***Eucalyptus marginata* and *Corymbia calophylla* over *Xanthorrhoea preissii***Vegetation Condition:** Very good**Disturbance type:** Plantations, tracks nearby

<u>Dominants</u>	Height (m)	% cover	Comments
<i>Eucalyptus marginata</i>	14	10	
<i>Corymbia calophylla</i>	11	20	
<i>Xanthorrhoea preissii</i>	0.5	5	
<u>Additional Species</u>			
<i>Hibbertia hypericoides</i>			
<i>Boronia dichotoma</i>			
<i>Daucus glochidiatus</i>			
<i>Johnsonia lupulina</i>			
<i>Tetraria</i> sp. Jarrah Forest			
<i>Desmocladius fasciculatus</i>			
<i>Briza maxima</i>			
<i>Leschenaultia biloba</i>			
<i>Banksia dallanneyi</i> subsp. <i>dallanneyi</i>			
<i>Burchardia congesta</i>			
<i>Aira cupaniana</i>			Weed
<i>Goodenia eatoniana</i>			
<i>Macrozamia riedlei</i>			
<i>Acacia iteaphylla</i>			Weed

**APPENDIX C: NATUREMAP SEARCH RESULTS FOR THREATENED AND
PRIORITY SPECIES THAT HAVE POTENTIAL TO OCCUR WITHIN SURVEY
AREA**

NatureMap Species Report

Created By Guest user on 07/11/2018

Kingdom Plantae
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 44' 26" E, 33° 31' 07" S
Buffer 10km
Group By Family

Family	Species	Records
Amaranthaceae	3	5
Amaryllidaceae	3	3
Anarthriaceae	2	9
Apiaceae	10	36
Apocynaceae	2	2
Apodanthaceae	1	1
Aponogetonaceae	1	23
Araliaceae	3	7
Asparagaceae	25	58
Asteraceae	26	32
Bignoniaceae	1	1
Boraginaceae	1	1
Brassicaceae	4	5
Bryaceae	1	1
Campanulaceae	2	2
Caprifoliaceae	1	1
Caryophyllaceae	5	7
Casuarinaceae	3	6
Celastraceae	3	6
Centrolepidaceae	3	5
Chenopodiaceae	2	3
Colchicaceae	3	4
Cupressaceae	1	2
Cyperaceae	24	43
Dasypogonaceae	4	8
Dennstaedtiaceae	1	3
Dicranaceae	2	5
Dilleniaceae	14	38
Droseraceae	11	14
Elaeocarpaceae	5	17
Elatinaceae	1	1
Ericaceae	25	71
Euphorbiaceae	8	8
Fabaceae	81	220
Gentianaceae	2	2
Geraniaceae	2	2
Goodeniaceae	8	46
Haemodorraceae	12	37
Haloragaceae	3	7
Hemerocallidaceae	8	15
Hydatellaceae	2	2
Hydrocharitaceae	1	2
Hypoxidaceae	1	1
Iridaceae	21	51
Juncaceae	3	3
Lamiaceae	4	8
Lauraceae	4	5
Linaceae	1	1
Lindsaeaceae	1	3
Loganiaceae	2	5
Loranthaceae	1	3
Malvaceae	5	6
Marsileaceae	2	2
Menyanthaceae	2	6
Myrtaceae	43	100
Olacaceae	1	2
Onagraceae	1	1
Orchidaceae	31	54
Orobanchaceae	1	3
Oxalidaceae	1	2
Phytolaccaceae	1	1
Pittosporaceae	3	7
Plantaginaceae	2	2
Poaceae	41	59
Podocarpaceae	1	3
Polygalaceae	1	1
Polygonaceae	3	3
Pottiaceae	1	1
Primulaceae	1	1
Proteaceae	46	159
Pteridaceae	1	1
Racopilaceae	1	1
Restionaceae	10	21
Rhamnaceae	1	1
Rosaceae	4	6

Rubiaceae	2	6
Rutaceae	9	42
Santalaceae	2	4
Selaginellaceae	1	1
Sematophyllaceae	1	1
Stylidiaceae	22	39
Thymelaeaceae	7	13
Verbenaceae	1	1
Violaceae	2	3
Xanthorrhoeaceae	7	22
Zamiaceae	1	6
TOTAL	617	1422

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Amaranthaceae				
1.	2648 <i>Alternanthera denticulata</i> (Lesser Joyweed)			
2.	2652 <i>Alternanthera nodiflora</i> (Common Joyweed)			
3.	2655 <i>Amaranthus albus</i> (Tumbleweed)	Y		
Amaryllidaceae				
4.	1493 <i>Leucojum aestivum</i> (Snowflake)	Y		
5.	1494 <i>Narcissus pseudonarcissus</i>	Y		
6.	44496 <i>Narcissus tazetta</i> subsp. <i>italicus</i>	Y		
Anarthriaceae				
7.	1062 <i>Anarthria prolifera</i>			
8.	1097 <i>Lyginia barbata</i>			
Apiaceae				
9.	6203 <i>Actinotus glomeratus</i>			
10.	6245 <i>Pentapeltis peltigera</i>			
11.	6249 <i>Platysace compressa</i> (Tapeworm Plant)			
12.	6253 <i>Platysace filiformis</i>			
13.	6259 <i>Platysace tenuissima</i>			
14.	6263 <i>Schoenolaena juncea</i>			
15.	6283 <i>Xanthosia atkinsoniana</i>			
16.	6284 <i>Xanthosia candida</i>			
17.	6285 <i>Xanthosia ciliata</i>			
18.	6289 <i>Xanthosia huegelii</i>			
Apocynaceae				
19.	6587 <i>Gomphocarpus fruticosus</i> (Narrowleaf Cottonbush)	Y		
20.	6575 <i>Vinca major</i> (Blue Periwinkle)	Y		
Apodanthaceae				
21.	2408 <i>Pilostyles hamiltonii</i>			
Aponogetonaceae				
22.	141 <i>Aponogeton hexatepalus</i> (Stalked Water Ribbons)		P4	
Araliaceae				
23.	6226 <i>Hydrocotyle callicarpa</i> (Small Pennywort)			
24.	6279 <i>Trachymene ornata</i> (Spongefruit)			
25.	6280 <i>Trachymene pilosa</i> (Native Parsnip)			
Asparagaceae				
26.	8779 <i>Asparagus asparagoides</i> (Bridal Creeper)	Y		
27.	1217 <i>Chamaexeros serra</i> (Little Fringe-leaf)			
28.	43505 <i>Hyacinthoides non-scripta</i>	Y		
29.	13562 <i>Lachenalia aloides</i>	Y		
30.	11464 <i>Laxmannia sessiliflora</i> subsp. <i>australis</i>			
31.	1223 <i>Lomandra caespitosa</i> (Tufted Mat Rush)			
32.	1225 <i>Lomandra drummondii</i>			
33.	1228 <i>Lomandra hermaphrodita</i>			
34.	1234 <i>Lomandra nigricans</i>			
35.	1238 <i>Lomandra pauciflora</i>			
36.	1239 <i>Lomandra preissii</i>			
37.	1240 <i>Lomandra purpurea</i> (Purple Mat Rush)			
38.	1243 <i>Lomandra sericea</i> (Silky Mat Rush)			
39.	1244 <i>Lomandra sonderi</i>			
40.	1245 <i>Lomandra spartea</i>			
41.	1246 <i>Lomandra suaveolens</i>			
42.	33298 <i>Lomandra whicherensis</i>		P3	
43.	1372 <i>Ornithogalum arabicum</i> (Lesser Cape Lily)	Y		
44.	1318 <i>Thysanotus arbuscula</i>			
45.	1319 <i>Thysanotus arenarius</i>			
46.	1328 <i>Thysanotus dichotomus</i> (Branching Fringe Lily)			
47.	1339 <i>Thysanotus multiflorus</i> (Many-flowered Fringe Lily)			
48.	1344 <i>Thysanotus pauciflorus</i> (Few Flowered Fringe Lily)			
49.	1351 <i>Thysanotus sparteus</i>			
50.	1354 <i>Thysanotus tenellus</i>			
Asteraceae				
51.	7838 <i>Arctotheca calendula</i> (Cape Weed, African Marigold)	Y		
52.	7911 <i>Carthamus lanatus</i> (Saffron Thistle)	Y		
53.	7945 <i>Cotula coronopifolia</i> (Waterbuttons)	Y		

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
54.	13354	<i>Craspedia variabilis</i>			
55.	19893	<i>Cynara cardunculus</i> subsp. <i>flavescens</i> (Artichoke Thistle, Wild Artichoke, Cardoon)	Y		
56.	16759	<i>Hyalosperma simplex</i> subsp. <i>simplex</i>			
57.	8086	<i>Hypochaeris glabra</i> (Smooth Catsear)	Y		
58.	9356	<i>Logfia gallica</i>			
59.	31237	<i>Mauranthemum paludosum</i>	Y		
60.	8106	<i>Millotia tenuifolia</i> (Soft Millotia)			
61.	8117	<i>Myriocephalus helichrysoides</i>			
62.	8133	<i>Olearia elaeophila</i>			
63.	8143	<i>Olearia paucidentata</i> (Autumn Scrub Daisy)			
64.	17756	<i>Osteospermum ecklonis</i>	Y		
65.	18352	<i>Pithocarpa pulchella</i> var. <i>melanostigma</i>			
66.	8175	<i>Podolepis gracilis</i> (Slender Podolepis)			
67.	8195	<i>Quinetia urvillei</i>			
68.	13300	<i>Rhodanthe citrina</i>			
69.	13312	<i>Rhodanthe pyrethrum</i>			
70.	8203	<i>Senecio diaschides</i>			
71.	20663	<i>Senecio multicaulis</i> subsp. <i>multicaulis</i>			
72.	8226	<i>Siloxerus pygmaeus</i>			
73.	8248	<i>Tolpis barbata</i> (Yellow Hawkweed)	Y		
74.	8251	<i>Trichocline spathulata</i> (Native Gerbera)			
75.	8255	<i>Ursinia anthemoides</i> (Ursinia)	Y		
76.	8257	<i>Vellereophyton dealbatum</i> (White Cudweed)	Y		
Bignoniaceae					
77.	7117	<i>Pandorea pandorana</i>			
Boraginaceae					
78.	6710	<i>Heliotropium europaeum</i> (Common Heliotrope)	Y		
Brassicaceae					
79.	3000	<i>Brassica tournefortii</i> (Mediterranean Turnip)	Y		
80.	2995	<i>Brassica x napus</i>	Y		
81.	3071	<i>Sisymbrium officinale</i> (Hedge Mustard)	Y		
82.	3072	<i>Sisymbrium orientale</i> (Indian Hedge Mustard)	Y		
Bryaceae					
83.	32426	<i>Rosulabryum campylothecium</i>			
Campanulaceae					
84.	7405	<i>Lobelia rarifolia</i>			
85.	7407	<i>Lobelia rhytidosperra</i> (Wrinkled-seeded Lobelia)			
Caprifoliaceae					
86.	7366	<i>Centranthus macrosiphon</i>	Y		
Caryophyllaceae					
87.	2894	<i>Moenchia erecta</i> (Erect Chickweed)	Y		
88.	19825	<i>Petrorhagia dubia</i>	Y		
89.	11803	<i>Silene gallica</i> var. <i>quinquevulnera</i>	Y		
90.	2912	<i>Spergula arvensis</i> (Corn Spurry)	Y		
91.	2915	<i>Spergularia rubra</i> (Sand Spurry)	Y		
Casuarinaceae					
92.	1728	<i>Allocasuarina fraseriana</i> (Sheoak, Kondil)			
93.	1732	<i>Allocasuarina humilis</i> (Dwarf Sheoak)			
94.	1739	<i>Allocasuarina thuyoides</i> (Horned Sheoak)			
Celastraceae					
95.	4733	<i>Stackhousia monogyna</i>			
96.	4735	<i>Stackhousia scoparia</i>			
97.	4737	<i>Tripterococcus brunonis</i> (Winged Stackhousia)			
Centrolepidaceae					
98.	1121	<i>Centrolepis aristata</i> (Pointed Centrolepis)			
99.	1125	<i>Centrolepis drummondiana</i>			
100.	1134	<i>Centrolepis polygyna</i> (Wiry Centrolepis)			
Chenopodiaceae					
101.	2491	<i>Chenopodium macrospermum</i>	Y		
102.	33480	<i>Dysphania pumilio</i> (Clammy Goosefoot)			
Colchicaceae					
103.	1382	<i>Baeometra uniflora</i>	Y		
104.	12770	<i>Burchardia congesta</i>			
105.	12072	<i>Wurmbea dioica</i> subsp. <i>alba</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Cupressaceae				
106.	36520 <i>Callitris acuminata</i> (Dwarf Cypress)			
Cyperaceae				
107.	740 <i>Baumea arthropphylla</i>			
108.	13766 <i>Caustis</i> sp. <i>Boyanup</i> (G.S. McCutcheon 1706)		P3	
109.	16245 <i>Cyathochaeta teretifolia</i>		P3	
110.	792 <i>Cyperus eragrostis</i> (Umbrella Sedge)	Y		
111.	822 <i>Eleocharis acuta</i> (Common Spikerush)			
112.	17605 <i>Eleocharis keigheryi</i>		T	
113.	20200 <i>Isolepis cernua</i> var. <i>setiformis</i>			
114.	917 <i>Isolepis marginata</i> (Coarse Club-rush)			
115.	919 <i>Isolepis oldfieldiana</i>			
116.	925 <i>Lepidosperma angustatum</i>			
117.	930 <i>Lepidosperma costale</i>			
118.	940 <i>Lepidosperma pubisquameum</i>			
119.	944 <i>Lepidosperma scabrum</i>			
120.	945 <i>Lepidosperma squamatum</i>			
121.	948 <i>Lepidosperma tetraquetrum</i>			
122.	953 <i>Mesomelaena graciliceps</i>			
123.	11473 <i>Mesomelaena stygia</i> subsp. <i>stygia</i>			
124.	973 <i>Schoenus asperocarpus</i> (Poison Sedge)			
125.	975 <i>Schoenus bifidus</i>			
126.	978 <i>Schoenus brevisetis</i>			
127.	984 <i>Schoenus curvifolius</i>			
128.	1017 <i>Schoenus subbulbosus</i>			
129.	1036 <i>Tetraria octandra</i>			
130.	35579 <i>Tetraria</i> sp. <i>Jarrah Forest</i> (R. Davis 7391)			
Dasypogonaceae				
131.	19309 <i>Calectasia narragara</i>			
132.	1218 <i>Dasypogon bromeliifolius</i> (Pineapple Bush)			
133.	1219 <i>Dasypogon hookeri</i> (Pineapple Bush)			
134.	1221 <i>Kingia australis</i> (Kingia, Pulonok)			
Dennstaedtiaceae				
135.	41651 <i>Pteridium esculentum</i> subsp. <i>esculentum</i>			
Dicranaceae				
136.	32334 <i>Campylopus australis</i>			
137.	32338 <i>Campylopus introflexus</i>	Y		
Dilleniaceae				
138.	5108 <i>Hibbertia acerosa</i> (Needle Leaved Guinea Flower)			
139.	5109 <i>Hibbertia amplexicaulis</i>			
140.	5112 <i>Hibbertia aurea</i>			
141.	5114 <i>Hibbertia commutata</i>			
142.	5117 <i>Hibbertia cuneiformis</i> (Cutleaf Hibbertia)			
143.	20051 <i>Hibbertia diamesogenos</i>			
144.	5125 <i>Hibbertia ferruginea</i>			
145.	5129 <i>Hibbertia glomerata</i>			
146.	5134 <i>Hibbertia huegelii</i>			
147.	5135 <i>Hibbertia hypericoides</i> (Yellow Buttercups)			
148.	45534 <i>Hibbertia hypericoides</i> subsp. <i>hypericoides</i>			
149.	5161 <i>Hibbertia quadricolor</i>			
150.	5162 <i>Hibbertia racemosa</i> (Stalked Guinea Flower)			
151.	5176 <i>Hibbertia vaginata</i>			
Droseraceae				
152.	3090 <i>Drosera barbigera</i>			
153.	3095 <i>Drosera erythrorhiza</i> (Red Ink Sundew)			
154.	13217 <i>Drosera erythrorhiza</i> subsp. <i>erythrorhiza</i>			
155.	3102 <i>Drosera huegelii</i> (Bold Sundew)			
156.	48691 <i>Drosera huegelii</i> var. <i>huegelii</i>			
157.	3108 <i>Drosera marchantii</i>			
158.	13209 <i>Drosera marchantii</i> subsp. <i>marchantii</i>			
159.	3110 <i>Drosera microphylla</i> (Golden Rainbow)			
160.	3112 <i>Drosera myriantha</i> (Star Rainbow)			
161.	8911 <i>Drosera rosulata</i>			
162.	3131 <i>Drosera stolonifera</i> (Leafy Sundew)			
Elaeocarpaceae				
163.	33377 <i>Platytheca anasima</i>		P2	

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
164.	4524	<i>Platytheca galioides</i>			
165.	4535	<i>Tetratheca hirsuta</i> (Black Eyed Susan)			
166.	48341	<i>Tetratheca hirsuta</i> subsp. <i>viminea</i>			
167.	4547	<i>Tremandra diffusa</i>			
Elatinaceae					
168.	5187	<i>Elatine gratioloides</i> (Waterwort)			
Ericaceae					
169.	6306	<i>Andersonia caerulea</i> (Foxtails)			
170.	18102	<i>Andersonia ferricola</i>		P1	
171.	6312	<i>Andersonia involucrata</i>			
172.	6314	<i>Andersonia lehmanniana</i>			
173.	6323	<i>Astroloma ciliatum</i> (Candle Cranberry)			
174.	6325	<i>Astroloma drummondii</i>			
175.	6334	<i>Astroloma pallidum</i> (Kick Bush)			
176.	6348	<i>Conostephium pendulum</i> (Pearl Flower)			
177.	6360	<i>Leucopogon australis</i> (Spiked Beard-heath)			
178.	6367	<i>Leucopogon capitellatus</i>			
179.	6374	<i>Leucopogon conostephioides</i>			
180.	6375	<i>Leucopogon cordatus</i>			
181.	6396	<i>Leucopogon glabellus</i>			
182.	6417	<i>Leucopogon obovatus</i>			
183.	6425	<i>Leucopogon oxycedrus</i>			
184.	6428	<i>Leucopogon pendulus</i>			
185.	6439	<i>Leucopogon pulchellus</i> (Beard-heath)			
186.	6441	<i>Leucopogon reflexus</i> (Heart-leaf Beard-heath)			
187.	29492	<i>Leucopogon</i> sp. <i>Busseton</i> (D. Cooper 243)		P2	
188.	6454	<i>Leucopogon verticillatus</i> (Tassel Flower)			
189.	6456	<i>Lysinema ciliatum</i> (Curry Flower)			
190.	34736	<i>Lysinema pentapetalum</i>			
191.	6464	<i>Needhamiella pumilio</i>			
192.	31931	<i>Sphenotoma capitata</i>			
193.	6476	<i>Styphelia tenuiflora</i> (Common Pinheath)			
Euphorbiaceae					
194.	4585	<i>Amperea ericoides</i>			
195.	16493	<i>Calycopeplus oligandrus</i>			
196.	4662	<i>Monotaxis grandiflora</i> (Diamond of the Desert)			
197.	4666	<i>Monotaxis occidentalis</i>			
198.	13683	<i>Ricinocarpos cyanescens</i>			
199.	4705	<i>Ricinus communis</i> (Castor Oil Plant)	Y		
200.	4716	<i>Stachystemon vermicularis</i>			
201.	20537	<i>Stachystemon virgatus</i>			
Fabaceae					
202.	15466	<i>Acacia applanata</i>			
203.	3247	<i>Acacia browniana</i>			
204.	11377	<i>Acacia browniana</i> var. <i>obscura</i>			
205.	11229	<i>Acacia drummondii</i> subsp. <i>affinis</i>		P3	
206.	11192	<i>Acacia drummondii</i> subsp. <i>elegans</i>			
207.	3331	<i>Acacia extensa</i> (Wiry Wattle)			
208.	3339	<i>Acacia flagelliformis</i>		P4	
209.	3374	<i>Acacia huegelii</i>			
210.	18217	<i>Acacia iteaphylla</i>	Y		
211.	3410	<i>Acacia lateriticola</i>			
212.	3448	<i>Acacia mooreana</i>			
213.	3453	<i>Acacia myrtifolia</i>			
214.	3454	<i>Acacia nervosa</i> (Rib Wattle)			
215.	3464	<i>Acacia obovata</i>			
216.	3496	<i>Acacia preissiana</i>			
217.	3502	<i>Acacia pulchella</i> (Prickly Moses)			
218.	15481	<i>Acacia pulchella</i> var. <i>glaberrima</i>			
219.	15483	<i>Acacia pulchella</i> var. <i>pulchella</i>			
220.	3537	<i>Acacia semitrullata</i>		P4	
221.	3557	<i>Acacia stenoptera</i> (Narrow Winged Wattle)			
222.	3574	<i>Acacia teretifolia</i>			
223.	3576	<i>Acacia tetragonocarpa</i>			
224.	3591	<i>Acacia urophylla</i>			
225.	15487	<i>Acacia varia</i> var. <i>varia</i>			
226.	3602	<i>Acacia willdenowiana</i> (Grass Wattle)			
227.	3686	<i>Aotus cordifolia</i>			

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228.	3689 <i>Aotus intermedia</i>			
229.	3710 <i>Bossiaea eriocarpa</i> (Common Brown Pea)			
230.	3714 <i>Bossiaea ornata</i> (Broad Leaved Brown Pea)			
231.	3717 <i>Bossiaea pulchella</i>			
232.	3718 <i>Bossiaea rufa</i>			
233.	8971 <i>Chorizema cordatum</i>			
234.	3757 <i>Chorizema glycinifolium</i>			
235.	13107 <i>Chorizema retrorsum</i>			
236.	3761 <i>Chorizema rhombeum</i>			
237.	19747 <i>Daviesia decurrens</i> subsp. <i>decurrens</i>			
238.	3808 <i>Daviesia elongata</i>		T	
239.	11879 <i>Daviesia hakeoides</i> subsp. <i>hakeoides</i>			
240.	3817 <i>Daviesia inflata</i>			
241.	3832 <i>Daviesia physodes</i>			
242.	3835 <i>Daviesia preissii</i>			
243.	3839 <i>Daviesia rhombifolia</i>			
244.	19852 <i>Dillwynia</i> sp. <i>Capel</i> (P.A. Jurjevich 1771)		P1	
245.	3880 <i>Eutaxia virgata</i>			
246.	3891 <i>Gastrolobium bilobum</i> (Heart Leaf Poison)			
247.	20512 <i>Gastrolobium praemorsum</i>			
248.	19733 <i>Gastrolobium retusum</i>			
249.	30453 <i>Gastrolobium</i> sp. <i>Yoongarillup</i> (S.Dilkes s.n. 1/9/1969)		P1	
250.	20474 <i>Gastrolobium whicherense</i>		P2	
251.	3936 <i>Genista linifolia</i> (Flaxleaf Broom)	Y		
252.	3948 <i>Gompholobium capitatum</i>			
253.	10909 <i>Gompholobium confertum</i>			
254.	19216 <i>Gompholobium cyaninum</i>			
255.	3950 <i>Gompholobium knightianum</i>			
256.	3951 <i>Gompholobium marginatum</i>			
257.	3954 <i>Gompholobium polymorphum</i>			
258.	3955 <i>Gompholobium preissii</i>			
259.	3956 <i>Gompholobium shuttleworthii</i>			
260.	3957 <i>Gompholobium tomentosum</i> (Hairy Yellow Pea)			
261.	3964 <i>Hovea chorizemifolia</i> (Holly-leaved Hovea)			
262.	3968 <i>Hovea trisperma</i> (Common Hovea)			
263.	12907 <i>Hovea trisperma</i> var. <i>grandiflora</i>			
264.	12859 <i>Hovea trisperma</i> var. <i>trisperma</i>			
265.	4017 <i>Jacksonia horrida</i>			
266.	4018 <i>Jacksonia lehmannii</i>			
267.	4036 <i>Kennedia carinata</i>			
268.	4037 <i>Kennedia coccinea</i> (Coral Vine)			
269.	4044 <i>Kennedia prostrata</i> (Scarlet Runner)			
270.	17114 <i>Paraserianthes lophantha</i> subsp. <i>lophantha</i>			
271.	4177 <i>Pultenaea ochreatea</i>			
272.	4180 <i>Pultenaea radiata</i>			
273.	4183 <i>Pultenaea skinneri</i> (Skinner's Pea)		P4	
274.	4187 <i>Pultenaea verruculosa</i>			
275.	17551 <i>Sphaerolobium drummondii</i>			
276.	4206 <i>Sphaerolobium macranthum</i>			
277.	4207 <i>Sphaerolobium medium</i>			
278.	4210 <i>Sphaerolobium scabriusculum</i>			
279.	4211 <i>Sphaerolobium vimineum</i> (Leafless Globe Pea)			
280.	4302 <i>Trifolium ligusticum</i> (Ligurian Clover)	Y		
281.	4317 <i>Ulex europaeus</i> (Gorse)	Y		
282.	11474 <i>Vicia sativa</i> subsp. <i>nigra</i>	Y		
Gentianaceae				
283.	6539 <i>Centaurium erythraea</i> (Common Centaury)	Y		
284.	6543 <i>Cicendia filiformis</i> (Slender Cicendia)	Y		
Geraniaceae				
285.	4332 <i>Erodium botrys</i> (Long Storksbill)	Y		
286.	4337 <i>Geranium dissectum</i> (Cutleaf Cranesbill)	Y		
Goodeniaceae				
287.	7454 <i>Dampiera linearis</i> (Common Dampiera)			
288.	7505 <i>Goodenia eatoniana</i>			
289.	19285 <i>Goodenia pulchella</i> subsp. <i>Wheatbelt</i> (L.W. Sage & F. Hort 795)			
290.	13165 <i>Goodenia pusilla</i>			
291.	7568 <i>Lechenaultia biloba</i> (Blue Leschenaultia)			
292.	7574 <i>Lechenaultia floribunda</i> (Free-flowering Leschenaultia)			
293.	7602 <i>Scaevola calliptera</i>			

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294.	7665	<i>Velleia trinervis</i>			
Haemodoraceae					
295.	1411	<i>Anigozanthos manglesii</i> (Mangles Kangaroo Paw, Kurulbrang)			
296.	1418	<i>Conostylis aculeata</i> (Prickly Conostylis)			
297.	1453	<i>Conostylis serrulata</i>			
298.	1454	<i>Conostylis setigera</i> (Bristly Cottonhead)			
299.	11597	<i>Conostylis setigera</i> subsp. <i>setigera</i>			
300.	1468	<i>Haemodorum laxum</i>			
301.	1474	<i>Haemodorum sparsiflorum</i>			
302.	1475	<i>Haemodorum spicatum</i> (Mardja)			
303.	1478	<i>Phlebocarya ciliata</i>			
304.	1479	<i>Phlebocarya filifolia</i>			
305.	1482	<i>Tribonanthes brachypetala</i>			
306.	1483	<i>Tribonanthes longipetala</i>			
Haloragaceae					
307.	33620	<i>Glischrocaryon angustifolium</i>			
308.	6160	<i>Gonocarpus paniculatus</i>			
309.	6189	<i>Myriophyllum crispatum</i>			
Hemerocallidaceae					
310.	23474	<i>Agrostocrinum hirsutum</i>			
311.	1261	<i>Agrostocrinum scabrum</i> (Blue Grass Lily)			
312.	1276	<i>Caesia micrantha</i> (Pale Grass Lily)			
313.	11883	<i>Corynotheca micrantha</i> var. <i>elongata</i>			
314.	1294	<i>Hodgsoniola junciformis</i>			
315.	1295	<i>Johnsonia acaulis</i>			
316.	1297	<i>Johnsonia lupulina</i> (Hooded Lily)			
317.	1363	<i>Tricoryne tenella</i>			
Hydatellaceae					
318.	1139	<i>Trithuria bibracteata</i>			
319.	1141	<i>Trithuria submersa</i>			
Hydrocharitaceae					
320.	168	<i>Ottelia ovalifolia</i> (Swamp Lily)			
Hypoxidaceae					
321.	43762	<i>Pauridia occidentalis</i> var. <i>quadriloba</i>			
Iridaceae					
322.	18279	<i>Babiana angustifolia</i>	Y		
323.	1515	<i>Ferraria crispa</i> (Black Flag)	Y		
324.	18392	<i>Freesia alba</i> x <i>leichtlinii</i>	Y		
325.	11919	<i>Gladiolus communis</i> subsp. <i>byzantinus</i>	Y		Y
326.	1523	<i>Gladiolus tristis</i> (Largeflower Gladiolus)	Y		
327.	1524	<i>Gladiolus undulatus</i> (Wild Gladiolus)	Y		
328.	1532	<i>Ixia maculata</i> (Yellow Ixia)	Y		
329.	1533	<i>Ixia paniculata</i>	Y		
330.	1534	<i>Ixia polystachya</i> (Variable Ixia)	Y		
331.	19179	<i>Moraea flaccida</i> (One-leaf Cape Tulip)	Y		
332.	11749	<i>Orthrosanthus laxus</i> var. <i>laxus</i> (Morning Iris)			
333.	1542	<i>Patersonia babianoides</i>			
334.	1550	<i>Patersonia occidentalis</i> (Purple Flag, Koma)			
335.	1553	<i>Patersonia umbrosa</i> (Yellow Flags)			
336.	11550	<i>Patersonia umbrosa</i> var. <i>xanthina</i> (Yellow Flags)			
337.	14924	<i>Romulea rosea</i> var. <i>communis</i>	Y		
338.	1557	<i>Sisyrinchium exile</i>	Y		
339.	1558	<i>Sparaxis bulbifera</i>	Y		
340.	1560	<i>Sparaxis pillansii</i> (Harlequin Flower)	Y		
341.	1561	<i>Tritonia crocata</i>	Y		
342.	13103	<i>Watsonia borbonica</i>	Y		
Juncaceae					
343.	1180	<i>Juncus capitatus</i> (Capitate Rush)	Y		
344.	1186	<i>Juncus microcephalus</i>	Y		
345.	1198	<i>Luzula meridionalis</i> (Field Woodrush)			
Lamiaceae					
346.	6855	<i>Hemigenia humilis</i>			
347.	6866	<i>Hemigenia pritzelii</i>			
348.	38323	<i>Lavandula stoechas</i> subsp. <i>stoechas</i>	Y		
349.	6883	<i>Mentha pulegium</i> (Pennyroyal)	Y		

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Lauraceae				
350.	2952 <i>Cassytha glabella</i> (Tangled Dodder Laurel)			
351.	2957 <i>Cassytha racemosa</i> (Dodder Laurel)			
352.	11242 <i>Cassytha racemosa</i> forma <i>pilosa</i>			
353.	11799 <i>Cassytha racemosa</i> forma <i>racemosa</i>			
Linaceae				
354.	4363 <i>Linum trigynum</i> (French Flax)	Y		
Lindsaeaceae				
355.	59 <i>Lindsaea linearis</i> (Screw Fern)			
Loganiaceae				
356.	46316 <i>Orianthera serpyllifolia</i> subsp. <i>angustifolia</i>			
357.	46256 <i>Orianthera wendyae</i>		P1	
Loranthaceae				
358.	2401 <i>Nuytsia floribunda</i> (Christmas Tree, Mudja)			
Malvaceae				
359.	10915 <i>Brachychiton populneus</i> (Kurrajong)	Y		
360.	45084 <i>Lasiopetalum laxiflorum</i>		P3	
361.	48345 <i>Lasiopetalum occidentale</i>			
362.	5084 <i>Thomasia grandiflora</i> (Large Flowered Thomasia)			
363.	5086 <i>Thomasia macrocalyx</i>			
Marsileaceae				
364.	74 <i>Marsilea drummondii</i> (Common Nardoo)			
365.	78 <i>Pilularia novae-hollandiae</i> (Austral Pillwort)			
Menyanthaceae				
366.	36181 <i>Ornduffia parnassifolia</i>			
367.	36200 <i>Ornduffia submersa</i>		P4	
Myrtaceae				
368.	5315 <i>Actinodium cunninghamii</i> (Albany Daisy)			
369.	17202 <i>Agonis flexuosa</i> var. <i>flexuosa</i>			
370.	36441 <i>Babingtonia camphorosmae</i> (Camphor Myrtle)			
371.	5415 <i>Calothamnus lateralis</i>			
372.	5429 <i>Calothamnus sanguineus</i> (Silky-leaved Blood flower, Pindak)			
373.	5458 <i>Calytrix flavescens</i> (Summer Starflower)			
374.	5483 <i>Calytrix tetragona</i> (Common Fringe-myrtle)			
375.	17104 <i>Corymbia calophylla</i> (Marri)			
376.	17105 <i>Corymbia haematoxylon</i> (Mountain Marri)			
377.	44791 <i>Corymbia maculata</i>	Y		
378.	34765 <i>Darwinia whicherensis</i>		T	
379.	13950 <i>Eremaea asterocarpa</i> subsp. <i>asterocarpa</i>			
380.	14104 <i>Eremaea pauciflora</i> var. <i>pauciflora</i>			
381.	5688 <i>Eucalyptus laeliae</i> (Darling Range Ghost Gum)			
382.	5708 <i>Eucalyptus marginata</i> (Jarrah, Djara)			
383.	13547 <i>Eucalyptus marginata</i> subsp. <i>marginata</i> (Jarrah)			
384.	44858 <i>Eucalyptus resinifera</i> subsp. <i>resinifera</i>	Y		Y
385.	5763 <i>Eucalyptus rudis</i> (Flooded Gum, Kulurda)			
386.	12906 <i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>			
387.	5816 <i>Homalospermum firmum</i>			
388.	5817 <i>Hypocalymma angustifolium</i> (White Myrtle, Kudjid)			
389.	5818 <i>Hypocalymma cordifolium</i>			
390.	5819 <i>Hypocalymma ericifolium</i>			
391.	5825 <i>Hypocalymma robustum</i> (Swan River Myrtle)			
392.	15498 <i>Kunzea glabrescens</i> (Spearwood)			
393.	5841 <i>Kunzea recurva</i>			
394.	14776 <i>Kunzea rostrata</i>			
395.	5921 <i>Melaleuca incana</i> (Grey Honeymyrtle)			
396.	5926 <i>Melaleuca lateritia</i> (Robin Redbreast Bush)			
397.	18394 <i>Melaleuca parviceps</i>			
398.	5980 <i>Melaleuca thymoides</i>			
399.	5983 <i>Melaleuca trichophylla</i>			
400.	20101 <i>Paragonis grandiflora</i>			
401.	16477 <i>Pericalymma ellipticum</i> var. <i>ellipticum</i>			
402.	16478 <i>Pericalymma ellipticum</i> var. <i>floridum</i>			
403.	15501 <i>Pericalymma spongiocaula</i>			
404.	20135 <i>Taxandria linearifolia</i>			
405.	20133 <i>Taxandria parviceps</i>			
406.	12388 <i>Verticordia acerosa</i> var. <i>preissii</i>			

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407.	6076	<i>Verticordia densiflora</i> (Compacted Featherflower)			
408.	12411	<i>Verticordia densiflora</i> var. <i>cespitosa</i>			
409.	12412	<i>Verticordia densiflora</i> var. <i>pedunculata</i>		T	
410.	15618	<i>Verticordia plumosa</i> var. <i>plumosa</i>			
Olacaceae					
411.	2365	<i>Olax benthamiana</i>			
Onagraceae					
412.	11992	<i>Epilobium billardiareanum</i> subsp. <i>intermedium</i>			
Orchidaceae					
413.	15332	<i>Caladenia attingens</i> subsp. <i>attingens</i>			
414.	1592	<i>Caladenia flava</i> (Cowslip Orchid)			
415.	15372	<i>Caladenia nana</i> subsp. <i>unita</i>			
416.	18026	<i>Caladenia pendens</i> subsp. <i>pendens</i>			
417.	15377	<i>Caladenia reptans</i> subsp. <i>reptans</i>			
418.	12945	<i>Corybas recurvus</i>			
419.	1627	<i>Cryptostylis ovata</i> (Slipper Orchid)			
420.	15404	<i>Cyanicula sericea</i>			
421.	19649	<i>Disa bracteata</i>	Y		
422.	1639	<i>Drakaea elastica</i> (Glossy-leaved Hammer Orchid)		T	
423.	1646	<i>Eriochilus dilatatus</i> (White Bunny Orchid)			
424.	15411	<i>Eriochilus dilatatus</i> subsp. <i>magnus</i>			
425.	15412	<i>Eriochilus dilatatus</i> subsp. <i>multiflorus</i>			
426.	1653	<i>Leporella fimbriata</i> (Hare Orchid)			
427.	31713	<i>Microtis cupularis</i>			
428.	15419	<i>Microtis media</i> subsp. <i>media</i>			
429.	15424	<i>Praecoxanthus aphyllus</i>			
430.	1671	<i>Prasophyllum elatum</i> (Tall Leek Orchid)			
431.	1672	<i>Prasophyllum fimbria</i> (Fringed Leek Orchid)			
432.	1680	<i>Prasophyllum parvifolium</i> (Autumn Leek Orchid)			
433.	1686	<i>Pterostylis barbata</i> (Bird Orchid)			
434.	11118	<i>Pterostylis pyramidalis</i> (Snail Orchid)			
435.	1693	<i>Pterostylis recurva</i> (Jug Orchid)			
436.	18655	<i>Pterostylis</i> sp. crinkled leaf (G.J. Keighery 13426)			
437.	10998	<i>Pterostylis turfosa</i> (Bird Orchid)			
438.	1698	<i>Pterostylis vittata</i> (Banded Greenhood)			
439.	16367	<i>Pyrorchis nigricans</i> (Red beaks, Elephants ears)			
440.	1705	<i>Thelymitra crinita</i> (Blue Lady Orchid)			
441.	1707	<i>Thelymitra flexuosa</i> (Twisted Sun Orchid)			
442.	11053	<i>Thelymitra macrophylla</i>			
443.	1717	<i>Thelymitra variegata</i> (Queen of Sheba)		P2	
Orobanchaceae					
444.	7122	<i>Orobanche minor</i> (Lesser Broomrape)	Y		
Oxalidaceae					
445.	4352	<i>Oxalis glabra</i>	Y		
Phytolaccaceae					
446.	2793	<i>Phytolacca octandra</i> (Red Ink Plant)	Y		
Pittosporaceae					
447.	25798	<i>Billardiera fusiformis</i> (Australian Bluebell)			
448.	3165	<i>Billardiera variifolia</i>			
449.	17630	<i>Marianthus tenuis</i>			
Plantaginaceae					
450.	4717	<i>Callitriche stagnalis</i> (Common Starwort)	Y		
451.	7303	<i>Plantago lanceolata</i> (Ribwort Plantain)	Y		
Poaceae					
452.	184	<i>Aira caryophyllea</i> (Silvery Hairgrass)	Y		
453.	185	<i>Aira cupaniana</i> (Silvery Hairgrass)	Y		
454.	13380	<i>Amphibromus nervosus</i>			
455.	194	<i>Amphipogon amphipogonoides</i>			
456.	20184	<i>Amphipogon laguroides</i> subsp. <i>laguroides</i>			
457.	200	<i>Amphipogon turbinatus</i>			
458.	202	<i>Anthoxanthum odoratum</i> (Sweet Vernal Grass)	Y		
459.	17234	<i>Austrostipa compressa</i>			
460.	17240	<i>Austrostipa flavescens</i>			
461.	17253	<i>Austrostipa semibarbata</i>			
462.	244	<i>Briza maxima</i> (Blowfly Grass)	Y		
463.	252	<i>Bromus madritensis</i> (Madrid Brome)			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
		Y		
464.	41564 <i>Cenchrus clandestinus</i> (Kikuyu Grass)	Y		
465.	41566 <i>Cenchrus longisetus</i> (Feathertop)	Y		
466.	41567 <i>Cenchrus macrourus</i> (African Feather Grass)	Y		
467.	299 <i>Deyeuxia quadriseta</i> (Reed Bentgrass)			
468.	320 <i>Digitaria sanguinalis</i> (Crab Grass)	Y		
469.	11105 <i>Echinochloa crus-galli</i>	Y		
470.	348 <i>Ehrharta erecta</i> (Panic Veldt Grass)	Y		
471.	373 <i>Eragrostis brownii</i> (Brown's Lovegrass)			
472.	379 <i>Eragrostis elongata</i> (Clustered Lovegrass)			
473.	17043 <i>Glyceria declinata</i>	Y		
474.	437 <i>Glyceria maxima</i> (Water Meadowgrass)	Y		
475.	439 <i>Hemarthria uncinata</i> (Matgrass)			
476.	11451 <i>Hemarthria uncinata</i> var. <i>uncinata</i>			
477.	20019 <i>Lachnagrostis filiformis</i>			
478.	492 <i>Neurachne alopecuroides</i> (Foxtail Mulga Grass)			
479.	527 <i>Paspalum dilatatum</i>	Y		
480.	528 <i>Paspalum distichum</i> (Water Couch)	Y		
481.	547 <i>Phalaris angusta</i>	Y		
482.	548 <i>Phalaris aquatica</i> (Phalaris)	Y		
483.	551 <i>Phalaris minor</i> (Lesser Canary Grass)	Y		
484.	571 <i>Poa annua</i> (Winter Grass)	Y		
485.	582 <i>Polypogon monspeliensis</i> (Annual Beardgrass)	Y		
486.	583 <i>Polypogon tenellus</i>			
487.	40431 <i>Rytidosperma acerosum</i>			
488.	40430 <i>Rytidosperma pilosum</i>			
489.	40427 <i>Rytidosperma setaceum</i>			
490.	613 <i>Setaria verticillata</i> (Whorled Pigeon Grass)	Y		
491.	617 <i>Sorghum halepense</i> (Johnson Grass)	Y		
492.	667 <i>Tetrarrhena laevis</i> (Forest Ricegrass)			

Podocarpaceae

493.	86 <i>Podocarpus drouynianus</i> (Wild Plum, Kula)			
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Polygalaceae

494.	4550 <i>Comesperma calymega</i> (Blue-spike Milkwort)			
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Polygonaceae

495.	13911 <i>Persicaria decipiens</i>			
496.	16983 <i>Persicaria maculosa</i>	Y		
497.	11052 <i>Persicaria prostrata</i>			

Pottiaceae

498.	32315 <i>Barbula calycina</i>			
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Primulaceae

499.	36375 <i>Lysimachia arvensis</i> (Pimpernel)	Y		
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Proteaceae

500.	1790 <i>Adenanthos meisneri</i>			
501.	1791 <i>Adenanthos obovatus</i> (Basket Flower)			
502.	28281 <i>Adenanthos</i> sp. <i>Whicher Range</i> (G.J. Keighery 9736)			
503.	1800 <i>Banksia attenuata</i> (Slender Banksia, Piara)			
504.	32580 <i>Banksia dallanneyi</i> var. <i>dallanneyi</i>			
505.	1819 <i>Banksia grandis</i> (Bull Banksia, Pulgarla)			
506.	1830 <i>Banksia littoralis</i> (Swamp Banksia, Pungura)			
507.	32080 <i>Banksia sessilis</i> var. <i>sessilis</i>			
508.	12111 <i>Banksia sphaerocarpa</i> var. <i>sphaerocarpa</i> (Fox Banksia)			
509.	32046 <i>Banksia squarrosa</i> subsp. <i>argillacea</i>		T	
510.	1863 <i>Conospermum capitatum</i>			
511.	16850 <i>Conospermum flexuosum</i> subsp. <i>laevigatum</i>			
512.	1945 <i>Franklandia triaristata</i> (Lanoline Bush)		P4	
513.	12219 <i>Grevillea bronwenae</i>		P3	
514.	13085 <i>Grevillea centristigma</i>			
515.	13429 <i>Grevillea diversifolia</i> subsp. <i>diversifolia</i>			
516.	2066 <i>Grevillea pilulifera</i> (Woolly-flowered Grevillea)			
517.	2078 <i>Grevillea pulchella</i> (Beautiful Grevillea)			
518.	15990 <i>Grevillea pulchella</i> subsp. <i>ascendens</i>			
519.	15991 <i>Grevillea pulchella</i> subsp. <i>pulchella</i>			
520.	2080 <i>Grevillea quercifolia</i> (Oak-leaf Grevillea)			
521.	12824 <i>Grevillea vestita</i> subsp. <i>vestita</i>			
522.	2128 <i>Hakea amplexicaulis</i> (Prickly Hakea)			
523.	2152 <i>Hakea cyclocarpa</i> (Ramshorn)			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
524.	45297	<i>Hakea dactyloides</i>	Y		
525.	2175	<i>Hakea lissocarpa</i> (Honey Bush)			
526.	2206	<i>Hakea stenocarpa</i> (Narrow-fruited Hakea)			
527.	16522	<i>Isopogon formosus</i> subsp. <i>dasylepis</i>		P3	
528.	2237	<i>Isopogon sphaerocephalus</i> (Drumstick Isopogon)			
529.	14083	<i>Lambertia multiflora</i> var. <i>darlingensis</i>			
530.	2267	<i>Persoonia longifolia</i> (Snottygobble)			
531.	2299	<i>Petrophile linearis</i> (Pixie Mops)			
532.	2312	<i>Petrophile striata</i>			
533.	2316	<i>Stirlingia latifolia</i> (Blueboy)			
534.	15529	<i>Synaphea floribunda</i>			
535.	2323	<i>Synaphea gracillima</i>			
536.	16769	<i>Synaphea hians</i>		P3	
537.	16865	<i>Synaphea odocoileops</i>		P1	
538.	2324	<i>Synaphea petiolaris</i> (Synaphea)			
539.	16862	<i>Synaphea petiolaris</i> subsp. <i>simplex</i>		P3	
540.	16863	<i>Synaphea petiolaris</i> subsp. <i>triloba</i>			
541.	31767	<i>Synaphea polypodioides</i>		P3	
542.	30751	<i>Synaphea</i> sp. <i>Pinjarra Plain</i> (A.S. George 17182)		T	
543.	16749	<i>Synaphea stenoloba</i>		T	
544.	15535	<i>Synaphea whicherensis</i>			
545.	2331	<i>Xylomelum occidentale</i> (Woody Pear, Djandin)			

Pteridaceae

546.	25	<i>Adiantum aethiopicum</i> (Common Maidenhair)
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Racopilaceae

547.	32480	<i>Racopilum cuspidigerum</i> var. <i>convolutaceum</i>
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Restionaceae

548.	17692	<i>Cytogonidium leptocarpoides</i>
549.	17691	<i>Desmocladius fasciculatus</i>
550.	16595	<i>Desmocladius flexuosus</i>
551.	16455	<i>Desmocladius virgatus</i>
552.	1070	<i>Hypolaena exsulca</i>
553.	17841	<i>Hypolaena pubescens</i>
554.	1085	<i>Lepyrodia glauca</i>
555.	1088	<i>Lepyrodia macra</i> (Large Scale Rush)
556.	1090	<i>Lepyrodia muirii</i>
557.	1092	<i>Loxocarya cinerea</i>

Rhamnaceae

558.	19704	<i>Stenanthemum sublineare</i>	P2
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Rosaceae

559.	3185	<i>Acaena novae-zelandiae</i>	Y
560.	17211	<i>Prunus cerasifera</i>	Y
561.	46201	<i>Prunus persica</i>	Y
562.	18391	<i>Pyrus communis</i>	Y

Rubiaceae

563.	18254	<i>Opercularia apiciflora</i>	
564.	17273	<i>Richardia brasiliensis</i>	Y

Rutaceae

565.	4415	<i>Boronia defoliata</i>	
566.	4416	<i>Boronia denticulata</i>	
567.	4417	<i>Boronia dichotoma</i>	
568.	4420	<i>Boronia fastigiata</i> (Bushy Boronia)	
569.	16618	<i>Boronia humifusa</i>	P1
570.	4428	<i>Boronia megastigma</i> (Scented Boronia)	
571.	4438	<i>Boronia ramosa</i>	
572.	4441	<i>Boronia spathulata</i> (Boronia)	
573.	18529	<i>Philotheca spicata</i> (Pepper and Salt)	

Santalaceae

574.	2342	<i>Leptomeria cunninghamii</i>
575.	17703	<i>Leptomeria ellytes</i>

Selaginellaceae

576.	6	<i>Selaginella gracillima</i> (Tiny Clubmoss)
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Sematophyllaceae

577.	32433	<i>Sematophyllum homomallum</i>
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Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Stylidiaceae				
578.	7674 <i>Levenhookia preissii</i> (Preiss's Stylewort)			
579.	7676 <i>Levenhookia pusilla</i> (Midget Stylewort)			
580.	7677 <i>Levenhookia stipitata</i> (Common Stylewort)			
581.	40480 <i>Stylidium acuminatum</i> subsp. <i>acuminatum</i>		P2	
582.	7684 <i>Stylidium amoenum</i> (Lovely Triggerplant)			
583.	30278 <i>Stylidium androsaceum</i>			
584.	39880 <i>Stylidium angustifolium</i> subsp. <i>glaucofolium</i>			
585.	7688 <i>Stylidium barleei</i> (Tooth-leaved Triggerplant)			
586.	7693 <i>Stylidium brunonianum</i> (Pink Fountain Triggerplant)			
587.	7696 <i>Stylidium calcaratum</i> (Book Triggerplant)			
588.	7699 <i>Stylidium carnosum</i> (Fleshy-leaved Triggerplant)			
589.	7702 <i>Stylidium ciliatum</i> (Golden Triggerplant)			
590.	7745 <i>Stylidium junceum</i> (Reed Triggerplant)			
591.	7752 <i>Stylidium lineatum</i> (Sunny Triggerplant)			
592.	25829 <i>Stylidium neurophyllum</i> (Coastal Plain Triggerplant)			
593.	7773 <i>Stylidium petiolare</i> (Horn Triggerplant)			
594.	7774 <i>Stylidium piliferum</i> (Common Butterfly Triggerplant)			
595.	7782 <i>Stylidium pulchellum</i> (Thumbelina Triggerplant)			
596.	7785 <i>Stylidium repens</i> (Matted Triggerplant)			
597.	7798 <i>Stylidium schoenoides</i> (Cow Kicks)			
598.	<i>Stylidium</i> sp.			
599.	7799 <i>Stylidium spathulatum</i> (Creamy Triggerplant)			
Thymelaeaceae				
600.	11928 <i>Pimelea ciliata</i> subsp. <i>ciliata</i>			
601.	5252 <i>Pimelea lanata</i>			
602.	11182 <i>Pimelea lehmanniana</i> subsp. <i>nervosa</i>			
603.	5259 <i>Pimelea preissii</i>			
604.	5261 <i>Pimelea rosea</i> (Rose Banjine)			
605.	18117 <i>Pimelea rosea</i> subsp. <i>rosea</i>			
606.	12041 <i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>			
Verbenaceae				
607.	36096 <i>Verbena incompta</i> (Purple-top Verbena)	Y		
Violaceae				
608.	12007 <i>Hybanthus floribundus</i> subsp. <i>floribundus</i>			
609.	5223 <i>Viola odorata</i> (Common Violet)	Y		
Xanthorrhoeaceae				
610.	1280 <i>Chamaescilla corymbosa</i> (Blue Squill)			
611.	19338 <i>Chamaescilla gibsonii</i>		P3	
612.	1249 <i>Xanthorrhoea acanthostachya</i>			
613.	14544 <i>Xanthorrhoea brunonis</i> subsp. <i>brunonis</i>			
614.	14545 <i>Xanthorrhoea brunonis</i> subsp. <i>semibarbata</i>			
615.	1253 <i>Xanthorrhoea gracilis</i> (Graceful Grass Tree, Mimidi)			
616.	1256 <i>Xanthorrhoea preissii</i> (Grass tree, Palga)			
Zamiaceae				
617.	85 <i>Macrozamia riedlei</i> (Zamia, Djiridji)			

Conservation Codes

T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

**APPENDIX D: EPBC PROTECTED MATTERS SEARCH REPORT FOR
THREATENED AND PRIORITY SPECIES THAT HAVE POTENTIAL TO OCCUR
WITHIN SURVEY AREA**



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 07/11/18 23:50:05

[Summary](#)

[Details](#)

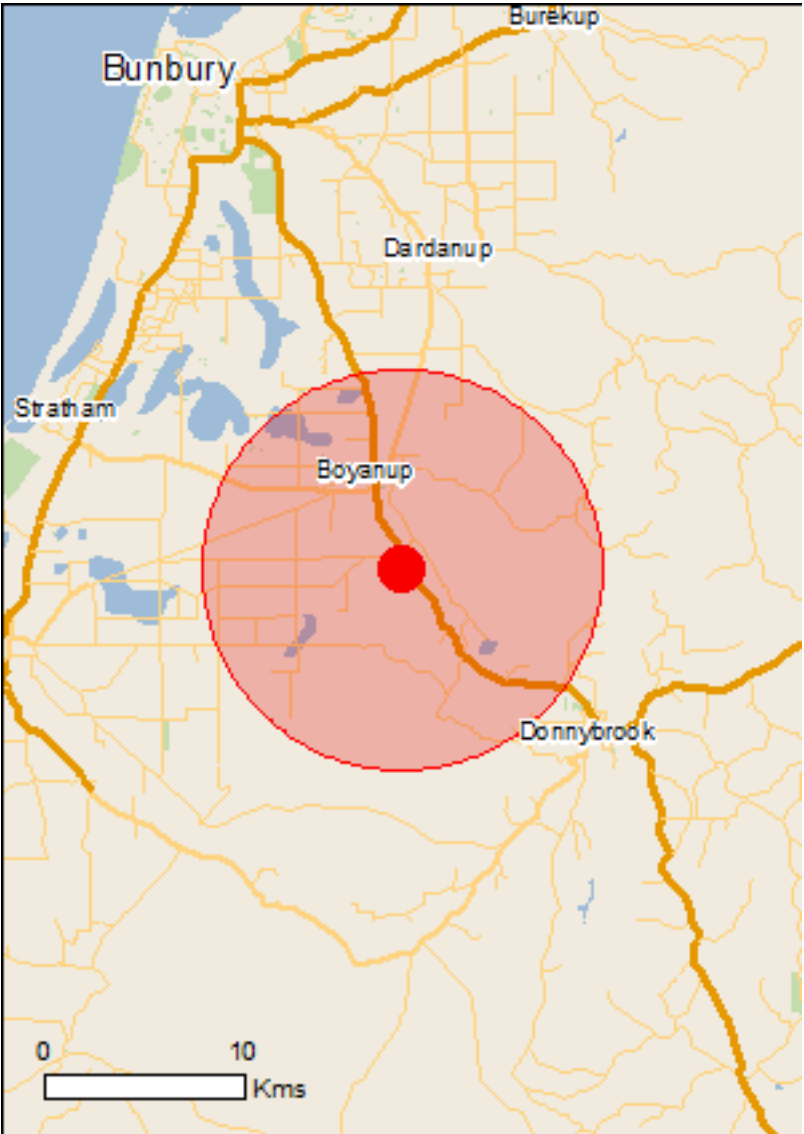
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	30
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	3
Regional Forest Agreements:	1
Invasive Species:	27
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area

Listed Threatened Species

[Resource Information]

Name	Status	Type of Presence
Birds		

Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
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Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
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Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
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Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
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Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
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Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
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Mammals

Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
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Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
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Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
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Other

Westralunio carteri Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
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Plants

Name	Status	Type of Presence
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat likely to occur within area
Banksia squarrosa subsp. argillacea Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat known to occur within area
Brachyscias verecundus Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
Chamelaucium sp. S coastal plain (R.D.Royce 4872) Royce's Waxflower [87814]	Vulnerable	Species or species habitat may occur within area
Daviesia elongata subsp. elongata Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat known to occur within area
Gastrolobium papilio Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
Lambertia echinata subsp. occidentalis Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within area
Petrophile latericola Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area
Sphenotoma drummondii Mountain Paper-heath [21160]	Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Synaphea stenoloba Dwellingup Synaphea [66311]	Endangered	Species or species habitat known to occur within area
Verticordia densiflora var. pedunculata Long-stalked Featherflower [55689]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area

Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land	[Resource Information]
The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.	

Name
Commonwealth Land -

Listed Marine Species	[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.	
Name	Type of Presence

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves		[Resource Information]
Name		State
Dardanup		WA
NTWA Bushland covenant (0107)		WA
Unnamed WA49857		WA

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included.

Name		State
South West WA RFA		Western Australia

Invasive Species

[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name		Status	Type of Presence
Birds			
Anas platyrhynchos			
Mallard [974]			Species or species habitat likely to occur within area
Columba livia			
Rock Pigeon, Rock Dove, Domestic Pigeon [803]			Species or species habitat likely to occur within area
Passer domesticus			
House Sparrow [405]			Species or species habitat likely to occur within area
Passer montanus			
Eurasian Tree Sparrow [406]			Species or species habitat likely to occur within area
Streptopelia chinensis			
Spotted Turtle-Dove [780]			Species or species habitat likely to occur within area
Streptopelia senegalensis			
Laughing Turtle-dove, Laughing Dove [781]			Species or species habitat likely to occur within area
Sturnus vulgaris			
Common Starling [389]			Species or species habitat likely to occur within area
Mammals			
Bos taurus			
Domestic Cattle [16]			Species or species habitat likely to occur within area
Canis lupus familiaris			
Domestic Dog [82654]			Species or species habitat likely to occur within area
Felis catus			
Cat, House Cat, Domestic Cat [19]			Species or species habitat likely to occur within area
Feral deer			
Feral deer species in Australia [85733]			Species or species habitat likely to occur within area
Mus musculus			
House Mouse [120]			Species or species habitat likely to occur within area

Name	Status	Type of Presence
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.51874 115.74069

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

APPENDIX 3: FAUNA SURVEY

Fauna Assessment

Lot 287



South Western Highway Gwindinup

March 2019

V1

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APPENDICES

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Acronyms/Abbreviations:

ALA: Atlas of Living Australia www.ala.org.au

BA: Birdlife Australia (Formerly RAOU, Birds Australia).

BC Act: Biodiversity Conservation Act 2016. WA Government.

°C: Degrees Celsius.

CALM: Department of Conservation and Land Management (now DPaW), WA Government.

CAMBA: China Australia Migratory Bird Agreement 1998.

CBD: Central Business District.

DBH: Diametre at Breast Height – tree measurement.

DEC: Department of Environment and Conservation (now DPaW), WA Government.

DEH: Department of Environment and Heritage (now DotEE), Australian Government.

DEP: Department of Environment Protection (now DER), WA Government.

DER: Department of Environment Regulation (formerly DEC, DoE), WA Government.

DEWHA: Department of the Environment, Water, Heritage and the Arts (now DotEE), Australian Government

DMP: Department of Mines and Petroleum (formerly DoIR), WA Government.

DoE: Department of Environment (now DER/DPaW), WA Government.

DoP: Department of Planning, WA Government.

DotE: Department of the Environment (now DotEE), Australian Government.

DotEE: Department of the Environment and Energy (formerly SEWPaC, DWEHA, DEH & DotE), Australian Government.

DoIR: Department of Industry and Resources (now DMP), WA Government.

DPaW: Department of Parks and Wildlife (formerly DEC, CALM, DoE), WA Government.

EP Act: *Environmental Protection Act 1986*, WA Government.

EPA: Environmental Protection Authority, WA Government.

EPBC Act: *Environment Protection and Biodiversity Conservation Act 1999*, Australian Government.

ha: Hectare (10,000 square metres).

IBRA: Interim Biogeographic Regionalisation for Australia.

IUCN: International Union for the Conservation of Nature and Natural Resources – commonly known as the World Conservation Union.

JAMBA: Japan Australia Migratory Bird Agreement 1981.

km: Kilometre.

m: Metre.

mm: Millimetre.

P: Priority - DPaW fauna conservation ranking.

POS: Public Open Space.

RAOU: Royal Australia Ornithologist Union.

ROKAMBA: Republic of Korea-Australia Migratory Bird Agreement 2007.

S: Schedule - Western Australian *Wildlife Conservation Act (1950)* Threatened Fauna Category.

SEWPaC: Department of Sustainability, Environment, Water, Population and Communities (now DotEE), Australian Government.

SRE: Short Range Endemic.

SSC: Species Survival Commission, International.

WA: Western Australia.

WAM: Western Australian Museum, WA Government.

WAPC: Western Australian Planning Commission, WA Government.

WC Act: *Wildlife Conservation Act 1950*, WA Government.

WRP: Western Ringtail Possum

SUMMARY

This report details the results of a fauna assessment Lot 287, South Western Highway Gwindinup (the subject site). Lot 287 has a total area of about 60 ha. About 31 ha of the subject site was historically cleared and subsequently used for an extraction industry operation and bluegum plantations. The balance of the area (~19 ha) contains remnant native vegetation (~19 ha).

It is understood that the landowner (Mr Mario Giacci) is investigating the potential to expand the existing extractive industry operation within the subject site. The fauna assessment reported on here represents one of several technical reports that will be used to provide an understanding of the suite of environmental values present within the subject site which will be used during the ongoing planning and approval process.

The scope of works was to conduct a level 1 fauna survey as defined by the EPA (EPA 2016). Because some listed threatened species (i.e. three species of black cockatoo) are known to occur in the general area, the scope of the survey work was expanded to include targeted assessment of the site's significance to these particular species. The assessment has included a literature review ("desktop study"), a series of day time surveys carried out in February 2018.

With respect to native vertebrate fauna, 29 mammal (including nine bat species), 92 bird, 36 reptile and three frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject site at times, a conclusion largely based on the presence of apparently suitable habitat.

Descriptions and example images of the main fauna habitats/dominant vegetation present within the subject site are provided in Table 1, with the location and extent of each unit being depicted in Figure 3.

The remnant native vegetation remaining within the subject site is in general terms comprised of various densities of jarrah, marri/mountain marri and banksia over shrubland on pisolitic gravel or sandy pisolitic gravel. The majority appears to have been subject to historical logging with most trees being relatively young in age. Groundcover is generally sparse suggesting historical clearing, grazing and/or frequent fires. Some small areas have been subject to gravel extraction in the past and subsequently partially regenerated.

Overall fauna habitat quality appears to be good and it can be expected that a high percentage of the predicted species (Appendix B) would utilise the subject site.

Opportunistic fauna observations made during the survey period are listed in Appendix B. A total of 25 fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the day time surveys.

The black cockatoo habitat assessment identified 405 trees within the subject site with a DBH of >50cm. Most (330 – 81.5%) of these trees did not appear to contain hollows of any size. Forty nine (~12.1%) were assessed as possibly having hollows, but of a likely size or orientation

that was deemed unsuitable for black cockatoos to utilise. Twenty six (6.4%) appeared to contain hollows possibly large enough for black cockatoos to use for nesting, though this assessment was based on the size of the entrance into an apparent hollow only. No conclusive evidence of any hollows being used by black cockatoos for nesting (currently or previously) was seen though two hollows appeared to have significant rub marks which indicates use by fauna of some type, possibly common brushtail possums.

Additional details on each habitat tree observed can be found in Appendix D.

Evidence of all two species of black cockatoos foraging within the subject site was observed. The main foraging evidence left was in the form of chewed marri/mountain fruits, with most of this evidence being attributed to the forest red-tailed black-cockatoo. A small number of examples of Baudin's foraging on marri was also seen.

Almost all (~19 ha) of the remnant native vegetation within the subject site can be regarded as foraging habitat for black cockatoos given the presence of the marri, jarrah and banksia in various concentrations in all remnants. No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey.

Besides the two species of black cockatoo recorded, evidence of one additional fauna species of conservation significance was observed during the survey period, this being the western ringtail possum. Evidence of this species was found in the form of some scats under a tree and a nearby drey (unoccupied).

In summary three vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period, these being:

- forest red-tailed black cockatoo – Vulnerable (WA/Federal);
- Baudin's black cockatoo – Endangered (WA/Federal); and
- western ringtail possum – Critically Endangered (WA/Federal).

An additional nine species of conservation significance may also utilise the subject site, though, as no evidence of these species presence was identified during the field survey, the status of some in the area remains uncertain. These species are:

- coastal plains skink – P3 (DBCA Priority Species);
- masked owl – P3 (DBCA Priority Species);
- south-western brush-tailed phascogale - S6 (WC Act);
- Carnaby's cockatoo – Endangered (WA/Federal);
- peregrine falcon – Schedule 7 (WA);
- quenda – Priority 4 (WA);

- western brush wallaby - Priority 4 (WA); and
- western false pipistrelle – P4 (DBCA Priority Species).

One invertebrate species of conservation significance has also been assessed as possibly occurring based on available information. The western pygmy trapdoor spider (Priority 3) has been collected in a state forest near the subject site (DBCA 2019) so it must be regarded as a potential species though its actual status within the subject site is unknown.

The exact location of proposed development within the subject site is yet to be finalise. Ongoing planning will need to take into account the potential presence of habitat used by some species of conservation significance and fauna in general so that any direct and indirect impacts can be avoided or minimised. Management plans and protocols that aim to minimise impact on fauna and fauna habitat should be employed if considered warranted.

1. INTRODUCTION

This report details the results of a fauna assessment of Lot 287, South Western Highway Gwindinup (the subject site) (Figures 1 and 2).

Lot 287 has a total area of about 60 ha. About 14 ha of the subject site was historically cleared and subsequently used for an extraction industry operation with the balance of the area containing a bluegum plantation (~27 ha) and remnant native vegetation (~19 ha).

It is understood that the landowner (Mr Mario Giacci) is investigating the potential to expand the existing extractive industry operation within the subject site. The fauna assessment reported on here represents one of several technical reports that will be used to provide an understanding of the suite of environmental values present within the subject site which will be used during the ongoing planning and approval process.

2. SCOPE OF WORKS

The scope of works was to conduct a Level 1 fauna survey as defined by the EPA (EPA 2016). Because the general area is known to be utilised by black cockatoos the scope of the survey work was expanded to include a baseline assessment of the sites significance to these species as well. The fauna assessment has therefore included:

1. Level 1 fauna assessment (in accordance with EPA (2016) guidelines);
2. Targeted searches for black cockatoo habitat/site use (habitat trees, existing and potential nest hollows, foraging and roosting habitat);
3. Report summarising methods, results and conclusions.

Note: For the purposes of this report the term black cockatoo is in reference to Baudin's black cockatoo *Calyptorhynchus baudinii*, Carnaby's black cockatoo *Calyptorhynchus latirostris* and the forest red-tailed black cockatoo *Calyptorhynchus banksii naso*.

3. METHODS

3.1 POTENTIAL FAUNA INVENTORY - LITERATURE REVIEW

3.1.1 Database Searches

Searches of the following databases were undertaken to aid in the compilation of a list of conservation significant fauna potentially occurring within the subject site:

- DBCA's NatureMap Database Search (combined data from DBCA, ALA, WAM, BA and consultant's reports) (DBCA 2019); and
- Protected Matters Search Tool (DotEE 2019).

It should be noted that lists produced during the abovementioned database searches contain observations/inferred distributions from a broader area than the subject site and therefore may include species that would only ever occur as vagrants due to a lack of suitable habitat or the presence of only marginal habitat within the subject site itself. The databases also often include or are based on very old records and in some cases certain species have become locally or regionally extinct.

Information from these sources should therefore be taken as indicative only and local knowledge and information also needs to be taken into consideration when determining what actual species may be present within the specific area being investigated.

3.1.2 Previous Fauna Surveys in the Area

Fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publicly available and could not be referenced. The most significant of those available have been used as the primary reference material for compiling the potential fauna assemblage for the general area.

Those reports referred to included, but were not limited to:

- Bamford, M.J and A.R. (2000). Proposed Gwindinup Mineral Sands Mine. Fauna Surveys; August and December 1999. Unpublished report for Cable Sands WA. January 2000.
- Bancroft, W. and Bamford, M. (2008). Fauna values of Bemax's Happy Valley mineral sands deposit. Unpublished report for Bemax Resources Limited. January 2008.
- Biologic (2014). Wonnerup North Vertebrate Fauna Assessment. Unpublished report for Cristal Mining Australia Ltd.
- Biota (2009). Tutunup Fauna Assemblage and Fauna Habitat Seasonal Survey. Unpublished report for Iluka Resources. March 2009.
- Biota (2007a). Yoganup 215 Strand Fauna and Faunal Assemblage Survey. Unpublished report for Iluka Resources. February 2007.
- Biota (2007b). Tutunup South Fauna Habitat and Fauna Assemblage Seasonal Survey. Unpublished report for Iluka Resources. December 2007.
- Harewood, G. (2009). Western Ringtail Possum Baseline Assessment. Tutunup. Unpublished report for Iluka Resources. August 2009.

- Harewood, G. (2012). Phase 1 and 2 Seasonal Fauna Surveys (Level 2). Yoongarillup Mineral Sands Project. Unpublished report for Doral Mineral Sands Pty Ltd.
- Harewood, G. (2013). Fauna Assessment of Yoganup Extended. Unpublished report for Iluka Resources Ltd.
- Harewood, G. (2017). Fauna Assessment of Lot 3833 (Part) Hyder Road – Yoganup Extended. Unpublished report for Iluka Resources Ltd.
- Harewood, G. (2018). Western Ringtail Possum 2018 Monitoring Survey, Gwindinup North Mineral Sands Mine, June/July 2018. Unpublished report for Cristal Mining Australia Limited. September 2016.
- Hart, Simpson and Assoc. (1997). Wonnerup -Tutunup Road - Vertebrate Fauna. Unpublished report for Westralian Sands Ltd.
- Ninox (2006). A Vertebrate Fauna Assessment of the Yoganup Mineral Sands Project Area. Unpublished report for Iluka Resources. March 2006.

As with the database searches some reports refer to species that would not occur in the subject site due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential fauna species list. It should also be noted that the NatureMap database is likely to include some records from previous fauna surveys in the area, including some of those listed above.

3.1.3 Existing Publications

The following represent the main publications used to identify and refine the potential fauna species list for the subject site:

- Anstis, M. (2013). Tadpoles and Frogs of Australia. New Holland Publishers, Sydney.
- Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.
- Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.
- Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2010). Field Guide to Reptiles and Frogs of the Perth Region. UWA Press, Nedlands.
- Churchill, S. (2008). Australian Bats. Second Edition, Allen & Unwin.
- Cogger, H.G. (2014). Reptiles and Amphibians of Australia. 7th Edition. CSIRO Publishing.

- Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.
- Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.
- Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.
- Morgan, D.L., Beatty, S.J., Klunzinger, M.W, Allen, M.G. and Burnham, Q.E (2011). Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia. Published by SERCUL.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.
- Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.
- Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.
- Wilson, S. and Swan, G. (2017). A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.
- Woinarski, J., Burbidge, A. & Harrison, P. (2014). The Action Plan for Australian Mammals 2012. CSIRO Publishing.

3.1.4 Fauna of Conservation Significance

The conservation significance of fauna species has been assessed using data from the following sources:

- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Administered by the Australian Government Department of the Environment and Energy (DotEE);

- *Wildlife Conservation Act 1950 (WC Act)*. Administered by the Western Australian DBCA (Govt. of WA 2018). Note: The Wildlife Conservation (Specially Protected Fauna) Notice 2018 has been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016 (BC Act)*;
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and the
- DBCA Priority Fauna list. A non-statutory list maintained by the DBCA for management purposes (DBCA 2018).

The *EPBC Act* also requires the compilation of a list of migratory species that are recognised under international treaties including the:

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

(Note – Some but not all species listed under JAMBA are also protected under Schedule 5 of the BC/WC Act.)

Most, but not all migratory bird species listed in the annexes to these bilateral agreements are also protected in Australia as matters of national environmental significance (NES) under the *EPBC Act*.

The conservation status of all vertebrate fauna species listed as occurring or possibly occurring in the vicinity of the subject site has been assessed using the most recent lists published in accordance with the above-mentioned instruments and is indicated as such in the fauna listings of this report. A full listing of conservation codes are provided in Appendix A.

A number of other species not listed in official lists can also be considered of local or regional conservation significance. These include species that have a restricted range, those that occur in breeding colonies and those at the limit of their range.

3.1.5 Invertebrate Fauna of Conservation Significance

For this assessment the review of potential conservation significant invertebrates has been limited to those listed by the DBCA and *EPBC Act* database searches (which rely on distribution records and known habitat preferences).

No assessment of the potential for SREs to be present has been made as it can be difficult to identify significant invertebrate species due to uncertainties in determining the range-restrictions of many species due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages.

Where invertebrates are collected during surveys, a high percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002).

3.1.6 Likelihood of Occurrence – Fauna of Conservation Significance

Fauna of conservation significance identified during the literature review as previously being recorded in the general area were assessed and ranked for their likelihood of occurrence within the subject site itself. The rankings and criteria used were:

- **Would Not Occur:** There is no suitable habitat for the species in the subject site and/or there is no documented record of the species in the general area since records have been kept and/or the species is generally accepted as being locally/regionally extinct (supported by a lack of recent records).
 - o **Locally Extinct:** Populations no longer occur within a small part of the species natural range, in this case within 10 or 20km of the subject site. Populations do however persist outside of this area.
 - o **Regionally Extinct:** Populations no longer occur in a large part of the species natural range, in this case within the southern/central forest region. Populations do however persist outside of this area.
- **Unlikely to Occur:** The subject site is outside of the currently documented distribution for the species in question, or no suitable habitat (type, quality and extent) was identified as being present during the field assessment. Individuals of some species may occur occasionally as vagrants/transients especially if suitable habitat is located nearby but the subject site itself would not support a population or part population of the species.
- **Possibly Occurs:** The subject site is within the known distribution of the species in question and habitat of at least marginal quality was identified as being present during the field assessment, supported in some cases by recent records being documented in literature from within or near the subject site. In some cases, while a species may be classified as possibly being present at times, habitat may be marginal (e.g. poor

quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

- **Known to Occur:** The species in question was positively identified as being present (for sedentary species) or as using the subject site as habitat for some other purpose (for non-sedentary/mobile species) during the field survey. This information may have been obtained by direct observation of individuals or by way of secondary evidence (e.g. foraging debris, tracks and scats). In some cases, while a species may be classified as known to occur, habitat may be marginal (e.g. poor quality, fragmented, limited in extent) and therefore the frequency of occurrence and/or population levels may be low.

3.1.7 Taxonomy and Nomenclature

Taxonomy and nomenclature for vertebrate fauna species used in this report is generally taken from the DBCA's WA Fauna Census Database which is assumed to follow Aplin and Smith (2001) for amphibians and reptiles and Johnstone (2001) for birds. Jackson and Groves (2015) has been used for mammals.

Common names are taken from the Western Australia Museum (WAM) recognised primary common name listings when specified, though where common names are not provided, they have been acquired from other publications. Sources include Cogger (2014), Wilson and Swan (2017), Van Dyck & Strahan (2013), Christidis and Boles (2008), Bush *et al.* (2010), Bush *et al.* (2007), Tyler & Doughty (2009), and Glauret (1961). Not all common names are generally accepted.

3.2 SITE SURVEYS

Daytime field survey work at the subject site was carried out on the 27 and 28 February 2019. All survey work was done by Greg Harewood (Zoologist).

3.2.1 Fauna Habitat Assessment

The vegetation communities mapped by DMBC (DMBC 2019) during the flora and vegetation survey have been used to classify the area into broad habitat types. This information has been supplemented by observations made during the field assessment undertaken during the fauna assessment.

As part of the literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the daytime reconnaissance survey the habitats within the subject site were assessed and specific elements identified, if present, to determine the likelihood of listed species of conservation significance occurring and its likely overall value to them on a local and regional scale.

The vegetation communities and landforms present have been used to classify the area into broad habitat types. As part of the literature review, available information on the habitat requirements of the species of conservation significance listed as possibly occurring in the area was researched. During the daytime survey the habitats within the subject site were assessed and specific elements identified, if present, to determine the likelihood of listed species of conservation significance occurring and its likely overall value to them on a local and regional scale.

3.2.2 Opportunistic Fauna Observations

Opportunistic observations of fauna species were made during all field survey work which primarily involved a series of transects across the subject site during the day while searching microhabitats such as logs, rocks, leaf litter and observations of bird species with binoculars. Secondary evidence of a species presence such as tracks, scats, skeletal remains, foraging evidence or calls were also noted if observed/heard.

3.2.3 Black Cockatoo Habitat Assessment

The following methods were employed to comply with the defined scope of works and are based on guidelines published by the federal DotEE (Commonwealth of Australia 2012) which states that surveys for Carnaby's, Baudin's and forest red-tailed black cockatoo habitat should:

- be done by a suitably qualified person with experience in vegetation or cockatoo surveys, depending on the type of survey being undertaken;
- maximise the chance of detecting the species' habitat and/or signs of use;
- determine the context of the site within the broader landscape—for example, the amount and quality of habitat nearby and in the local region (for example, within 10 km);
- account for uncertainty and error (false presence and absences); and
- include collation of existing data on known locations of breeding and feeding birds and night roost locations.

Habitat used by black cockatoos have been placed into three categories by the DotEE (Commonwealth of Australia 2012) these being:

- Breeding Habitat;
- Foraging Habitat; and
- Night Roosting Habitat.

So as to comply with the requested scope of works and in line with the published guidelines the following was carried out.

3.2.3.1 Black Cockatoo Breeding Habitat

The black cockatoo breeding habitat assessment has involved the identification of all suitable breeding trees species within the subject site that have a Diameter at Breast Height (DBH) of equal to or over 50cm. The DBH of each tree was estimated using a pre-made 50 cm “caliper”.

Target tree species included marri and jarrah and any other *Corymbia/Eucalyptus* species of a suitable size that were present. Peppermints, *banksia*, sheoak and melaleuca tree species (for example) were not assessed as they typically do not develop hollows that are used by black cockatoos.

The location of each tree identified as being over the threshold DBH was recorded with a GPS and details on tree species, number and size of hollows (if any) noted. Trees observed to contain hollows (of any size/type) were marked with “H” using spray paint.

Potential hollows were placed into one of four categories, based on the size of the apparent hollow entrance, these being

- Small = ~<5cm diameter (i.e. entrance too small for a black cockatoo);
- Medium = ~5cm-10cm diameter (i.e. entrance too small for a black cockatoo);
- Large = ~>10cm diameter (entrance large enough for a black cockatoo but possible hollow appears to be unsuitable for nesting i.e. wrong orientation, too small, too low or too shallow); or
- Large (cockatoo) = ~>10cm diameter (entrance appears big enough to provide access to a possible hollow that may be suitable for a black cockatoo to use for nesting).

Based on this assessment trees present within the subject site have then been placed into one of four categories:

- Tree < 50cm DBH or an unsuitable species (not assessed/recorded);
- Tree >50cm DBH, no hollows seen;
- Tree >50cm DBH, one or more hollows seen, none of which were considered suitable for black cockatoos to use for nesting; or
- Tree >50cm DBH, one or more hollows seen, with at least one considered suitable or possibly for black cockatoos to use for nesting.

For the purposes of this study a tree containing a potential cockatoo nest hollow was defined as:

Generally, any tree which is alive or dead that contains one or more hollows or possible hollows (cavities within the trunk or branches) which appear suitable for occupation by black cockatoos for the purpose of nesting/breeding. Hollows or apparent hollows that had an entrance greater than about 10cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk, were recorded as a “potential nest hollow”.

Identified hollows were examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches).

3.2.3.2 Black Cockatoo Foraging Habitat

The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around the base of trees) observed during the field survey was recorded. The nature and extent of potential foraging habitat present was also documented irrespective of the presence of any actual foraging evidence.

3.2.3.3 Black Cockatoo Roosting Habitat

Direct and indirect evidence of black cockatoos roosting within trees within the subject site was noted if observed (e.g. branch clippings, droppings or moulted feathers).

3.2.4 Other Species of Conservation Significance

Evidence of the presence or likely presence of other species of conservation significance (including suitable habitat) was searched for and recorded concurrent with other field work. The aim was to obtain sufficient information to make a definitive comment on the likely significance of the subject site to other species of conservation significance which may be present.

4. SURVEY CONSTRAINTS

No seasonal sampling has been carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the subject site at the time of the field assessments. It should also be recognised that site conditions can change with time.

Some fauna species are reported as potentially occurring within the subject site based on there being suitable habitat (quality and extent) within the subject site or immediately

adjacent. With respect to opportunistic observations, the possibility exists that certain species may not have been detected during field investigations due to:

- seasonal inactivity during the field survey;
- species present within micro habitats not surveyed;
- cryptic species able to avoid detection; and
- transient wide-ranging species not present during the survey period.

Lack of observational data on some species should therefore not necessarily be taken as an indication that a species is absent from the subject site.

The habitat requirements and ecology of many of the species known to occur in the wider area are often not well understood or documented. It can therefore be difficult to exclude species from the potential list based on a lack of a specific habitat or microhabitat within the subject site. As a consequence of this limitation the potential fauna list produced is most likely an overestimation of those species that actually utilise the subject site for some purpose. Some species may be present in the general area but may only use the subject site itself on rare occasions or as vagrants/transients.

In recognition of survey limitations, a precautionary approach has been adopted for this assessment. Any fauna species that would possibly occur within the subject site (or immediately adjacent), as identified through ecological databases, publications, discussions with local experts/residents and the habitat knowledge of the Author, has been assumed to potentially occur in the subject site.

During the black cockatoo habitat survey a search for trees containing hollows was completed. It should be noted that identifying hollows suitable for fauna species from ground level has limitations. Generally, the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level.

The location of observations was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about 5 to 10 metres, though it should be noted that in some circumstance the accuracy can increase or decrease beyond this range.

5. RESULTS

5.1 POTENTIAL FAUNA INVENTORY – LITERATURE REVIEW

A list of fauna species considered most likely to occur in the subject site has been compiled from information obtained during the literature review and is presented in Appendix B. This listing was refined after information gathered during the site reconnaissance survey was assessed.

The results of some previous fauna surveys carried out in the general area are summarised in this species listing as are the DBCA NatureMap database search results. Species considered unlikely to occur with the subject site but previously recorded in other surveys and/or which appear in the DBCA database search are not listed. The raw database search results from NatureMap (DBCA 2019) and the Protected Matters Search Tool (DotEE 2019) are contained within Appendix C.

The list of potential fauna takes into consideration that firstly the species in question is not known to be locally extinct and secondly that suitable habitat for each species, as identified during the habitat assessment, is present within the subject site. Compiling an accurate fauna list has limitations (see Section 4 above) and therefore the listing is likely to be an overestimation of the fauna species actually present within the subject site at any one time.

With respect to native vertebrate fauna, 29 mammals (includes nine bat species), 92 bird, 36 reptile and three frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject area at times. Nine species of introduced animals could also frequent the area.

Of the 154 native animals that are listed as potentially occurring in the area, seven are considered to be endangered/vulnerable or in need of special protection under State and/or Federal law. In addition, five DBCA priority species have also been listed as potentially present.

5.2 SITE SURVEYS

5.2.1 Fauna Habitat Assessment

The western section of the subject site located on the upper slope of the Whicher Scarp which is an arcuate north-facing scarp formed during the late Tertiary and early Pleistocene by marine erosion of underlying sedimentary rocks and in this area marks the inland limit of the Swan Coastal Plain (Note: in some documents the Whicher Scarp is referred to as being entirely within the Southern Jarrah Forest Biogeographic Sub-region e.g. EPA 2009). The eastern section of Lot 287 slopes down to a valley created by the Preston River.

The Swan Coastal Plain (SWA) was classified as part of the Interim Biogeographical Regionalisation for Australia and is in broad terms described as a:

“Low lying coastal plain mainly covered with Woodlands. It is dominated by *Banksia* or Tuart on sandy soils, *Allocasuarina obesa* on outwash plains, and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah Woodland. Warm Mediterranean. Three phases of marine sand dune development provide relief. The outwash plains, once dominated by *A. obesa* – Marri Woodlands and *Melaleuca* shrublands, are extensive only in the south.” (Thackway and Cresswell, 1996; IBRA, 2000).

The subject site itself is within a further defined subregion of the SWA referred to as the Swan Coastal Plan subregion or the Perth subregion (SWA2). This is defined as:

“Colluvial and aeolian sands, alluvial river flats, coastal limestone. Heath and/or Tuart woodlands on limestone, *Banksia* and Jarrah - *Banksia* woodlands on Quaternary marine dunes of various ages, Marri on colluvial and alluvials. Includes a complex series of seasonal wetlands and also includes Rottnest, Carnac and Garden Islands etc. Rainfall ranges between 600 and 1000 mm annually and the climate is Mediterranean”. The subregion has an area of about 1, 333,900 ha (Mitchell *et al.* 2002).

The remnant native vegetation remaining within the subject site is in general terms comprised of various densities of jarrah, marri/mountain marri and *banksia* over shrubland on pisolitic gravel or sandy pisolitic gravel. The majority appears to have been subject to historical logging with most trees being relatively young in age. Groundcover is generally sparse suggesting historical clearing, grazing and/or frequent fires. Some small areas have been subject to gravel extraction in the past and subsequently partially regenerated.

Descriptions and example images of the main fauna habitats/dominant vegetation present within the subject site are provided in Table 1. The location and extent of each of the identified habitat/vegetation units is shown in Figure 3 (data courtesy DMBC 2019).

Table 1: Main Fauna Habitats within the Subject Site

Unit	Fauna Habitat Description	Example Image
VT1	Tall woodland of jarrah (<i>Eucalyptus marginata</i>) and marri (<i>Corymbia calophylla</i>) over low woodland of <i>Banksia grandis</i> over tall sparse shrubland of <i>Kunzea glabrescens</i> over low sparse shrubland of <i>Xanthorrhoea preissii</i>. Total Area = ~0.79 ha (1.7%)	

Unit	Fauna Habitat Description	Example Image
VT2	Tall woodland of jarrah (<i>E. marginata</i>) and marri (<i>C. calophylla</i>) over tall sparse shrubland of <i>Kunzea glabrescens</i> over low sparse shrubland of <i>Xanthorrhoea preissii</i> and <i>Xanthorrhoea gracilis</i>. Total Area = ~0.84 ha (~1.4%)	
VT3	Tall woodland of jarrah (<i>E. marginata</i>) and (<i>C. calophylla</i>) over low sparse shrubland of <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> Total Area = ~17.39 ha (~28.6%)	
D	Disturbed: Bluegum plantations, tracks and clearings Total Area = 40.98 ha (~68.3%)	

Overall fauna habitat quality in areas of natural bushland appears to be good and it can be expected that a high percentage of the predicted species would utilise the subject site. For some species the habitat may however be marginal in quality, mainly due to the sparse nature of the ground cover generally present and also due to a lack of canopy connectivity, particularly in the midstorey vegetation.

Based on available vegetation mapping it is estimated that there is approximately 21,500 ha of native vegetation within 12 km the subject site. Remnant native vegetation present within the subject site (total ~19 ha) makes up ~0.088% of this total.

5.2.2 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix B. A total of 25 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the course of site surveys. Most of the fauna species recorded were common, widespread bird species.

Evidence of three listed threatened species was observed (forest red-tailed (Vulnerable) and Baudin's black-cockatoo (Endangered) - chewed marri fruits at several locations and the western ringtail possum (Critically Endangered) – scats and a drey at one location). No evidence of any listed migratory or priority fauna species was found.

5.2.3 Black Cockatoo Habitat Assessment

5.2.3.1 Black Cockatoo Breeding Habitat

Trees considered potentially suitable for black cockatoos to use as nesting habitat (using DotEE criteria i.e. DBH $\geq$ 50cm (Commonwealth of Australia 2012) but ultimately subject to a suitable hollow being present or developing and a range of other factors) which were found within the subject site comprised the following species:

- Jarrah - *Eucalyptus marginata*;
- Marri – *Corymbia calophylla*;
- Mountain Marri - *Corymbia haematoxylon*; and
- Dead unidentified species.

A summary of the potential black cockatoo habitat trees observed within the subject site area is provided in Table 2 below and their location shown in Figure 4.

Table 2: Summary of Potential Black Cockatoo Habitat Trees (DBH $\geq$ 50cm) within the Subject Site

Total Number of Habitat Trees Recorded	Number of Trees with <u>No Hollows</u> Observed	Number of Trees with Hollows Considered <u>Unsuitable</u> for Nesting Black Cockatoos	Number of Trees with Hollows Considered <u>Possibly</u> Suitable for Nesting Black Cockatoos	Tree Species		
				Jarrah	Marri/Mountain Marri	Dead Unknown
405	330	49	26	249	141	15

The assessment identified 405 trees within the subject site with a DBH of ≥ 50 cm. Most (330 – 81.5%) of these trees did not appear to contain hollows of any size. Forty nine (~12.1%) were assessed as possibly having hollows, but of a likely size or orientation that was deemed unsuitable for black cockatoos to utilise. Twenty six (6.4%) appeared to contain hollows possibly large enough for black cockatoos to use for nesting, though this assessment was based on the size of the entrance into an apparent hollow only. No conclusive evidence of any hollows being used by black cockatoos for nesting (currently or previously) was seen though two hollows appeared to have significant rub marks which indicates use by fauna of some type, possibly common brushtail possums.

Additional details on each habitat tree observed can be found in Appendix D.

Based on available mapping, there is approximately 21,500 ha of remnant native vegetation within 12 kilometres of the subject site. Much of this is likely to contain “potential” breeding habitat (i.e. suitable tree species with a DBH ≥ 50 cm).

5.2.3.2 Black Cockatoo Foraging Habitat

Following is a list of the main plant species observed within the subject site that are known to be used as a direct food source (i.e. fruits or flowers) by one or more species of black cockatoo:

- Jarrah - *Eucalyptus marginata*;
- Marri - *Corymbia calophylla*;
- Bull Banksia – *Banksia grandis*;
- Couch Honeypot Dryandra – *Banksia dallanneyi*;
- Honeybush – *Hakea lissocarpa* (and possibly *H. amplexicaulis*); and
- Balga - *Xanthorrhoea preissii* (and possibly *X. gracilis*)

Evidence of two species of black cockatoos foraging within the subject site was observed. The main foraging evidence left was in the form of chewed marri/mountain fruits, with most of this evidence being attributed to the forest red-tailed black-cockatoo. A small number of examples of Baudin’s foraging on marri was also seen.

Almost all (~19 ha) of the remnant native vegetation within the subject site can be regarded as foraging habitat for black cockatoos given the presence of the abovementioned plant species in various concentrations in all remnants.

Based on available vegetation mapping it is estimated that there is approximately 21,500 ha of native vegetation within 12 km the subject site, much of which is very likely to represent potential black cockatoo foraging habitat of some type.

5.2.3.3 Black Cockatoo Roosting Habitat

No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey.

A review of the 2018 Great Cocky Count database shows no documented roost sites within the subject site. The closest active roost is located approximately 500 m north east of the subject site. This roost was in use by 193 White-tailed Black Cockatoos during the 2018 count (Peck *et al.* 2018). Another seven documented roost sites (but not necessarily in current use) occur within 12 km of the subject site.

5.2.4 Other Species of Conservation Significance

As indicated above and besides the two species of black cockatoo, evidence of one additional fauna species of conservation significance was observed during the survey period, this being the western ringtail possum. Evidence of this species was found in the form of some scats under a tree and a nearby drey (unoccupied).

No direct evidence of any other species of conservation significance being present was found however based on the habitats present an additional seven species are considered as potentially present though their actual status in the subject site is unknown. These species are discussed in more detail in the following sections.

5.3 FAUNA INVENTORY – SUMMARY

5.3.1 Vertebrate Fauna

Table 3 summarises the number of vertebrate fauna species potentially occurring within or utilising at times the subject site, based on results from the literature review and observations made during the field assessment. A complete list of vertebrate fauna possibly inhabiting or frequenting the subject site is located in Appendix B.

As previously discussed, despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the subject site (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At any one time only a subset of the listed potential species are likely to be present within the bounds of the subject site.

Table 3: Summary of Potential Vertebrate Fauna Species (as listed in Appendix B)

Group	Total number of <u>Potential</u> species	Potential number of <u>Specially Protected</u> species	Potential number of <u>Migratory</u> species	Potential number of <u>Priority</u> species	Number of species <u>recorded</u> during field survey
Amphibians	3	0	0	0	0
Reptiles	36	0	0	1	1
Birds	95 ³	4	0	1	21
Non-Volant Mammals	20 ⁶	3	0	2	3
Volant Mammals (Bats)	9	0	0	1	0
Total	163⁹	7	0	5	25

Superscript = number of introduced species included in total.

5.3.2 Vertebrate Fauna of Conservation Significance

A review of the *EPBC Act* threatened fauna list, DBCA's Threatened Fauna Database and Priority List, unpublished reports and scientific publications identified a number of specially protected, priority or migratory vertebrate fauna species as potentially occurring in the general vicinity of the subject site. Of these species, most that have no potential whatsoever to utilise the subject site for any purpose have been omitted from the potential list (Appendix B), principally due to lack of suitable habitat (including extent and/or quality) or known local extinction.

Table 4 below listed those species previously recorded or considered potentially present in the wider area along with an assessment of their likelihood of occurrence within the subject site itself.

Table 4: Likelihood of Occurrence – Fauna Species of Conservation Significance (continues on following pages).

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Comments
	BC Act/ DBCA Priority	EPBC Act				
Swan Coastal Plain Shield-backed Trapdoor Spider <i>Idiosoma sigillatum</i>	P3	-	Burrows of this species usually found in banksia woodland and heathland on sandy soils.	No/Marginal	Unlikely to Occur.	Habitat appears unsuitable.
Western Pygmy Trapdoor Spider <i>Bertmainius opimus</i>	P3	-	Poorly documented - Lives in shallow burrows on eucalyptus bark or in topsoil.	?	Possibly occurs	Previously recorded in nearby state forest (DBCA 2019).
Vasse Pachysaga (cricket) <i>Pachysaga strobila</i>	P1	-	Not documented.	?	Unlikely to Occur	Given the lack of published records and apparent knowledge on this species, its status within the subject site is difficult to determine, however the probability of it being present can be regarded as being extremely low
Carter's Freshwater Mussel <i>Westralunio carteri</i>	S3	VU	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots.	No	Would Not Occur.	No suitable habitat.
Pouched Lamprey <i>Geotria australis</i>	S3	VU	This species lives in mud burrows in the upper reaches of coastal streams for the first 4 years of life until migrating to the sea. Adults migrate up to 60km upstream during spawning.	No	Would Not Occur.	No suitable habitat.
Coastal Plains Skink <i>Ctenotus ora</i>	P3	-	Sandy substrates with low vegetation (including heath) in open <i>Eucalyptus/Corymbia</i> woodland over <i>Banksia</i> .	Yes	Possibly occurs	Previously recorded at several locations along the Whicher Scarp (See Appendix B).
Blue-billed Duck <i>Oxyura australis</i>	P4	-	Well vegetated freshwater swamps, large dams and lakes, winters on more open water. Occasionally salt lakes and estuaries freshened by floodwaters.	No	Would Not Occur.	No suitable habitat.
Migratory Shorebirds/Wetland Species/Marine Species (various reptiles, birds and mammals)	S5, Various	Ma, Mig, Various	Varies between species but includes open ocean, beaches and permanent/temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats sandbars, pastures, airfields, sports fields and lawns.	No	Would Not Occur.	No suitable habitat.
Eastern Osprey <i>Pandion haliaetus</i>	S5	Ma, Mig	Coasts, estuaries, bays, inlets, islands, and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Ascends larger rivers.	No	Would Not Occur.	May very occasionally fly along the nearby Preston River

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Comments
	BC Act/ DBCA Priority	EPBC Act				
Peregrine Falcon <i>Falco peregrinus</i>	S7	-	Diverse from rainforest to arid shrublands, from coastal heath to alpine. Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes.	Yes	Possibly Occurs.	Uncommon but the subject site may represent part of a larger home range used by individuals of this species.
Masked Owl (SW population) <i>Tyto n. novaehollandiae</i>	P3	-	Roosts and nests in heavy forest, hunts over open woodlands and farmlands.	Yes	Possibly Occurs.	Uncommon but may occur, if only occasionally.
Barking Owl (SW population) <i>Ninox connivens connivens</i>	P2	-	Dense vegetation, especially forest and thickets of waterside vegetation such as <i>melaleucas</i> . Roosts in tree hollows.	No	Would Not Occur.	Habitat appears unsuitable and rarely recorded in his part of the south west.
Australasian Bittern <i>Botaurus poiciloptilus</i>	S1	EN	Freshwater wetlands, occasionally estuarine; prefers heavy vegetation such as beds of tall dense <i>Typha</i> , <i>Baumea</i> and sedges in freshwater swamps.	No	Would Not Occur.	No suitable habitat.
Black Bittern <i>Ixobrychus flavicollis</i>	P1	-	Freshwater pools, swamps and lagoons well screened with trees. Shelters in dense waterside vegetation.	No	Would Not Occur.	No suitable habitat.
Little Bittern <i>Ixobrychus minutus</i>	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of <i>Typha</i> , <i>Baumea</i> and tall rushes in freshwater swamps around lakes and along rivers.	No	Would Not Occur.	No suitable habitat.
Carnaby's Black Cockatoo <i>Calyptrorhynchus latirostris</i>	S2	EN	Forests, woodlands, heathlands, farms; feeds on <i>Banksia</i> , <i>Hakea</i> and Marri.	Yes	Possibly Occurs.	Subject site contains areas of foraging habitat and potential breeding habitat.
Baudin's Black Cockatoo <i>Calyptrorhynchus baudinii</i>	S2	EN	Mainly eucalypt forests where it feeds primarily on the marri seeds.	Yes	Known to Occur	Subject site contains areas of foraging habitat and potential breeding habitat.
Forest Red-tailed Black Cockatoo <i>Calyptrorhynchus banksii naso</i>	S3	VU	Eucalypt forests, feeds on marri, jarrah, blackbutt, karri, sheoak and snottygobble.	Yes	Known to Occur	Subject site contains areas of foraging habitat and potential breeding habitat.
Fork-tailed Swift <i>Apus pacificus</i>	S5	Ma, Mig	Low to very high airspace over varied habitat from rainforest to semi desert.	Yes	Unlikely to Occur, Flyover only on very rare occasions.	May occur very occasionally for brief periods.
Grey Wagtail <i>Motacilla cinerea</i>	S5	Mig, Ma	In Australia, near running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields.	No	Would Not Occur.	Never recorded in this area.

Species	Conservation Status		Habitat Preferences	Habitat Present	Likelihood of Occurrence	Comments
	BC Act/ DBCA Priority	EPBC Act				
Chuditch <i>Dasyurus geoffroii</i>	S3	VU	Forest, mallee shrublands, woodland and desert. The densest populations have been found in riparian jarrah forest.	Yes	Possibly Occurs.	Recorded during several surveys in nearby areas (see Appendix B).
South-western Brush-tailed Phascogale <i>Phascogale tapoatafa wambenger</i>	S6	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover.	Yes	Possibly Occurs.	Recorded during several surveys in nearby areas (see Appendix B).
Quenda <i>Isodon fusciventer</i>	P4	-	Dense scrubby, often swampy, vegetation with dense cover.	Yes/Marginal	Possibly Occurs.	Recorded during several surveys in nearby areas (see Appendix B).
Western Ringtail Possum <i>Pseudocheirus occidentalis</i>	S1	VU	Coastal peppermint, coastal peppermint-tuart, jarrah-marri associations, sheoak woodland, and eucalypt woodland and mallee.	Yes	Known to Occur.	Present, but likely to be in low densities as habitat in some areas is marginal in quality. Recorded during several surveys in nearby areas (see Appendix B).
Quokka <i>Setonix brachyurus</i>	S3	VU	Currently restricted to densely vegetated coastal heaths, swamps, riverine habitats including tea-tree thickets on sandy soils along creek systems.	No	Would Not Occur. Locally extinct.	Locally extinct and habitat unsuitable.
Woylie <i>Bettongia penicillata ogilbyi</i>	S1	EN	Open forest and woodland with a low, dense, understorey of tussock grasses or woody scrub. Formerly occurred in a wider range of habitats including spinifex hummock grasslands.	Yes/Marginal	Would Not Occur. Locally extinct.	Locally extinct.
Western Brush Wallaby <i>Notamacropus irma</i>	P4	-	Open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets.	Yes	Possibly Occurs.	Recorded during several surveys in nearby areas (see Appendix B).
Western False Pipistrelle <i>Falsistrellus mackenziei</i>	P4	-	Wet sclerophyll forest dominated by karri and in high rainfall zones of the jarrah and marri forest.	Yes	Possibly Occurs.	Uncommon but recorded during some surveys in nearby areas (see Appendix B).
Water Rat <i>Hydromys chrysogaster</i>	P4	-	Permanent water, fresh, brackish or marine.	No	Would Not Occur.	No suitable habitat.

Note: see Appendix A for conservation codes

The following vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period:

- Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso* – S3 (WC Act), Vulnerable (EPBC Act)
Foraging evidence attributed to this species were observed during the survey period (numerous chewed marri fruits). A high percentage of the remnant vegetation within the subject site represents foraging habitat. No evidence of actual breeding taking place was observed however all larger trees ($\geq 50\text{cm}$ DBH) can be considered potential breeding habitat, a number of which appear to contain large hollows. No roosting sites identified though likely to use some trees within the subject site for this purpose.
- Baudin's Black-Cockatoo *Calyptorhynchus baudinii* – S2 (WC Act), Vulnerable (EPBC Act)
Foraging evidence attributed to this species was observed during the survey period (chewed marri fruits). A high percentage of the remnant vegetation within the subject site represents foraging habitat. No evidence of actual breeding taking place was observed however all larger trees ($\geq 50\text{cm}$ DBH) can be considered potential breeding habitat, a number of which appear to contain large hollows. No roosting sites identified though likely to use some trees within the subject site for this purpose.
- Western Ringtail Possum *Pseudocheirus occidentalis* – S1 (WC Act), Critically Endangered (EPBC Act)
Evidence of this species was found during the daytime survey in the form of some scats near an unoccupied drey. Overall habitat does however appear marginal due to the sparse nature of the midstorey vegetation and a lack of canopy connectivity. This suggests that this species is only present in low densities.

Based on the habitats present and current documented distributions it is considered possible that several additional vertebrate species of conservation significance may use the subject site for some purpose at times, though, as no evidence of them was found at the time of the field survey was found, the status of some in the area remains uncertain.

These species are:

- Coastal Plains Skink *Ctenotus ora* – P3 (DBCA Priority Species)
Status of this species within the subject site is difficult to determine without a detailed survey, however, given the location of the subject site within its documented range, some recent nearby records and the presence of habitat that appears suitable it must be assumed to be present. Listed as a potential species based on available information.
- Carnaby's Black-Cockatoo *Calyptorhynchus latirostris* – S2 (WC Act), Endangered (EPBC Act)
This species is known to frequent the general area and as suitable habitat is present it must be assumed to occur. A high percentage of the remnant vegetation within the

subject site represents foraging habitat. No evidence of actual breeding taking place was observed however all larger trees ($\geq 50\text{cm}$ DBH) can be considered potential breeding habitat, a number of which appear to contain large hollows. No roosting sites identified though likely to use some trees within the subject site for this purpose. Listed as a potential species based on available information.

- Peregrine Falcon *Falco peregrinus* – S7 (WC Act)
This species potentially utilises some sections of the subject site as part of a much larger home range though only likely to occur infrequently. No evidence of nesting seen. Listed as a potential species based on available information.
- Masked Owl *Tyto novaehollandiae* – P3 (DBCA Priority Species)
Status in the general area is difficult to determine. May utilise woodland areas within and near the subject site for roosting and therefore may forage in more open areas. Probably only present rarely. Listed as a potential species based on available information.
- South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger* – S6 (WC Act)
Recorded during previous surveys in the general area (Bancroft and Bamford 2008, Harewood 2014, G. Harewood pers. obs. 2013) and likely to be present in woodland areas containing tree hollows. Listed as a potential species based on available information.
- Chuditch *Dasyurus geoffroyi* - S3 (WC Act), Vulnerable (EPBC Act)
Without a detailed survey the status of this species within the subject site is difficult to determine however given there are some nearby records (Bancroft and Bamford 2008, G. Harewood pers. obs. 2013) it must be considered a potential species. Listed as a potential species based on available information.
- Quenda *Isodon fusciventer* – P4 (DBCA Priority Species)
Habitat is general marginal for this species given the sparse nature of groundcover but it may occur in some areas where the densest vegetation occurs. Listed as a potential species based on available information.
- Western Brush Wallaby *Macropus irma* - P4 (DBCA Priority Species)
This species is known to occur in the general area (G. Harewood pers. obs. 2016). As habitat appears suitable it must be assumed to occur, if only occasionally. Listed as a potential species based on available information.
- Western False Pipistrelle *Falsistrellus mackenziei* – P4 (DBCA Priority Species)
There is a lack of records of this species in the immediate vicinity but given habitat appears at least marginally suitable it must be assumed to occur, if only occasionally. Listed as a potential species based on available information.

As listed in Table 4, a number of other species of conservation significance, while possibly present in the wider area are not considered as potential species due to known localised

extinction (and no subsequent recruitment from adjoining areas), lack of suitable habitat and/or the presence of feral predators.

5.3.3 Invertebrate Fauna of Conservation Significance

Four conservation significant invertebrate species appeared in the DBCA database search (DBCA 2019), these being an unnamed cricket (*Pachysaga strobila*), the Swan Coastal Plain shield-backed trapdoor spider (*Idiosoma sigillatum*), the western pygmy trapdoor spider (*Bertmainius opimus*) and Carter's freshwater mussel (*Westralunio carteri*).

Both the Swan Coastal Plain shield-backed trapdoor spider and Carter's freshwater mussel have been assessed as not occurring due to a lack of suitable habitat. *Pachysaga strobila* is also considered as unlikely to occur though it is difficult to totally discount its possible presence.

The western pygmy trapdoor spider has been collected in a state forest near the subject site (DBCA 2019) so it must be regarded as a potential species though its actual status within the subject site is unknown.

6. CONCLUSION

The fauna assessment within the subject site was undertaken for the purposes of delineating and characterising the fauna habitats and faunal assemblages present. Targeted searches for black cockatoo habitat was also carried out.

With respect to native vertebrate fauna, 29 mammals (includes nine bat species), 92 bird, 36 reptile and three frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject area at times, a conclusion largely based on the presence of apparently suitable habitat. Overall fauna habitat quality appears to be good and it can be expected that a high percentage of the predicted species would utilise the subject site.

The assessment identified the presence of "potential" black cockatoo breeding and foraging habitat within the subject site and the presence of the western ringtail possum. A number of additional federal and/or state listed threatened and DBCA priority fauna species may also occur though in most cases their use of the subject site wasn't detected during the survey period.

In summary three vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period, these being:

- forest red-tailed black cockatoo – Vulnerable (WA/Federal);
- Baudin's black cockatoo – Endangered (WA/Federal); and

- western ringtail possum – Critically Endangered (WA/Federal).

An additional nine species of conservation significance may also utilise the subject site, though, as no evidence of these species presence was identified during the field survey, the status of some in the area remains uncertain. These species are:

- coastal plains skink – P3 (DBCA Priority Species);
- masked owl – P3 (DBCA Priority Species);
- south-western brush-tailed phascogale - S6 (WC Act);
- Carnaby's cockatoo – Endangered (WA/Federal);
- peregrine falcon – Schedule 7 (WA);
- quenda – Priority 4 (WA);
- western brush wallaby - Priority 4 (WA); and
- western false pipistrelle – P4 (DBCA Priority Species).

One invertebrate species of conservation significance has also been assessed as possibly occurring based on available information. The western pygmy trapdoor spider (Priority 3) has been collected in a state forest near the subject site (DBCA 2019) so it must be regarded as a potential species though its actual status within the subject site is unknown.

The exact location of proposed development within the subject site is yet to be finalise. Ongoing planning will need to take into account the potential presence of habitat used by some species of conservation significance and fauna in general so that any direct and indirect impacts can be avoided or minimised. Management plans and protocols that aim to minimise impact on fauna and fauna habitat should be employed if considered warranted.

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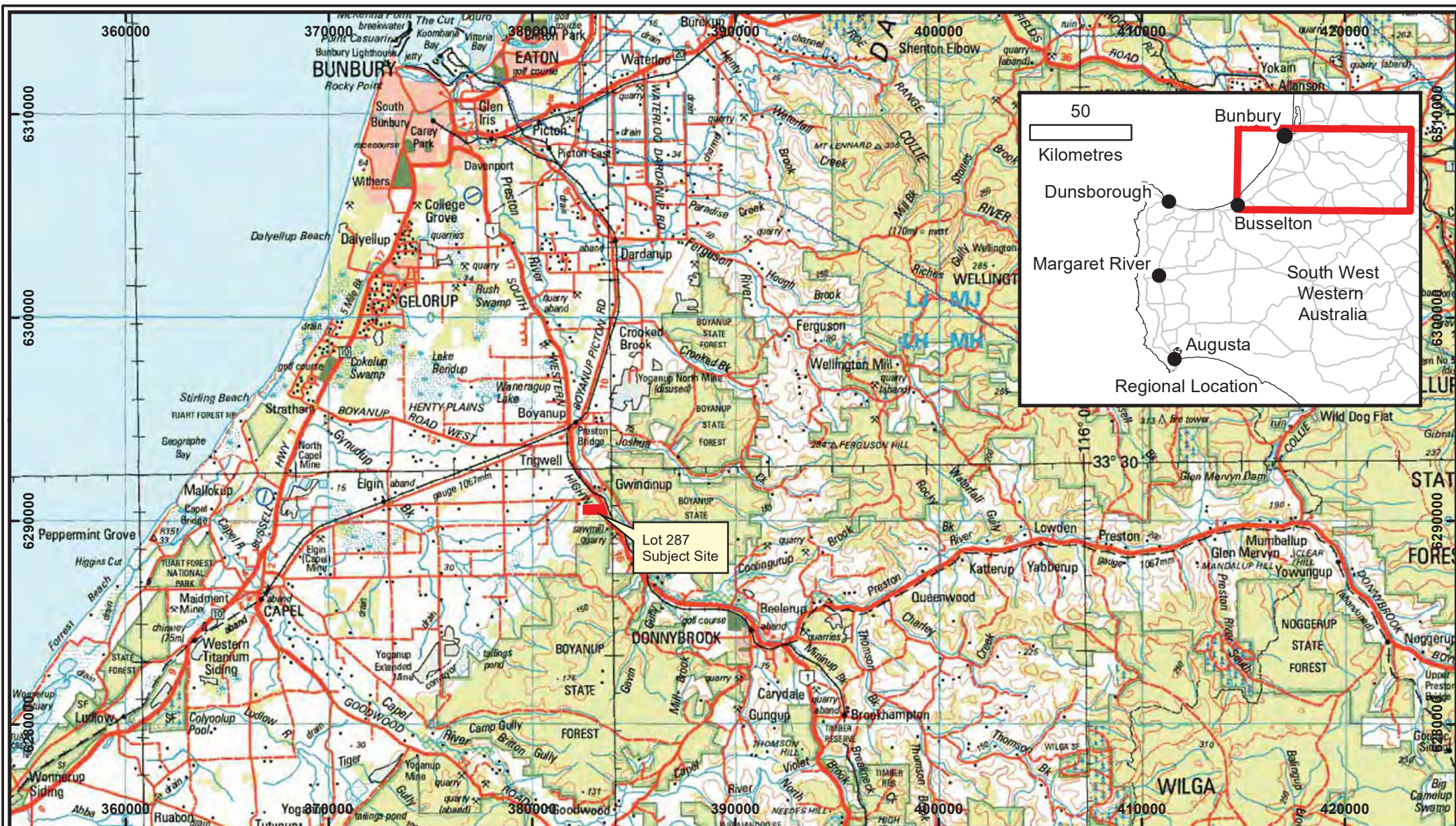
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FIGURES



Legend

Subject Site



0 5 10 15 20
Kilometres



Drawn: G Harewood

Date: Mar 2019

Scale: 1:250,000

Projection/Coordinate System: UTM/MGA Zone 50

Lot 287 SW Highway
Gwindinup

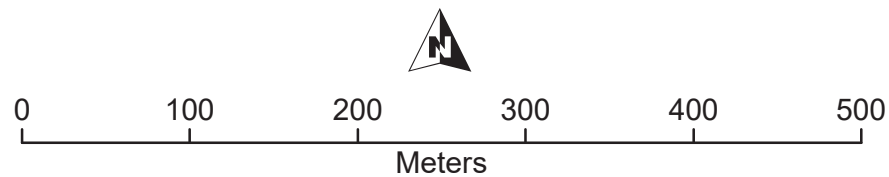
**Subject Site
and Surrounds**

Figure: 1



Legend

Subject Site



Drawn: G Harewood
Date: Mar 2019
Scale: 1:4,500

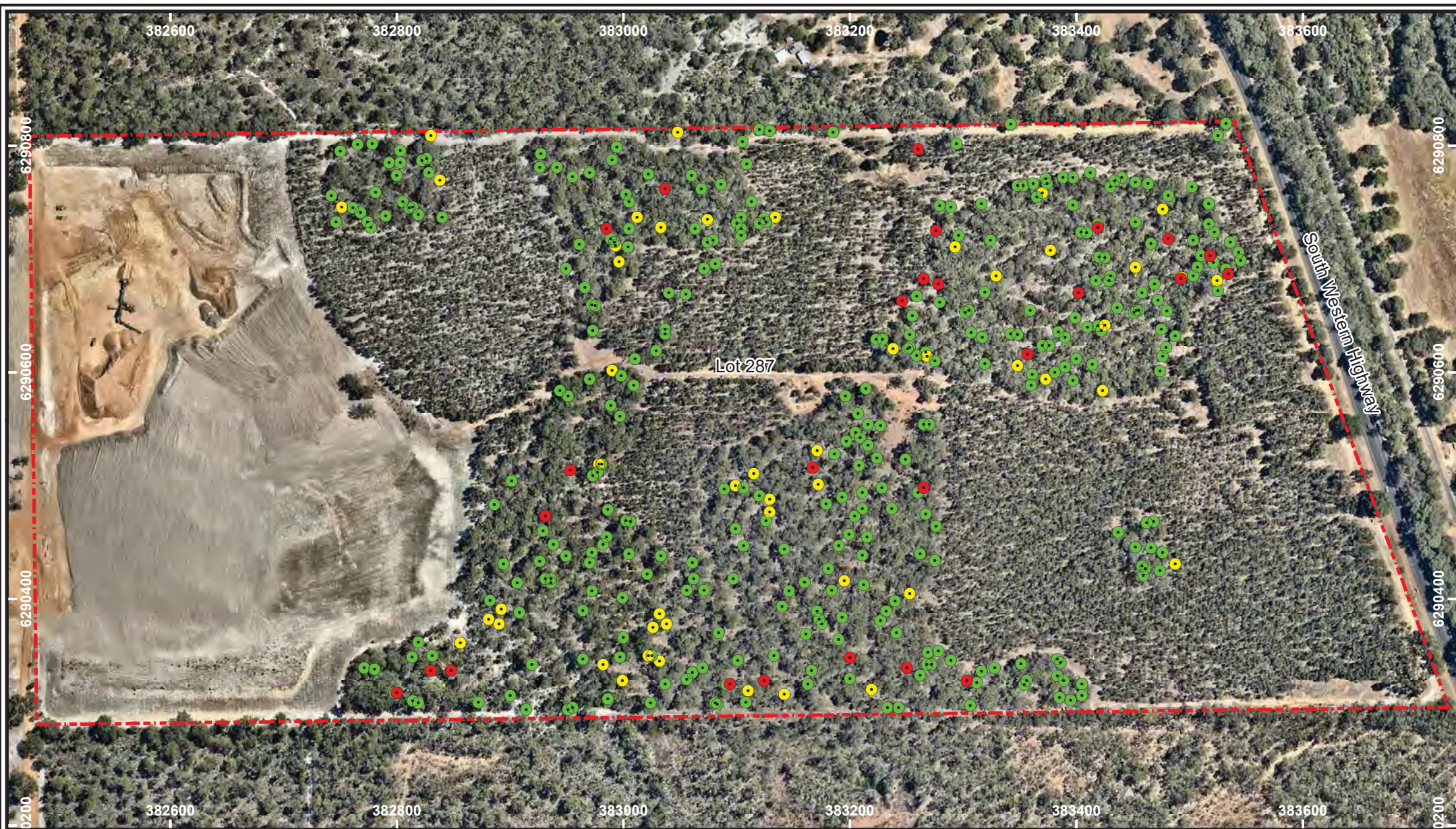
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Lot 287 SW Highway
Gwindinup

**Subject Site
Aerial Photograph**

Figure: 2

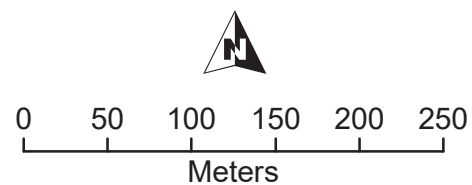




Legend

 Subject Site

-  Habitat Tree - One or more hollows possibly suitable for black cockatoos
-  Habitat Tree - One or more possible hollows unsuitable for black cockatoos
-  Habitat Tree - No hollows seen



Drawn: G Harewood

Date: Mar 2019

Scale: 1:4,500

Projection/Coordinate System: UTM/MGA Zone 50

Lot 287 SW Highway
Gwindinup

**Habitat Trees
(DBH >50cm)**

Figure: 4

APPENDIX A

CONSERVATION CATEGORIES

EPBC Act (1999) Threatened Fauna Categories

Threatened fauna may be listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* in any one of the following categories:

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically Endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the <i>EPBC Act</i>

Note: Only species in those categories marked with an asterisk are matters of national environmental significance (NES) under the *EPBC Act*.

Wildlife Conservation (Specially Protected Fauna) Notice 2018 Categories

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Code	Description
Schedule 1 (S1) Critically Endangered species	CR	Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
Schedule 2 (S2) Endangered species	EN	Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
Schedule 3 (S3) Vulnerable species	VU	Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Schedule 4 (S4) Presumed extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last member of the species has died.
Schedule 5 (S5) Migratory birds protected under an international agreement	MI	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
Schedule 6 (S6) Fauna that is of special conservation need as conservation dependent fauna	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7 (S7) Other specially protected fauna.	OS	Fauna otherwise in need of special protection to ensure their conservation.

Western Australian DBCA Priority Fauna Categories

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Code	Description
Priority 1 (P1) Poorly Known Species.	P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2 (P2) Poorly Known Species.	P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3 (P3) Poorly Known Species.	P3	Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4 (P4) Rare, Near Threatened and other species in need of monitoring.	P4	(a) Rare: Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened: Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

IUCN Red List Threatened Species Categories

The *IUCN Red List of Threatened Species*[™] is a checklist of taxa that have undergone an extinction risk assessment using the *IUCN Red List Categories and Criteria*.

Categories are summarized below.

Category	Code	Description
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.
Not Evaluated	NE	Taxa which has not been evaluated.

A full list of categories and their meanings are available at:

<http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria>

APPENDIX B

FAUNA OBSERVED OR POTENTIALLY PRESENT

Fauna Observed or Potentially Present

Lot 287 SW Highway.

Approx. centroid = 115.74103°E, 33.51841°S

Compiled by Greg Harewood - March 2019

Recorded (Captured/Sighted/Heard/Signs) = X

A = Harewood, G (2019). Fauna Assessment Lot 287 South Western Highway. Unpublished report for M.Giacchi. March 2019.

B = Harewood, G (2016). Fauna Assessment Lot 3833 (Part) Hyder Road - Yoganup Extended. Unpublished report for Iluka Resources Limited. December 2016

C = Harewood, G (2013). Terrestrial Fauna Assessment (Level 1) Yoganup Extended Mineral Sands Project. Unpublished report for Iluka Resources Limited. March 2013

D = Harewood, G (2014). Phase 1 and 2 Seasonal Fauna Surveys (Level 2) . Yoongarillup Mineral Sands Project. Unpublished report for Doral Mineral Sands Pty Ltd.

E = Bancroft, W. and Bamford, M. (2008). Fauna values of Bemax's Happy Valley mineral sands deposit. Unpublished report for Bemax Resources Limited. January 2008 (includes Gwindinup).

F = Biota (2009). Tutunup Fauna Assemblage and Fauna Habitat Seasonal Survey. Unpublished report for Iluka Resources. March 2009.

G = Biota (2007a). Yoganup 215 Strand Fauna and Faunal Assemblage Survey. Unpublished report for Iluka Resources. February 2007.

H = Biota (2007b). Tutunup South Fauna Habitat and Fauna Assemblage Seasonal Survey. Unpublished report for Iluka Resources. December 2007.

I = Ninox (2006). A Vertebrate Fauna Assessment of the Yoganup Mineral Sands Project Area. Unpublished report for Iluka Resources. March 2006.

J = Hart, Simpson and Assoc. (1997). Wonnerup -Tutunup Road - Vertebrate Fauna. Unpublished report for Westralian Sands Ltd.

K = DBCA (2019). NatureMap Database search. "By Circle" 115° 44' 28" E, 33° 31' 06" S (plus 20km buffer). 8 March 2019.

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
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Amphibia

Myobatrachidae

Ground or Burrowing Frogs

<i>Heleioporus eyrei</i>	Moaning Frog	LC		X		X	X	X	X	X		X	X
<i>Limnodynastes dorsalis</i>	Western Banjo Frog	LC				X	X			X		X	X
<i>Pseudophryne guentheri</i>	Crawling Toadlet	LC						X				X	

Reptilia

Diplodactylidae

<i>Diplodactylus polyophthalmus</i>	Speckled Stone Gecko					X	X	X				X	
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Gekkonidae Geckoes													
<i>Christinus marmoratus</i>	Marbled Gecko					X	X	X	X	X		X	X
Pygopodidae Legless Lizards													
<i>Aprasia pulchella</i>	Pretty Worm Lizard					X	X		X	X		X	X
<i>Aprasia repens</i>	Sandplain Worm Lizard						X			X		X	
<i>Delma australis</i>	Marble-faced Delma					X							
<i>Lialis burtonis</i>	Burton's Legless Lizard						X	X	X			X	X
<i>Pygopus lepidopus</i>	Common Scaly Foot												
Agamidae Dragon Lizards													
<i>Pogona minor</i>	Western Bearded Dragon					X	X	X	X	X		X	X
Varanidae Monitor's or Goanna's													
<i>Varanus gouldii</i>	Sand Monitor						X						X
<i>Varanus rosenbergi</i>	Heath Monitor					X	X	X		X	X	X	

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Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Scincidae Skinks													
<i>Acritoscincus trilineatum</i>	Southwestern Cool Skink					X	X	X	X	X		X	
<i>Cryptoblepharus buechananii</i>	Fence Skink		X	X		X	X	X	X	X			X
<i>Ctenotus impar</i>	Odd-striped Ctenotus					X	X	X	X	X		X	X
<i>Ctenotus ora</i>	Coastal Plains Skink	P3				X	X	X	X	X		X	X
<i>Egernia kingii</i>	King's Skink					X		X	X			X	X
<i>Egernia napoleonis</i>	Salmon-bellied Skink					X	X			X	X		X
<i>Hemiergis gracilipes</i>	Southwestern Mulch Skink								X				X
<i>Hemiergis peronii peronii</i>	Four-toed Earless Skink									X			
<i>Hemiergis peronii tridactyla</i>	Three-toed Earless Skink					X	X	X	X			X	
<i>Hemiergis quadrilineata</i>	Two-toed Mulch Skink												X
<i>Lerista distinguenda</i>	South West Four-toed Lerista					X	X	X	X	X		X	X
<i>Lerista elegans</i>	West Coast Four-toed Lerista					X		X	X	X			X
<i>Menetia greyii</i>	Dwarf Skink					X	X	X	X	X		X	X
<i>Morethia lineocellata</i>	West Coast Pale-flecked Morethia					X	X	X	X	X		X	X
<i>Morethia obscura</i>	Shrubland Pale-flecked Morethia					X	X	X	X	X			X

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Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
<i>Tiliqua rugosa</i>	Bobtail			X		X	X	X	X	X		X	X
Typhlopidae Blind Snakes													
<i>Ramphotyphlops australis</i>	Southern Blind Snake					X	X	X	X	X		X	
<i>Ramphotyphlops pinguis</i>	Fat Blind Snake					X	X			X			
Boidae Pythons, Boas													
<i>Morelia spilota imbricata</i>	Southern Carpet Python						X						
Elapidae Elapid Snakes													
<i>Echiopsis curta</i>	Bardick												
<i>Elapognathus coronatus</i>	Crowned Snake					X							X
<i>Notechis scutatus</i>	Tiger Snake						X		X			X	X
<i>Parasuta gouldii</i>	Gould's Hooded Snake												
<i>Parasuta nigriceps</i>	Black-backed Snake					X			X			X	X
<i>Pseudonaja affinis</i>	Dugite					X	X					X	X
<i>Simoselaps bertholdi</i>	Jan's Banded Snake												X

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Aves													
Casuariidae Emus, Cassowaries													
<i>Dromaius novaehollandiae</i>	Emu	LC	X	X	X	X	X	X	X	X	X		X
Phasianidae Quails, Pheasants													
<i>Coturnix pectoralis</i>	Stubble Quail	LC			X	X	X						X
<i>Coturnix ypsilophora</i>	Brown Quail	LC							X				
Anatidae Geese, Swans, Ducks													
<i>Anas gracilis</i>	Grey Teal	LC			X		X		X		X	X	X
<i>Anas superciliosa</i>	Pacific Black Duck	LC			X		X	X	X		X	X	X
<i>Chenonetta jubata</i>	Australian Wood Duck	LC			X	X	X	X	X		X	X	X
<i>Tadorna tadornoides</i>	Australian Shelduck	LC		X	X	X	X	X				X	X

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Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Accipitridae													
Kites, Goshawks, Eagles, Harriers													
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	LC				X	X						X
<i>Accipiter fasciatus</i>	Brown Goshawk	LC			X		X			X	X		X
<i>Aquila audax</i>	Wedge-tailed Eagle	LC				X	X	X	X			X	X
<i>Aquila morphnoides</i>	Little Eagle	LC			X		X						
<i>Circus approximans</i>	Swamp Harrier	LC			X				X				X
<i>Elanus caeruleus</i>	Black-shouldered Kite	LC			X								
<i>Haliastur sphenurus</i>	Whistling Kite	LC			X			X					X
<i>Hamirostra isura</i>	Square-tailed Kite	LC					X						
Falconidae													
Falcons													
<i>Falco berigora</i>	Brown Falcon	LC		X			X						X
<i>Falco cenchroides</i>	Australian Kestrel	LC			X	X	X		X				X
<i>Falco longipennis</i>	Australian Hobby	LC							X				X
<i>Falco peregrinus</i>	Peregrine Falcon	S7 LC					X						X
Turnicidae													
Button-quails													
<i>Turnix varia</i>	Painted Button-quail	LC					X						

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Columbidae Pigeons, Doves													
<i>Ocyphaps lophotes</i>	Crested Pigeon	LC		X	X	X	X	X	X		X	X	X
<i>Phaps chalcoptera</i>	Common Bronzewing	LC	X		X	X	X	X	X	X	X	X	X
<i>Phaps elegans</i>	Brush Bronzewing	LC											
Psittacidae Parrots													
<i>Cacatua sanguinea gymnopsis</i>	Little Corella	Introduced			X								X
<i>Cacatua tenuirostris</i>	Eatern Long-billed Corella	Introduced											
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo	S3 VU	X	X	X	X	X	X	X	X	X	X	X
<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo	S2 EN EN A3cde	X	X	X	X	X	X	X		X	X	X
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	S2 EN EN A2bcde		X	X	X	X	X	X	X		X	X
<i>Glossopsitta porphyrocephala</i>	Purple-crowned Lorikeet	LC				X	X			X			
<i>Neophema elegans</i>	Elegant Parrot	LC			X	X	X	X	X	X			X
<i>Platycercus icterotis icterotis</i>	Western Rosella (western ssp)	LC					X	X	X				X
<i>Platycercus spurius</i>	Red-capped Parrot	LC	X	X	X	X	X	X	X	X	X	X	X
<i>Platycercus zonarius</i>	Australian Ringneck	LC	X	X	X	X	X	X	X	X	X	X	X
<i>Polytelis anthopeplus</i>	Regent Parrot	LC							X			X	X

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Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Cuculidae Parasitic Cuckoos													
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	LC					X	X				X	X
<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo	LC					X	X	X				
<i>Chrysococcyx lucidus</i>	Shining Bronze Cuckoo	LC				X	X	X	X			X	
<i>Cuculus pallidus</i>	Pallid Cuckoo	LC		X				X				X	
Strigidae Hawk Owls													
<i>Ninox novaeseelandiae</i>	Boobook Owl	LC			X	X	X	X					
Tytonidae Barn Owls													
<i>Tyto alba</i>	Barn Owl	LC			X								
<i>Tyto n. novaehollandiae</i>	Masked Owl (SW pop)	P3											X
Podargidae Frogmouths													
<i>Podargus strigoides</i>	Tawny Frogmouth	LC			X		X	X					X
Aegothelidae Owlet-nightjars													
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	LC					X						X

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Halcyonidae Tree Kingfishers													
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Introduced		X	X	X	X	X	X	X	X	X	X
<i>Todiramphus sanctus</i>	Sacred Kingfisher	LC					X	X				X	X
Meropidae Bee-eaters													
<i>Merops ornatus</i>	Rainbow Bee-eater	JA LC	X	X	X	X	X	X	X	X		X	X
Climacteridae Treecreepers													
<i>Climacteris rufa</i>	Rufous Treecreeper	LC						X					
Maluridae Fairy Wrens, GrassWrens													
<i>Malurus elegans</i>	Red-winged Fairy-wren	LC				X	X	X	X	X			X
<i>Malurus splendens</i>	Splendid Fairy-wren	LC		X	X	X	X	X	X	X	X	X	X
<i>Stipiturus malachurus</i>	Southern Emu-wren	LC						X	X				X

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Acanthizidae													
Thornbills, Geryones, Fieldwrens & Whitefaces													
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill	LC	X	X	X	X	X	X	X	X	X	X	X
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	LC	X	X	X	X	X	X	X		X	X	X
<i>Acanthiza inornata</i>	Western Thornbill	LC					X		X	X	X		X
<i>Gerygone fusca</i>	Western Gerygone	LC	X	X	X	X	X	X	X	X	X	X	X
<i>Sericornis frontalis</i>	White-browed Scrubwren	LC				X	X	X	X	X	X		X
<i>Smicrornis brevirostris</i>	Weebill	LC	X	X		X	X	X		X	X		X
Pardalotidae													
Pardalotes													
<i>Pardalotus punctatus</i>	Spotted Pardalote	LC					X	X	X				X
<i>Pardalotus striatus</i>	Striated Pardalote	LC		X	X	X	X	X	X	X	X	X	X

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Meliphagidae Honeyeaters, Chats													
<i>Acanthorhynchus superciliosus</i>	Western Spinebill	LC				X	X	X	X	X	X	X	X
<i>Anthochaera carunculata</i>	Red Wattlebird	LC	X	X	X	X	X		X	X	X	X	X
<i>Anthochaera lunulata</i>	Western Little Wattlebird	LC		X									X
<i>Epthianura albifrons</i>	White-fronted Chat	LC							X				X
<i>Lichenostomus virescens</i>	Singing Honeyeater	LC						X		X			
<i>Lichmera indistincta</i>	Brown Honeyeater	LC		X	X	X	X	X	X	X	X	X	X
<i>Melithreptus chloropsis</i>	Gilbert's Honeyeater	LC					X	X					
<i>Phylidonyris melanops</i>	Tawny-crowned Honeyeater	LC						X	X				
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	LC							X				
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	LC			X	X	X	X	X	X	X	X	X
Petroicidae Australian Robins													
<i>Eopsaltria georgiana</i>	White-breasted Robin	LC					X	X	X				X
<i>Eopsaltria griseogularis</i>	Western Yellow Robin	LC	X			X	X	X	X				
<i>Petroica multicolor</i>	Scarlet Robin	LC	X	X		X	X	X	X	X			

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Neosittidae Sitellas													
<i>Daphoenositta chrysoptera</i>	Varied Sittella	LC	X			X	X	X	X				X
Pachycephalidae Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers													
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	LC	X	X		X	X	X	X	X	X		X
<i>Pachycephala occidentalis</i>	Western Whistler	LC	X	X	X	X	X	X	X	X	X		
<i>Pachycephala rufiventris</i>	Rufous Whistler	LC		X	X	X	X	X	X			X	X
Dicruridae Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo													
<i>Grallina cyanoleuca</i>	Magpie-lark	LC			X	X	X		X			X	X
<i>Rhipidura fuliginosa</i>	Grey Fantail	LC	X	X	X	X	X	X	X	X	X	X	
<i>Rhipidura leucophrys</i>	Willie Wagtail	LC		X	X	X	X	X	X	X		X	X
Campephagidae Cuckoo-shrikes, Trillers													
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	LC		X	X	X	X	X	X	X	X	X	X
<i>Lalage tricolor</i>	White-winged Triller	LC			X		X						

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Artamidae Woodswallows, Butcherbirds, Currawongs													
<i>Artamus cinereus</i>	Black-faced Woodswallow	LC		X	X		X		X			X	X
<i>Artamus cyanopterus</i>	Dusky Woodswallow	LC			X		X	X	X	X			X
Cracticidae Currawongs, Magpies & Butcherbirds													
<i>Cracticus tibicen</i>	Australian Magpie	LC	X	X	X	X	X	X	X	X	X	X	X
<i>Cracticus torquatus</i>	Grey Butcherbird	LC		X	X	X	X	X	X			X	X
<i>Strepera versicolor</i>	Grey Currawong	LC	X			X	X	X					X
Corvidae Ravens, Crows													
<i>Corvus coronoides</i>	Australian Raven	LC	X	X	X	X	X	X	X	X	X	X	X
Motacillidae Old World Pipits, Wagtails													
<i>Anthus australis</i>	Australian Pipit	LC			X	X	X	X	X				
Estrilidae Grass Finches & Mannikins													
<i>Stagonopleura oculata</i>	Red-eared Firetail	LC						X					X
Dicaeidae Flowerpeckers													
<i>Dicaeum hirundinaceum</i>	Mistletoebird	LC											X

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Hirundinidae Swallows, Martins													
<i>Hirundo ariel</i>	Fairy Martin	LC			X								
<i>Hirundo neoxena</i>	Welcome Swallow	LC			X	X	X		X	X		X	X
<i>Hirundo nigricans</i>	Tree Martin	LC			X	X	X	X	X		X	X	
Sylviidae Old World Warblers													
<i>Cincloramphus cruralis</i>	Brown Songlark	LC				X							
<i>Cincloramphus mathewsi</i>	Rufous Songlark	LC					X					X	
Zosteropidae White-eyes													
<i>Zosterops lateralis</i>	Grey-breasted White-eye	LC		X	X		X	X	X	X	X	X	X
Mammalia													
Tachyglossidae Echidnas													
<i>Tachyglossus aculeatus</i>	Echidna	LC		X			X	X		X	X		

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DBCA Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA IUCN Red List Category Definitions LC = Least Concern - see Appendix A and <https://www.iucnredlist.org/resources/categories-and-criteria>.

Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Dasyuridae Carnivorous Marsupials													
<i>Antechinus flavipes</i>	Yellow-footed Antechinus, Mardo					X	X		X	X			X
<i>Phascogale tapoatafa wambenger</i>	SW Brush-tailed Phascogale	S6				X	X						X
<i>Sminthopsis gilberti</i>	Gilbert's Dunnart	LC					X		X	X			X
<i>Sminthopsis griseoventer</i>	Grey-bellied Dunnart	LC							X	X			
Peramelidae Bandicoots													
<i>Isoodon fusciventer</i>	Quenda	P4 LC		X	X	X	X	X	X	X		X	X
Phalangeridae Brushtail Possums, Cuscuses													
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	LC	X	X	X	X	X	X	X	X	X	X	
Burramyidae Pygmy Possums													
<i>Cercartetus concinnus</i>	Western Pygmy-possum	LC				X	X	X		X			X
Tarsipedidae Honey Possum													
<i>Tarsipes rostratus</i>	Honey Possum, Noolbenger	LC					X			X		X	
Pseudocheiridae Ringtail Possums													
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	S1 CR CR A2bce+3bce+4bc	X	X	X		X	X					X

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Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Macropodidae Kangaroos, Wallabies													
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	LC	X	X	X	X	X	X	X	X	X	X	X
<i>Notamacropus irma</i>	Western Brush Wallaby	P4 LC				X	X	X		X			
Molossidae Freetail Bats													
<i>Austronomus australis</i>	White-striped Freetail-bat	LC			X	X	X		X	X			
<i>Ozimops kitcheneri</i>	South-western Freetail-bat	LC				X							
Vespertilionidae Ordinary Bats													
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	LC				X		X					X
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	LC				X		X		X			X
<i>Falsistrellus mackenziei</i>	Western False Pipistrelle	P4 NT							X				X
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat	LC				X		X					X
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	LC								X			
<i>Nyctophilus major</i>	Western Long-eared Bat	LC											
<i>Vespadelus regulus</i>	Southern Forest Bat	LC				X	X	X	X	X			X

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Class Family Species	Common Name	Conservation Status	A	B	C	D	E	F	G	H	I	J	K
Muridae Rats, Mice													
<i>Mus musculus</i>	House Mouse	Introduced				X	X	X	X			X	X
<i>Rattus fuscipes</i>	Western Bush Rat	LC				X		X	X				
<i>Rattus rattus</i>	Black Rat	Introduced				X	X	X					X
Canidae Dogs, Foxes													
<i>Vulpes vulpes</i>	Red Fox	Introduced			X	X	X	X			X	X	
Felidae Cats													
<i>Felis catus</i>	Cat	Introduced			X			X					
Suidae Pigs													
<i>Sus scrofa</i>	Pig	Introduced		X		X	X						
Leporidae Rabbits, Hares													
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced		X	X	X	X	X	X	X	X	X	X

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APPENDIX C

DBCA & EPBC DATABASE SEARCH RESULTS

NatureMap - Lot 287

Created By Greg Harewood on 08/03/2019

Kingdom Animalia
Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115° 44' 28" E, 33° 31' 06" S
Buffer 20km
Group By Species Group

Species Group	Species	Records
Amphibian	10	134
Bird	156	9038
Fish	7	13
Invertebrate	160	495
Mammal	30	2971
Reptile	31	143
TOTAL	394	12794

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
Amphibian				
1.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
2.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
3.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
4.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
5.	25404 <i>Geocrinia leai</i> (Ticking Frog)			
6.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
7.	25411 <i>Heleioporus inornatus</i> (Whooping Frog)			
8.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
9.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
10.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
Bird				
11.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
12.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
13.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
14.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
15.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
16.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
17.	25537 <i>Accipiter novaehollandiae</i> (Grey Goshawk)			
18.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
19.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
20.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
21.	24301 <i>Aegotheles cristatus</i> subsp. <i>cristatus</i> (Australian Owlet-nightjar)			
22.	24310 <i>Anas castanea</i> (Chestnut Teal)			
23.	24312 <i>Anas gracilis</i> (Grey Teal)			
24.	24313 <i>Anas platyrhynchos</i> (Mallard)			
25.	<i>Anas platyrhynchos</i> subsp. <i>domesticus</i>			
26.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
27.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
28.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
29.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
30.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
31.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
32.	41324 <i>Ardea modesta</i> (great egret, white egret)			
33.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
34.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
35.	24610 <i>Ardeotis australis</i> (Australian Bustard)			
36.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
37.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
38.	24318 <i>Aythya australis</i> (Hardhead)			
39.	<i>Barnardius zonarius</i>			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
40.	24319	<i>Biziura lobata</i> (Musk Duck)			
41.	24345	<i>Botaurus poiciloptilus</i> (Australasian Bittern)		g	
42.	25714	<i>Cacatua pastinator</i> (Western Long-billed Corella)			
43.	25716	<i>Cacatua sanguinea</i> (Little Corella)			
44.	25598	<i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
45.	42307	<i>Cacomantis pallidus</i> (Pallid Cuckoo)			
46.	25717	<i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
47.	24731	<i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)		g	
48.	24733	<i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		g	
49.	24734	<i>Calyptorhynchus latirostris</i> (Camaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		g	
50.	48400	<i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)		g	
51.	24377	<i>Charadrius ruficapillus</i> (Red-capped Plover)			
52.	24321	<i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
53.		<i>Chroicocephalus novaehollandiae</i>			
54.		<i>Circus aeruginosus</i>			Y
55.	24288	<i>Circus approximans</i> (Swamp Harrier)			
56.	24774	<i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
57.	25675	<i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
58.	24399	<i>Columba livia</i> (Domestic Pigeon)	Y		
59.	25568	<i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
60.	25592	<i>Corvus coronoides</i> (Australian Raven)			
61.	24417	<i>Corvus coronoides</i> subsp. <i>perplexus</i> (Australian Raven)			
62.	24671	<i>Coturnix pectoralis</i> (Stubble Quail)			
63.	24420	<i>Cracticus nigrogularis</i> (Pied Butcherbird)			
64.	25595	<i>Cracticus tibicen</i> (Australian Magpie)			
65.		<i>Cracticus torquatus</i>			
66.	25596	<i>Cracticus torquatus</i> (Grey Butcherbird)			
67.	24322	<i>Cygnus atratus</i> (Black Swan)			
68.	30901	<i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
69.	25673	<i>Daphoenositta chrysoptera</i> (Varied Sittella)			
70.	25607	<i>Dicaeum hirundinaceum</i> (Mistletoebird)			
71.	24470	<i>Dromaius novaehollandiae</i> (Emu)			
72.		<i>Egretta garzetta</i>			
73.		<i>Egretta novaehollandiae</i>			
74.		<i>Elanus axillaris</i>			
75.	47937	<i>Elseya melanops</i> (Black-fronted Dotterel)			
76.		<i>Eolophus roseicapillus</i>			
77.	24652	<i>Eopsaltria georgiana</i> (White-breasted Robin)			
78.	24567	<i>Epthianura albifrons</i> (White-fronted Chat)			
79.	25621	<i>Falco berigora</i> (Brown Falcon)			
80.	25622	<i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
81.	25623	<i>Falco longipennis</i> (Australian Hobby)			
82.	25624	<i>Falco peregrinus</i> (Peregrine Falcon)		S	
83.	24616	<i>Falcunculus frontatus</i> subsp. <i>leucogaster</i> (Western Shrike-tit, Crested Shrike-tit)			
84.	25727	<i>Fulica atra</i> (Eurasian Coot)			
85.	24761	<i>Fulica atra</i> subsp. <i>australis</i> (Eurasian Coot)			
86.	25729	<i>Gallinula tenebrosa</i> (Dusky Moorhen)			
87.	24763	<i>Gallinula tenebrosa</i> subsp. <i>tenebrosa</i> (Dusky Moorhen)			
88.	25730	<i>Gallirallus philippensis</i> (Buff-banded Rail)			
89.	25530	<i>Gerygone fusca</i> (Western Gerygone)			
90.	24443	<i>Grallina cyanoleuca</i> (Magpie-lark)			
91.	24293	<i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
92.	24295	<i>Haliastur spheurnus</i> (Whistling Kite)			
93.	47965	<i>Hieraaetus morphnoides</i> (Little Eagle)			
94.	25734	<i>Himantopus himantopus</i> (Black-winged Stilt)			
95.	24491	<i>Hirundo neoxena</i> (Welcome Swallow)			
96.	24511	<i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
97.	25661	<i>Lichmera indistincta</i> (Brown Honeyeater)			
98.		<i>Lophoctinia isura</i>			
99.	24690	<i>Macronectes giganteus</i> (Southern Giant Petrel)		IA	
100.	24326	<i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
101.	25650	<i>Malurus elegans</i> (Red-winged Fairy-wren)			
102.	25654	<i>Malurus splendens</i> (Splendid Fairy-wren)			
103.	25758	<i>Megalurus gramineus</i> (Little Grassbird)			
104.	47997	<i>Melanodryas cucullata</i> (Hooded Robin)			
105.	24598	<i>Merops ornatus</i> (Rainbow Bee-eater)			
106.		<i>Microcarbo melanoleucos</i>			
107.	25610	<i>Myiagra inquieta</i> (Restless Flycatcher)			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
108.	24738	<i>Neophema elegans</i> (Elegant Parrot)			
109.	25564	<i>Nycticorax caledonicus</i> (Rufous Night Heron)			
110.	24407	<i>Ocyphaps lophotes</i> (Crested Pigeon)			
111.	24328	<i>Oxyura australis</i> (Blue-billed Duck)		P4	
112.	25680	<i>Pachycephala rufiventris</i> (Rufous Whistler)			
113.	24692	<i>Pachyptila belcheri</i> (Slender-billed Prion)			
114.	24693	<i>Pachyptila desolata</i> (Antarctic Prion)			
115.	48591	<i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
116.	25681	<i>Pardalotus punctatus</i> (Spotted Pardalote)			
117.	24626	<i>Pardalotus punctatus</i> subsp. <i>xanthopyge</i> (Yellow-rumped Pardalote)			
118.	25682	<i>Pardalotus striatus</i> (Striated Pardalote)			
119.	24648	<i>Pelecanus conspicillatus</i> (Australian Pelican)			
120.	48061	<i>Petrochelidon nigricans</i> (Tree Martin)			
121.	48066	<i>Petroica boodang</i> (Scarlet Robin)			
122.	24659	<i>Petroica goodenovii</i> (Red-capped Robin)			
123.	25697	<i>Phalacrocorax carbo</i> (Great Cormorant)			
124.	25698	<i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
125.	24667	<i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
126.	25699	<i>Phalacrocorax varius</i> (Pied Cormorant)			
127.	24409	<i>Phaps chalcoptera</i> (Common Bronzewing)			
128.	48071	<i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
129.	24596	<i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
130.	24841	<i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
131.	25720	<i>Platycercus icterotis</i> (Western Rosella)			
132.	24745	<i>Platycercus icterotis</i> subsp. <i>icterotis</i> (Western Rosella)			
133.	24747	<i>Platycercus spurius</i> (Red-capped Parrot)			
134.	24750	<i>Platycercus zonarius</i> subsp. <i>semitorquatus</i> (Twenty-eight Parrot)			
135.	24843	<i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
136.	25703	<i>Podargus strigoides</i> (Tawny Frogmouth)			
137.	24679	<i>Podargus strigoides</i> subsp. <i>brachypterus</i> (Tawny Frogmouth)			
138.	25704	<i>Podiceps cristatus</i> (Great Crested Grebe)			
139.	24681	<i>Poliiocephalus poliocephalus</i> (Hoary-headed Grebe)			
140.	25722	<i>Polytelis anthopeplus</i> (Regent Parrot)			
141.	25731	<i>Porphyrio porphyrio</i> (Purple Swamphen)			
142.	24767	<i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
143.	24703	<i>Pterodroma lessonii</i> (White-headed Petrel)			
144.		<i>Purpureicephalus spurius</i>			
145.	24776	<i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
146.	48096	<i>Rhipidura albiscapa</i> (Grey Fantail)			
147.	25614	<i>Rhipidura leucophrys</i> (Willie Wagtail)			
148.	25534	<i>Sericornis frontalis</i> (White-browed Scrubwren)			
149.	30948	<i>Smicromis brevirostris</i> (Weebill)			
150.	24645	<i>Stagonopleura oculata</i> (Red-eared Firetail)			
151.	24329	<i>Stictonetta naevosa</i> (Freckled Duck)			
152.	25655	<i>Stipiturus malachurus</i> (Southern Emu-wren)			
153.	25597	<i>Strepera versicolor</i> (Grey Currawong)			
154.	25590	<i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
155.	25705	<i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
156.	24682	<i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
157.	24331	<i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
158.	34134	<i>Thalassarche carteri</i> (Indian Yellow-nosed Albatross)		g	
159.	48597	<i>Thalasseus bergii</i> (Crested Tern)		IA	
160.	24845	<i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
161.	25549	<i>Todiramphus sanctus</i> (Sacred Kingfisher)			
162.	24808	<i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	
163.	48147	<i>Turnix varius</i> (Painted Button-quail)			
164.	24855	<i>Tyto novaehollandiae</i> subsp. <i>novaehollandiae</i> (Masked Owl (southwest))		P3	
165.	24386	<i>Vanellus tricolor</i> (Banded Lapwing)			
166.	25765	<i>Zosterops lateralis</i> (Grey-breasted White-eye, Silveryeye)			
ish					
167.		<i>Bostockia porosa</i>			
168.		<i>Carassius auratus</i>			
169.		<i>Echeneis naucrates</i>			
170.		<i>Edelia vittata</i>			
171.	34028	<i>Galaxias occidentalis</i> (Western Minnow)			
172.	34030	<i>Geotria australis</i> (Pouched Lamprey)		P3	
173.		<i>Nannoperca vittata</i>			

Invertebrate

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
174.	<i>Acariformes sp.</i>			
175.	<i>Aganippe raphiduca</i>			
176.	<i>Akamptogonus novarae</i>			
177.	<i>Allothreua maculata</i>			
178.	<i>Aname mainae</i>			
179.	<i>Aname tepperi</i>			
180.	<i>Ancylidae sp.</i>			
181.	<i>Anisops sp.</i>			
182.	<i>Antichiropus nanus</i>			
183.	<i>Antiporus occidentalis</i>			
184.	<i>Antiporus sp.</i>			
185.	<i>Arachnura higginsii</i>			
186.	<i>Araneus cyphoxis</i>			
187.	<i>Araneus senicaudatus</i>			
188.	<i>Argiope protensa</i>			
189.	<i>Arkys alticephala</i>			
190.	<i>Arkys walckenaeri</i>			
191.	<i>Arrenuridae sp.</i>			
192.	<i>Artoria flavimana</i>			
193.	<i>Artoriopsis expolita</i>			
194.	<i>Athericidae sp.</i>			
195.	<i>Aturidae sp.</i>			
196.	<i>Austracantha minax</i>			
197.	<i>Backobourkia brounii</i>			
198.	<i>Badumna insignis</i>			
199.	<i>Baetidae sp.</i>			
200.	<i>Baiami tegenarioides</i>			
201.	<i>Baiami volucripes</i>			
202.	<i>Berosus discolor</i>			
203.	<i>Berosus munitipennis</i>			
204.	47873 <i>Bertmainius opimus</i> (western pygmy trapdoor spider)		P3	
205.	<i>Botryocladus freemani</i>			
206.	<i>Caenidae sp.</i>			
207.	<i>Carabidae sp.</i>			
208.	<i>Ceinidae sp.</i>			
209.	<i>Celaenia excavata</i>			
210.	<i>Ceratopogonidae sp.</i>			
211.	<i>Cercophonius sulcatus</i>			
212.	<i>Cherax preissii</i>			
213.	<i>Cherax quinquecarinatus</i>			
214.	<i>Chironominae sp.</i>			
215.	<i>Chironomus aff. altermans</i> (V24) (CB)			
216.	<i>Chironomus tepperi</i>			
217.	<i>Clynotis severus</i>			
218.	<i>Coenagrionidae sp.</i>			
219.	<i>Copepoda sp.</i>			
220.	<i>Corixidae sp.</i>			
221.	<i>Cormocephalus hartmeyerii</i>			
222.	<i>Corynoneura sp.</i> (V49) (SAP)			
223.	<i>Cricotopus 'parbicinctus'</i>			
224.	<i>Cryptoerithus quobba</i>			
225.	<i>Culex (Culex) australicus</i>			
226.	<i>Culicidae sp.</i>			
227.	<i>Cyclosa trilobata</i>			
228.	<i>Dicrotendipes sp. A</i> (V47) (SAP)			
229.	<i>Dingosa serrata</i>			
230.	<i>Dugesidae sp.</i>			
231.	<i>Dytiscidae sp.</i>			
232.	<i>Ecnomidae sp.</i>			
233.	<i>Erigone prominens</i>			
234.	<i>Eriophora biapicata</i>			
235.	<i>Gomphidae sp.</i>			
236.	<i>Gripopterygidae sp.</i>			
237.	<i>Gyrinidae sp.</i>			
238.	<i>Harrisius sp.</i>			
239.	<i>Harrisius sp. B</i> (SFM)			
240.	<i>Helochares tenuistriatus</i>			
241.	<i>Helpis minitabunda</i>			
242.	<i>Hemicorduliidae sp.</i>			
243.	<i>Hydrobiosidae sp.</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
244.	<i>Hydrophilidae</i> sp.			
245.	<i>Hydropsychidae</i> sp.			
246.	<i>Hydroptilidae</i> sp.			
247.	<i>Hyriidae</i> sp.			
248.	48935 <i>Idiosoma sigillatum</i> (Swan Coastal Plain shield-backed trapdoor spider)		P3	
249.	<i>Insulodrilus bifidus</i>			
250.	<i>Isopeda leishmanni</i>			
251.	<i>Isopedella cana</i>			
252.	<i>Isopedella castanea</i>			
253.	<i>Kiefferulus intertinctus</i>			
254.	<i>Lampona brevipipes</i>			
255.	<i>Lampona cylindrata</i>			
256.	<i>Lampona punctigera</i>			
257.	<i>Lancetes lanceolatus</i>			
258.	<i>Latrodectus hasseltii</i>			
259.	<i>Leptoceridae</i> sp.			
260.	<i>Leptoperla australica</i>			
261.	<i>Leptophlebiid</i> genus S sp. AV1			
262.	<i>Leptophlebiidae</i> sp.			
263.	<i>Lestidae</i> sp.			
264.	<i>Libellulidae</i> sp.			
265.	<i>Limbodessus inornatus</i>			
266.	<i>Limnophyes vestitus</i> (V41)			
267.	<i>Limnoxenus zelandicus</i>			
268.	<i>Maratus pavonis</i>			
269.	<i>Megapodagrionidae</i> sp.			
270.	<i>Micronecta robusta</i>			
271.	<i>Microvelia</i> sp.			
272.	<i>Missulena granulosa</i>			
273.	<i>Missulena hoggi</i>			
274.	<i>Missulena occatoria</i>			
275.	<i>Mituliodon tarantulinus</i>			
276.	<i>Mitzoruga insularis</i>			
277.	<i>Nephila edulis</i>			
278.	<i>Newmanoperla exigua</i>			
279.	<i>Nicodamus mainae</i>			
280.	<i>Nousia</i> sp. AV16			
281.	<i>Nunciella aspera</i>			
282.	<i>Ocrisiona parmeliae</i>			
283.	<i>Oligochaeta</i> sp.			
284.	<i>Ommatoiulus moreletii</i>			
285.	<i>Opisthopora</i> sp.			
286.	<i>Orthocladinae</i> sp.			
287.	<i>Ostracoda</i> (unident.)			
288.	33989 <i>Pachysaga strobila</i> (Vasse <i>Pachysaga</i> (Busselton-Donnybrook), cricket)		P1	
289.	<i>Palaemonidae</i> sp.			
290.	<i>Paracymus spenceri</i>			
291.	<i>Parakiefferiella variegatus</i>			
292.	<i>Paralimnophyes pullulus</i> (V42)			
293.	<i>Paramelitidae</i> sp.			
294.	<i>Paramerina levidensis</i>			
295.	<i>Parastacidae</i> sp.			
296.	<i>Pentaneurini</i> genus V20			
297.	<i>Perthiidae</i> sp.			
298.	<i>Philopotamidae</i> sp.			
299.	<i>Pholcus phalangioides</i>			
300.	<i>Phreatoicidae</i> sp.			
301.	<i>Phreodrilidae</i> sp.			
302.	<i>Planorbidae</i> sp.			
303.	<i>Platorish gelorup</i>			
304.	<i>Platynectes decempunctatus</i> var <i>polygrammus</i>			
305.	<i>Platynectes</i> sp.			
306.	<i>Polypedium</i> nr. <i>convexum</i> (SAP)			
307.	<i>Polypedium watsoni</i>			
308.	<i>Pyrallidae</i> sp.			
309.	<i>Rhantus suturalis</i>			
310.	<i>Riethia</i> v5			
311.	<i>Scirtidae</i> sp.			
312.	<i>Scutigera indecisa</i>			
313.	<i>Simuliidae</i> sp.			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
314.	<i>Staphylinidae</i> sp.			
315.	<i>Sternopriscus browni</i>			
316.	<i>Sternopriscus</i> sp.			
317.	<i>Tabanidae</i> sp.			
318.	<i>Tamopsis distinguenda</i>			
319.	<i>Tanypodinae</i> sp.			
320.	<i>Tanytarsus</i> nr K5			
321.	<i>Tanytarsus palmatus</i>			
322.	<i>Tasmanicosa leuckartii</i>			
323.	<i>Telephlebiidae</i> sp.			
324.	<i>Tetragnatha demissa</i>			
325.	<i>Tipulidae</i> sp.			
326.	<i>Triplectides</i> sp. AV21 (SFM)			
327.	<i>Urodacus novaehollandiae</i>			
328.	<i>Uvarus pictipes</i>			
329.	<i>Veliidae</i> sp.			
330.	<i>Venator immansueta</i>			
331.	<i>Venatrix pullastra</i>			
332.	34113 <i>Westralunio carteri</i> (Carter's Freshwater Mussel)		g	
333.	<i>Zachria flavicoma</i>			

Mammal

334.	24088 <i>Antechinus flavipes</i> subsp. <i>leucogaster</i> (Yellow-footed Antechinus, Mardo)			
335.	24162 <i>Bettongia penicillata</i> subsp. <i>ogilbyi</i> (Woylie, Brush-tailed Bettong)		g	
336.	24251 <i>Bos taurus</i> (European Cattle)	Y		
337.	24072 <i>Caperea marginata</i> (Pygmy Right Whale)			
338.	24086 <i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)			
339.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattled Bat)			
340.	24187 <i>Chalinolobus morio</i> (Chocolate Wattled Bat)			
341.	24092 <i>Dasyurus geoffroyi</i> (Chuditch, Western Quoll)		g	
342.	24043 <i>Eubalaena australis</i> (Southern Right Whale)		g	
343.	24189 <i>Falsistrellus mackenziei</i> (Western False Pipistrelle, Western Falsistrelle)		P4	
344.	24056 <i>Grampus griseus</i> (Risso's Dolphin)			
345.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
346.	48588 <i>Isoodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
347.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
348.	24076 <i>Mesoplodon bowdoini</i> (Andrew's Beaked Whale)			
349.	24078 <i>Mesoplodon grayi</i> (Gray's Beaked Whale)			
350.	24213 <i>Mirounga leonina</i> (Southern Elephant Seal)			
351.	24223 <i>Mus musculus</i> (House Mouse)	Y		
352.	48022 <i>Notamacropus irma</i> (Western Brush Wallaby)		P4	
353.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
354.	25508 <i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)		S	
355.	48070 <i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		S	
356.	24166 <i>Pseudocheirus occidentalis</i> (Western Ringtail Possum, ngwayir)		g	
357.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
358.	24145 <i>Setonix brachyurus</i> (Quokka)		g	
359.	24111 <i>Sminthopsis gilberti</i> (Gilbert's Dunnart)			
360.	25521 <i>Trichosurus vulpecula</i> (Common Brushtail Possum)			
361.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
362.	30954 <i>Tursiops aduncus</i> (Indo-Pacific Bottlenose Dolphin)			
363.	24206 <i>Vespadelus regulus</i> (Southern Forest Bat)			

Reptile

364.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
365.	24990 <i>Aprasia pulchella</i> (Granite Worm-lizard)			
366.	25335 <i>Caretta caretta</i> (Loggerhead Turtle)		g	
367.	25336 <i>Chelonia mydas</i> (Green Turtle)		g	
368.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
369.	30893 <i>Cryptoblepharus buchananii</i>			
370.	25047 <i>Ctenotus impar</i>			
371.	25049 <i>Ctenotus labillardieri</i>			
372.	41641 <i>Ctenotus ora</i> (Coastal Plains Skink)		P3	
373.	25096 <i>Egernia kingii</i> (King's Skink)			
374.	25100 <i>Egernia napoleonis</i>			
375.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
376.	30919 <i>Hemiergis gracilipes</i> (skink)			
377.	25118 <i>Hemiergis peronii</i> subsp. <i>tridactyla</i>			
378.	25119 <i>Hemiergis quadrilineata</i>			
379.	25131 <i>Lerista distinguenda</i>			

	Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
380.	25133	<i>Lerista elegans</i>			
381.	25005	<i>Lialis burtonis</i>			
382.	42413	<i>Lissolepis luctuosa</i> (Western Swamp Skink)			
383.	25184	<i>Menetia greyii</i>			
384.	25191	<i>Morethia lineocellata</i>			
385.	25192	<i>Morethia obscura</i>			
386.	25252	<i>Notechis scutatus</i> (Tiger Snake)			
387.	25255	<i>Parasuta nigriceps</i>			
388.	25510	<i>Pogona minor</i> (Dwarf Bearded Dragon)			
389.	24907	<i>Pogona minor subsp. minor</i> (Dwarf Bearded Dragon)			
390.	25259	<i>Pseudonaja affinis subsp. affinis</i> (Dugite)			
391.	25266	<i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
392.	25519	<i>Tiliqua rugosa</i>			
393.	25207	<i>Tiliqua rugosa subsp. rugosa</i>			
394.	25218	<i>Varanus gouldii</i> (Bungarra or Sand Monitor)			

Conservation Codes

g Rare or likely to become extinct
g Presumed extinct
IA Protected under international agreement
S Other specially protected fauna
1 Priority 1
2 Priority 2
3 Priority 3
4 Priority 4
5 Priority 5

¹ For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created 08/03/19 14:42:56

[Summary](#)

[Details](#)

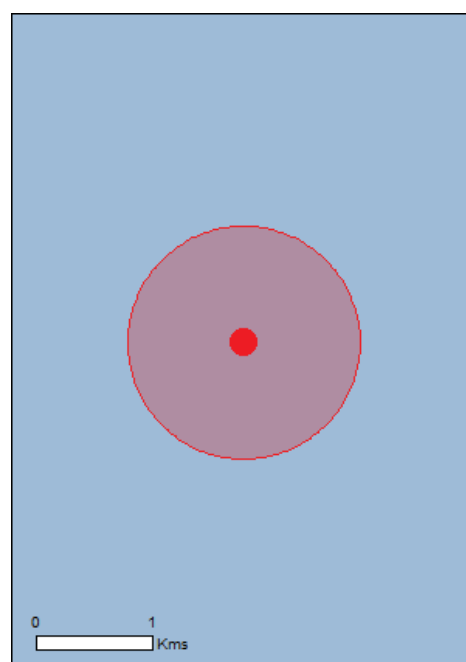
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

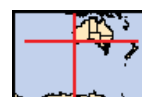
[Acknowledgements](#)



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[Coordinates](#)

Buffer 1.0 km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties	None
National Heritage Places	None
Wetlands of International Importance	None
Great Barrier Reef Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological Communities	1
Listed Threatened Species	21
Listed Migratory Species	9

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth heritage values of a Commonwealth heritage place. Information on the heritage values can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land	None
Commonwealth Heritage Places	None
Listed Marine Species	13
Whales and other Cetaceans	None
Critical Habitats	None
Commonwealth Reserves Terrestrial	None
Australian Marine Parks	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves	None
Regional Forest Agreements	1
Invasive Species	22
Nationally Important Wetlands	None
Key Ecological Features Marine	None

Details

Matters of National Environmental Significance

Threatened Ecological Communities

[Resource Information](#)

For threatened ecological communities here the distribution is given, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less given, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area

Threatened Species

[Resource Information](#)

Name	Status	Type of Presence
Birds		

[Calidris ferruginea](#)

Curlew Sandpiper 156	Critically Endangered	Species or species habitat may occur within area
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[Calyptorhynchus banksii naso](#)

Forest Redtailed BlackCockatoo, Galah 7034	Vulnerable	Species or species habitat likely to occur within area
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[Calyptorhynchus baudinii](#)

Baudin's Cockatoo, longbilled BlackCockatoo 769	Endangered	Breeding likely to occur within area
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[Calyptorhynchus latirostris](#)

Carnaby's Cockatoo, Shortbilled BlackCockatoo 9523	Endangered	Species or species habitat known to occur within area
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[Numenius madagascariensis](#)

Eastern Curlew, Far Eastern Curlew 47	Critically Endangered	Species or species habitat may occur within area
---------------------------------------	-----------------------	--

Mammals

[Dasyurus geoffroii](#)

Chuditch, Western quoll 30	Vulnerable	Species or species habitat likely to occur within area
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[Pseudocheirus occidentalis](#)

Western Ringtail Possum, Ngaiyur, Womp, Woder, Ngoor, Ngoolangit 5911	Critically Endangered	Species or species habitat known to occur within area
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Fish

[Westralunio carteri](#)

Carter's Freshwater Mussel, Freshwater Mussel 6266	Vulnerable	Species or species habitat known to occur within area
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Plants

[Banksia nivea subsp. uliginosa](#)

Swamp oneypot 2766	Endangered	Species or species habitat may occur within area
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[Banksia squarrosa subsp. argillacea](#)

Whiche Range Dryandra 2769	Vulnerable	Species or species habitat may occur within area
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Name	Status	type of Presence
Brachyscias verecundus Ironstone Brachyscias ♂1321g	Critically Endangered	Species or species habitat may occur g ithin area
Caladenia hoffmanii g offman's Spidergprchid ♂6719g	Endangered	Species or species habitat may occur g ithin area
Chamelaucium sp. S coastal plain gR.D.Royce 4872g Royce's Wagflog er ♂7814g	gulnerable	Species or species habitat may occur g ithin area
Drakaea micrantha Dg arf g ammergprchid ♂6755g	gulnerable	Species or species habitat may occur g ithin area
Eleocharis keigheryi geighery's Eleocharis ♂4893g	gulnerable	Species or species habitat may occur g ithin area
Gastrolobium papilio Butterflygeaved Gastrolobium ♂78415g	Endangered	Species or species habitat may occur g ithin area
gambertia echinata subsp. occidentalis Western Prickly g oneysuckle ♂4528g	Endangered	Species or species habitat may occur g ithin area
Sphenotoma drummondii Mountain Papergheath ♂1160g	Endangered	Species or species habitat may occur g ithin area
Synaphea sp. Fairbridge Farm gD. Papenfus 696g Selena's Synaphea ♂2881g	Critically Endangered	Species or species habitat may occur g ithin area
Synaphea sp. Serpentine gG.R. Brand 103g ♂6879g	Critically Endangered	Species or species habitat may occur g ithin area
Synaphea stenoloba Dg ellingup Synaphea ♂6311g	Endangered	Species or species habitat may occur g ithin area

gisted Migratory Species gResource Information g

gSpecies is listed under a different scientific name on the EPBC Act gghreatened Species list.

Name	ghreatened	gype of Presence
Migratory Marine Birds		

Apus pacificus Forkgtailed Sg ift ♂78g		Species or species habitat likely to occur g ithin area
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Migratory gerrestrial Species

Motacilla cinerea Grey Wagtail ♂42g		Species or species habitat may occur g ithin area
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Migratory Wetlands Species

Actitis hypoleucos Common Sandpiper ♂9309g		Species or species habitat may occur g ithin area
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Calidris acuminata Sharpgtailed Sandpiper ♂74g		Species or species habitat may occur g ithin area
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Calidris ferruginea Curleg Sandpiper ♂56g	Critically Endangered	Species or species habitat may occur g ithin area
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Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper 58g		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew 47g	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Bald Eagle 52g		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank 32g		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Threatened Marine Species	Threatened	Resource Information
Species is listed under a different scientific name on the EPBC Act Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper 309g		Species or species habitat may occur within area
Apus pacificus Forktailed Shearwater 78g		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret 541g		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret 542g		Species or species habitat may occur within area
Calidris acuminata Sharptailed Sandpiper 74g		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper 56g	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper 58g		Species or species habitat may occur within area
Haliaeetus leucogaster Whitebellied SeaEagle 43g		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater 70g		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail 42g		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew 47g	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Bald Eagle 52g		Species or species habitat may occur within area
Gringa nebularia Common Greenshank, Greenshank 32g		Species or species habitat likely to occur within area

Extra Information

Regional Forest Agreements [Resource Information](#)

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information](#)

Weeds reported here are the 20 species of national significance along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from the Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard 74g		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon 3g		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Gull, Laughing Dove 81g		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling 89g		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle 6g		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog 2654g		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat 19g		Species or species habitat likely to occur within area
Mus musculus House Mouse 20g		Species or species habitat likely to occur within area

Name	Status	type of Presence
<i>Lepus cuniculus</i> Rabbit, European Rabbit 128g		Species or species habitat likely to occur within area
<i>Rattus rattus</i> Black Rat, Ship Rat 14g		Species or species habitat likely to occur within area
<i>Sus scrofa</i> Pig 1g		Species or species habitat likely to occur within area
<i>Vulpes vulpes</i> Red Fox, Fox 18g		Species or species habitat likely to occur within area
Plants		
<i>Asparagus asparagoides</i> Bridal Creeper, Bridal veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus 2473g		Species or species habitat likely to occur within area
<i>Brachiaria mutica</i> Para Grass 879g		Species or species habitat may occur within area
<i>Cenchrus ciliaris</i> Buffelgrass, Black Buffelgrass 213g		Species or species habitat may occur within area
<i>Chrysanthemoides monilifera</i> Bitou Bush, Boneset 8983g		Species or species habitat may occur within area
<i>Genista linifolia</i> Flag-leaved Broom, Mediterranean Broom, Flag Broom 800g		Species or species habitat likely to occur within area
<i>Genista</i> sp. <i>Genista monspessulana</i> Broom 7538g		Species or species habitat may occur within area
<i>Ulex europaeus</i> Common gale, Common gale 160g		Species or species habitat may occur within area
<i>Pinus radiata</i> Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine 780g		Species or species habitat may occur within area
<i>Rubus fruticosus</i> aggregate Blackberry, European Blackberry 8406g		Species or species habitat likely to occur within area
<i>Salix</i> spp. except <i>S. babylonica</i> , <i>S. calodendron</i> <i>S. reichardtii</i> Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow 8497g		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National heritage properties, Wetlands of International and National Importance, Commonwealth and State territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (e.g. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat or environmental modelling (MAGENg or BIG CgIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short timeframe, maps are derived either from 0.04 or 0.02 decimal degree cells by an automated process using polygon capture techniques (static 100 kilometre grid cells, alpha hull and convex hull) or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100g or 250g map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

133.51841 115.74103

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

[Office of Environment and Heritage, New South Wales](#)
[Department of Environment and Primary Industries, Victoria](#)
[Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
[Department of Environment, Water and Natural Resources, South Australia](#)
[Department of Land and Resource Management, Northern Territory](#)
[Department of Environmental and Heritage Protection, Queensland](#)
[Department of Parks and Wildlife, Western Australia](#)
[Environment and Planning Directorate, ACT](#)
[Birdlife Australia](#)
[Australian Bird and Bat Banding Scheme](#)
[Australian National Wildlife Collection](#)
[Natural history museums of Australia](#)
[Museum Victoria](#)
[Australian Museum](#)
[South Australian Museum](#)
[Queensland Museum](#)
[Online Zoological Collections of Australian Museums](#)
[Queensland Herbarium](#)
[National Herbarium of NSW](#)
[Royal Botanic Gardens and National Herbarium of Victoria](#)
[Tasmanian Herbarium](#)
[State Herbarium of South Australia](#)
[Northern Territory Herbarium](#)
[Western Australian Herbarium](#)
[Australian National Herbarium, Canberra](#)
[University of New England](#)
[Ocean Biogeographic Information System](#)
[Australian Government, Department of Defence](#)
[Forestry Corporation, NSW](#)
[Geoscience Australia](#)
[CSIRO](#)
[Australian Tropical Herbarium, Cairns](#)
[Bird Australia](#)
[Australian Government Australian Antarctic Data Centre](#)
[Museum and Art Gallery of the Northern Territory](#)
[Australian Government National Environmental Science Program](#)
[Australian Institute of Marine Science](#)
[Reef Life Survey Australia](#)
[American Museum of Natural History](#)
[Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
[Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

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APPENDIX D

BLACK COCKATOO HABITAT TREE DETAILS

Habitat Trees

DBH >50cm

Datum - GDA94

Entrance Size Ranges - Small = >5cm, Medium = 5, 10cm, Large = >10cm

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt001	50H	383532	6290820	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt002	50H	383525	6290809	Marri	20+	>50	0		No Signs	No Signs	No	
wpt003	50H	383342	6290819	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt004	50H	383294	6290802	Marri	20+	>50	0		No Signs	No Signs	No	
wpt005	50H	383260	6290797	Marri	20+	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt006	50H	383185	6290812	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt007	50H	383129	6290813	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt008	50H	383120	6290814	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt009	50H	383105	6290804	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt010	50H	383048	6290812	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt011	50H	382830	6290809	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt012	50H	382822	6290787	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt013	50H	382826	6290789	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt014	50H	382803	6290796	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt015	50H	382793	6290785	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt016	50H	382778	6290802	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt017	50H	382765	6290801	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt018	50H	382750	6290795	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt019	50H	382742	6290756	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt020	50H	382751	6290746	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt021	50H	382746	6290733	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt022	50H	382768	6290741	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt023	50H	382761	6290745	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt024	50H	382774	6290733	Marri	10-15	>50	0		No Signs	No Signs	No	
wpt025	50H	382777	6290728	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt026	50H	382790	6290738	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt027	50H	382805	6290751	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt028	50H	382811	6290745	Dead Unknown	15-20	>50	0		No Signs	No Signs	No	
wpt029	50H	382814	6290746	Marri	15-20	>50	0		No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt030	50H	382819	6290739	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt031	50H	382840	6290737	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt032	50H	382838	6290770	Dead Unknown	5-10	>50	1	Medium	No Signs	No Signs	No	
wpt033	50H	382828	6290776	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt034	50H	382803	6290785	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt035	50H	382800	6290774	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt036	50H	382781	6290759	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt037	50H	382926	6290781	Marri	20+	>50	0		No Signs	No Signs	No	
wpt038	50H	383405	6290315	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt039	50H	382927	6290793	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt040	50H	382941	6290781	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt041	50H	382955	6290773	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt042	50H	382990	6290788	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt043	50H	382994	6290799	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt044	50H	383022	6290775	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt045	50H	383037	6290762	Jarrah	15-20	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	
wpt046	50H	383060	6290774	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt047	50H	383069	6290762	Jarrah	5-10	>50	0		No Signs	No Signs	No	
wpt048	50H	383109	6290784	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt049	50H	383113	6290751	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt050	50H	383134	6290737	Jarrah	15-20	>50	1	Medium	No Signs	No Signs	No	
wpt051	50H	383124	6290736	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt052	50H	383126	6290733	Marri	20+	>50	0		No Signs	No Signs	No	
wpt053	50H	383120	6290732	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt054	50H	383104	6290737	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt055	50H	383104	6290721	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt056	50H	383104	6290727	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt057	50H	383100	6290732	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt058	50H	383079	6290717	Marri	20+	>50	0		No Signs	No Signs	No	
wpt059	50H	383074	6290715	Marri	20+	>50	0		No Signs	No Signs	No	
wpt060	50H	383081	6290696	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt061	50H	383071	6290692	Marri	10-15	>50	0		No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt062	50H	383055	6290669	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt063	50H	383040	6290670	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt064	50H	383037	6290638	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt065	50H	383037	6290634	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt066	50H	383029	6290619	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt067	50H	383010	6290612	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt068	50H	382973	6290637	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt069	50H	382975	6290659	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt070	50H	382972	6290660	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt071	50H	382966	6290675	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt073	50H	382949	6290692	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt074	50H	382961	6290713	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt075	50H	382970	6290776	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt076	50H	383002	6290757	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt077	50H	383005	6290751	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt078	50H	383012	6290737	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt079	50H	383033	6290728	Marri	10-15	>50	2+	Medium	No Signs	No Signs	No	
wpt080	50H	383063	6290727	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt081	50H	383074	6290735	Jarrah	10-15	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt082	50H	383086	6290766	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt083	50H	383005	6290727	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt084	50H	383004	6290711	Marri	20+	>50	0		No Signs	No Signs	No	
wpt085	50H	382996	6290698	Jarrah	20+	>50	2+	Small	No Signs	No Signs	No	
wpt086	50H	382993	6290712	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt087	50H	382992	6290715	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt088	50H	382989	6290718	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt089	50H	382985	6290727	Jarrah	15-20	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Possible knot hole and spout branch
wpt090	50H	383279	6290747	Marri	20+	>50	0		No Signs	No Signs	No	
wpt091	50H	383289	6290746	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt092	50H	383296	6290721	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt093	50H	383293	6290711	Marri	20+	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt094	50H	383276	6290725	Jarrah	15-20	>50	2+	Medium-Large (cockatoo)	No Signs	No Signs	Yes	Possible knot hole - some signs of use?

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt095	50H	383265	6290683	Marri	15-20	>50	2+	Large (cockatoo)	No Signs	No Signs	Yes	Larh knot hole
wpt096	50H	383278	6290678	Dead Marri	15-20	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Possible large top opening hollow
wpt097	50H	383279	6290662	Jarra	15-20	>50	0		No Signs	No Signs	No	
wpt098	50H	383259	6290667	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt099	50H	383246	6290663	Jarra	15-20	>50	2+	Medium-Large (cockatoo)	No Signs	No Signs	Yes	Possible large spout
wpt100	50H	383255	6290650	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt101	50H	383253	6290633	Marri	20+	>50	0		No Signs	No Signs	No	
wpt102	50H	383253	6290622	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt103	50H	383251	6290621	Marri	20+	>50	0		No Signs	No Signs	No	
wpt104	50H	383238	6290621	Jarra	15-20	>50	1	Medium	No Signs	Rub marks	No	
wpt105	50H	383229	6290629	Jarra	15-20	>50	0		No Signs	No Signs	No	
wpt106	50H	383223	6290629	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt107	50H	383259	6290615	Marri	20+	>50	0		No Signs	No Signs	No	
wpt108	50H	383267	6290618	Jarra	15-20	>50	0		No Signs	No Signs	No	
wpt109	50H	383268	6290614	Marri	15-20	>50	1	Medium	No Signs	No Signs	No	
wpt110	50H	383275	6290610	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt111	50H	383319	6290608	Marri	20+	>50	0		No Signs	No Signs	No	
wpt112	50H	383348	6290606	Marri	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt113	50H	383361	6290598	Jarra	15-20	>50	0		No Signs	No Signs	No	
wpt114	50H	383360	6290589	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt115	50H	383373	6290594	Marri	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt116	50H	383381	6290600	Marri	20+	>50	0		No Signs	No Signs	No	
wpt117	50H	383390	6290605	Jarra	15-20	>50	0		No Signs	No Signs	No	
wpt118	50H	383400	6290612	Jarra	15-20	>50	0		No Signs	No Signs	No	
wpt119	50H	383397	6290593	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt120	50H	383423	6290584	Marri	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt121	50H	383414	6290607	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt122	50H	383474	6290601	Marri	20+	>50	0		No Signs	No Signs	No	
wpt123	50H	383476	6290614	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt124	50H	383479	6290622	Jarra	15-20	>50	0		No Signs	No Signs	No	
wpt125	50H	383475	6290638	Jarra	15-20	>50	0		No Signs	No Signs	No	
wpt126	50H	383487	6290632	Jarra	15-20	>50	0		No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt127	50H	383525	6290672	Marri	20+	>50	0		No Signs	No Signs	No	
wpt128	50H	383524	6290681	Marri	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt129	50H	383534	6290687	Dead Marri	15-20	>50	2+	Medium-Large (cockatoo)	No Signs	No Signs	Yes	
wpt130	50H	383532	6290691	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt131	50H	383545	6290699	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt132	50H	383543	6290706	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt133	50H	383536	6290715	Marri	20+	>50	0		No Signs	No Signs	No	
wpt134	50H	383518	6290703	Dead Jarrah	15-20	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt135	50H	383522	6290724	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt136	50H	383517	6290731	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt137	50H	383517	6290749	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt138	50H	383502	6290764	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt139	50H	383481	6290756	Marri	20+	>50	0		No Signs	No Signs	No	
wpt140	50H	383463	6290767	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt141	50H	383452	6290768	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt142	50H	383440	6290772	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt143	50H	383434	6290769	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt144	50H	383430	6290764	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt145	50H	383412	6290776	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt146	50H	383397	6290772	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt147	50H	383388	6290772	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt148	50H	383374	6290767	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt149	50H	383373	6290771	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt150	50H	383370	6290758	Marri	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt151	50H	383365	6290755	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt152	50H	383362	6290767	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt153	50H	383353	6290765	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt154	50H	383348	6290765	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt155	50H	383324	6290717	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt156	50H	383316	6290749	Jarraah	15-20	>50	0		No Signs	No Signs	No	
wpt157	50H	383329	6290685	Jarraah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt158	50H	383319	6290671	Marri	15-20	>50	0		No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt159	50H	383305	6290655	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt160	50H	383302	6290653	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt161	50H	383307	6290635	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt162	50H	383317	6290631	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt163	50H	383342	6290634	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt164	50H	383348	6290633	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt165	50H	383357	6290616	Dead Marri	20+	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	
wpt166	50H	383370	6290624	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt167	50H	383376	6290624	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt168	50H	383359	6290655	Jarrah	10-15	>50	0		No Signs	No Signs	No	
wpt169	50H	383384	6290636	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt170	50H	383390	6290631	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt171	50H	383410	6290640	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt172	50H	383419	6290641	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt173	50H	383422	6290637	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt174	50H	383425	6290642	Dead Marri	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt175	50H	383436	6290657	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt176	50H	383451	6290653	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt177	50H	383455	6290655	Dead Marri	15-20	>50	0		No Signs	No Signs	No	
wpt178	50H	383453	6290655	Jarrah	10-15	>50	0		No Signs	No Signs	No	
wpt179	50H	383458	6290670	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt180	50H	383472	6290664	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt181	50H	383480	6290654	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt182	50H	383469	6290678	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt183	50H	383492	6290683	Dead Unknown	10-15	>50	1	Medium-Large (cockatoo)	No Signs	No Signs	Yes	Possible large spout
wpt184	50H	383493	6290684	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt185	50H	383503	6290685	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt186	50H	383507	6290693	Marri	20+	>50	0		No Signs	No Signs	No	
wpt187	50H	383510	6290703	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt188	50H	383521	6290697	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt189	50H	383503	6290717	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt190	50H	383481	6290718	Jarrah	15-20	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Possible large top opening hollow

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt191	50H	383466	6290714	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt192	50H	383476	6290744	Marri	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt193	50H	383452	6290733	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt194	50H	383419	6290731	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt195	50H	383419	6290728	Marri	15-20	>50	1	Large (cockatoo)	No Signs	Rub marks	Yes	Possible large knot hole
wpt196	50H	383409	6290723	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt197	50H	383404	6290724	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt198	50H	383397	6290748	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt199	50H	383377	6290708	Marri	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt200	50H	383402	6290670	Dead Unknown	10-15	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt201	50H	383399	6290648	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt202	50H	383417	6290681	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt203	50H	383429	6290681	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt204	50H	383430	6290685	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt205	50H	383425	6290701	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt206	50H	383420	6290702	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt207	50H	383452	6290693	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt208	50H	383395	6290311	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt209	50H	383385	6290313	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt210	50H	383306	6290306	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt211	50H	383243	6290304	Dead Unknown	15-20	>50	0		No Signs	No Signs	No	
wpt212	50H	383233	6290304	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt213	50H	383219	6290320	Dead Unknown	15-20	>50	2+	Small	No Signs	No Signs	No	
wpt214	50H	383200	6290330	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt215	50H	383200	6290348	Jarrah	15-20	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Numerous possible large hollows
wpt216	50H	383166	6290337	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt217	50H	383163	6290325	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt218	50H	383142	6290316	Dead Marri	20+	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt219	50H	383124	6290328	Dead Unknown	15-20	>50	2+	Medium-Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt220	50H	383110	6290319	Dead Jarrah	15-20	>50	2+	Small	No Signs	No Signs	No	
wpt221	50H	383108	6290309	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt222	50H	383094	6290325	Marri	5-10	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout (~4m high)

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt223	50H	383091	6290324	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt224	50H	383083	6290307	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt225	50H	383081	6290308	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt226	50H	383070	6290339	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt227	50H	383061	6290335	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt228	50H	383056	6290329	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt229	50H	383037	6290325	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt230	50H	383024	6290308	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt231	50H	382999	6290328	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt232	50H	382986	6290312	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt233	50H	382955	6290304	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt234	50H	382951	6290302	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt235	50H	382914	6290302	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt236	50H	382900	6290315	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt237	50H	382872	6290309	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt238	50H	382819	6290308	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt239	50H	382814	6290310	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt240	50H	382800	6290317	Dead Jarrah	10-15	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Possible hollows in large branches
wpt241	50H	382798	6290317	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt242	50H	382771	6290339	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt243	50H	382780	6290338	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt244	50H	382813	6290349	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt245	50H	382819	6290362	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt246	50H	382831	6290350	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt247	50H	382830	6290337	Marri	5-10	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt248	50H	382848	6290337	Jarrah	15-20	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt249	50H	382856	6290361	Marri	5-10	>50	1	Medium	No Signs	No Signs	No	
wpt250	50H	382919	6290342	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt251	50H	382890	6290378	Dead Unknown	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt252	50H	382908	6290388	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt253	50H	382881	6290382	Dead Unknown	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt254	50H	382892	6290391	Dead Unknown	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt255	50H	382882	6290399	Jarrah	10-15	>50	0		No Signs	No Signs	No	
wpt256	50H	382906	6290414	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt257	50H	382894	6290431	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt258	50H	382886	6290483	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt259	50H	382901	6290504	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt260	50H	382953	6290514	Dead Unknown	0-5	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt261	50H	382951	6290579	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt262	50H	382944	6290584	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt263	50H	382970	6290594	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt264	50H	382990	6290602	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt265	50H	382998	6290597	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt266	50H	383009	6290589	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt267	50H	382989	6290571	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt268	50H	382997	6290561	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt269	50H	382981	6290519	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt270	50H	382981	6290519	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt271	50H	382978	6290519	Jarrah	15-20	>50	1	Medium	No Signs	No Signs	No	
wpt272	50H	382977	6290512	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt273	50H	382973	6290509	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt274	50H	382986	6290479	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt275	50H	383002	6290469	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt276	50H	383006	6290468	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt277	50H	383005	6290440	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt278	50H	383033	6290438	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt279	50H	383061	6290432	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt280	50H	383021	6290422	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt281	50H	383032	6290387	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt282	50H	383026	6290375	Jarrah	15-20	>50	2+	Small	No Signs	No Signs	No	
wpt283	50H	383038	6290378	Jarrah	15-20	>50	2+	Small	No Signs	No Signs	No	
wpt284	50H	383032	6290345	Jarrah	15-20	>50	2+	Small	No Signs	No Signs	No	
wpt285	50H	383025	6290350	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt286	50H	383022	6290350	Jarrah	15-20	>50	2+	Small	No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt287	50H	382997	6290349	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt288	50H	383000	6290366	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt289	50H	382982	6290342	Dead Unknown	15-20	>50	2+	Small	No Signs	No Signs	No	
wpt290	50H	382964	6290347	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt291	50H	382936	6290414	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt292	50H	382931	6290418	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt293	50H	382936	6290418	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt294	50H	382926	6290433	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt295	50H	382938	6290448	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt296	50H	382949	6290438	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt297	50H	382929	6290460	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt298	50H	382931	6290473	Jarrah	15-20	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt299	50H	382982	6290448	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt300	50H	382985	6290455	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt301	50H	382972	6290441	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt302	50H	382970	6290432	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt303	50H	382972	6290407	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt304	50H	382964	6290390	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt305	50H	382999	6290401	Jarrah	0-5	>50	0		No Signs	No Signs	No	
wpt306	50H	383056	6290408	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt307	50H	383062	6290418	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt308	50H	383071	6290408	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt309	50H	383097	6290418	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt310	50H	383106	6290447	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt311	50H	383099	6290462	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt312	50H	383089	6290497	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt313	50H	383099	6290500	Jarrah	15-20	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt314	50H	383106	6290498	Marri	20+	>50	0		No Signs	No Signs	No	
wpt315	50H	383120	6290491	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt316	50H	383115	6290511	Jarrah	15-20	>50	2+	Small	No Signs	No Signs	No	
wpt317	50H	383167	6290516	Jarrah	20+	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Possible large fissure
wpt318	50H	383172	6290501	Jarrah	20+	>50	2+	Small-Medium	No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt319	50H	383171	6290531	Jarrah	15-20	>50	2+	Small	No Signs	No Signs	No	
wpt320	50H	383197	6290539	Dead Unknown	0-5	>50	0		No Signs	No Signs	No	
wpt321	50H	383205	6290547	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt322	50H	383196	6290579	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt323	50H	383214	6290586	Marri	20+	>50	0		No Signs	No Signs	No	
wpt324	50H	383207	6290564	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt325	50H	383209	6290542	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt326	50H	383216	6290554	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt327	50H	383227	6290553	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt328	50H	383216	6290536	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt329	50H	383224	6290524	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt330	50H	383208	6290518	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt331	50H	383228	6290498	Marri	20+	>50	0		No Signs	No Signs	No	
wpt332	50H	383211	6290494	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt333	50H	383211	6290480	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt334	50H	383204	6290473	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt335	50H	383199	6290457	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt336	50H	383215	6290455	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt337	50H	383211	6290439	Marri	5-10	>50	0		No Signs	No Signs	No	
wpt338	50H	383212	6290412	Marri	20+	>50	0		No Signs	No Signs	No	
wpt339	50H	383227	6290381	Marri	20+	>50	0		No Signs	No Signs	No	
wpt340	50H	383190	6290364	Marri	20+	>50	0		No Signs	No Signs	No	
wpt341	50H	383175	6290378	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt342	50H	383173	6290382	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt343	50H	383171	6290389	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt344	50H	383161	6290369	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt345	50H	383133	6290350	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt346	50H	383101	6290346	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt347	50H	383084	6290370	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt348	50H	383140	6290393	Marri	20+	>50	0		No Signs	No Signs	No	
wpt349	50H	383146	6290407	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt350	50H	383160	6290415	Marri	15-20	>50	0		No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt351	50H	383142	6290444	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt352	50H	383126	6290469	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt353	50H	383129	6290477	Jarrah	5-10	>50	1	Medium	No Signs	No Signs	No	
wpt354	50H	383129	6290488	Dead Unknown	5-10	>50	1	Medium	No Signs	No Signs	No	
wpt355	50H	383179	6290484	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt356	50H	383193	6290490	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt357	50H	383186	6290528	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt358	50H	383190	6290447	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt359	50H	383181	6290427	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt360	50H	383195	6290416	Marri	15-20	>50	1	Medium	No Signs	No Signs	No	
wpt361	50H	383184	6290408	Dead Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt362	50H	383193	6290384	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt363	50H	383237	6290480	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt364	50H	383260	6290494	Marri	20+	>50	0		No Signs	No Signs	No	
wpt365	50H	383265	6290498	Marri	15-20	>50	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt366	50H	383249	6290523	Marri	20+	>50	0		No Signs	No Signs	No	
wpt367	50H	383265	6290554	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt368	50H	383270	6290554	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt369	50H	383267	6290475	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt370	50H	383276	6290464	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt371	50H	383262	6290440	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt372	50H	383275	6290434	Marri	20+	>50	0		No Signs	No Signs	No	
wpt373	50H	383253	6290405	Jarrah	20+	>50	2+	Small-Medium	No Signs	No Signs	No	
wpt374	50H	383240	6290398	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt375	50H	383232	6290389	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt376	50H	383241	6290370	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt377	50H	383250	6290339	Jarrah	15-20	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt378	50H	383269	6290353	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt379	50H	383272	6290342	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt380	50H	383268	6290342	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt381	50H	383262	6290333	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt382	50H	383278	6290354	Jarrah	15-20	>50	0		No Signs	No Signs	No	

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt383	50H	383289	6290346	Marri	10-15	>50	0		No Signs	No Signs	No	
wpt384	50H	383303	6290328	Jarrah	5-10	>50	1	Large (cockatoo)	No Signs	No Signs	Yes	Possible spout
wpt385	50H	383312	6290326	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt386	50H	383316	6290336	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt387	50H	383328	6290339	Marri	20+	>50	0		No Signs	No Signs	No	
wpt388	50H	383356	6290328	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt389	50H	383354	6290324	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt390	50H	383351	6290343	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt391	50H	383383	6290347	Marri	20+	>50	0		No Signs	No Signs	No	
wpt392	50H	383386	6290344	Marri	20+	>50	0		No Signs	No Signs	No	
wpt393	50H	383383	6290332	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt394	50H	383389	6290328	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt395	50H	383405	6290325	Marri	20+	>50	0		No Signs	No Signs	No	
wpt396	50H	383459	6290421	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt397	50H	383461	6290427	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt398	50H	383458	6290429	Marri	20+	>50	0		No Signs	No Signs	No	
wpt399	50H	383452	6290446	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt400	50H	383437	6290459	Marri	15-20	>50	0		No Signs	No Signs	No	
wpt401	50H	383462	6290467	Marri	20+	>50	0		No Signs	No Signs	No	
wpt402	50H	383468	6290468	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt403	50H	383466	6290445	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt404	50H	383476	6290441	Jarrah	20+	>50	0		No Signs	No Signs	No	
wpt405	50H	383474	6290425	Jarrah	15-20	>50	0		No Signs	No Signs	No	
wpt406	50H	383487	6290431	Dead Unknown	15-20	>50	2+	Small	No Signs	No Signs	No	

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APPENDIX 4: HERITAGE SEARCH

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No Aboriginal Cultural Heritage (ACH) Register in Custom search area - Polygon - 115.734472636272°E, 33.5158407216949°S (GDA94) : 115.746006135035°E, 33.5158765016346°S (GDA94) : 115.747840766001°E, 33.5204114891763°S (GDA94) : 115.734418992092°E, 33.5204562117354°S (GDA94) : 115.734483365108°E, 33.5158317767077°S (GDA94) : 115.734472636272°E, 33.5158407216949°S (GDA94)

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All Aboriginal cultural heritage in Western Australia is protected, whether or not the ACH has been reported or exists on the Register.

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Your heritage enquiry is on land **within or adjacent to** the following Indigenous Land Use Agreement(s): Gnaala Karla Booja Indigenous Land Use Agreement.

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The ILUAs bind the parties (including 'the State', which encompasses all State Government Departments and certain State Government agencies) to enter into a Noongar Standard Heritage Agreement (NSHA) when conducting Aboriginal Heritage Surveys in the ILUA areas, unless they have an existing heritage agreement. It is also intended that other State agencies and instrumentalities enter into the NSHA when conducting Aboriginal Heritage Surveys in the ILUA areas. It is recommended a NSHA is entered into, and an 'Activity Notice' issued under the NSHA, if there is a risk that an activity will 'impact' (i.e. by excavating, damaging, destroying or altering in any way) an Aboriginal heritage site. The Aboriginal Heritage Due Diligence Guidelines, which are referenced by the NSHA, provide guidance on how to assess the potential risk to Aboriginal heritage.

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If you are a State Government Department, Agency or Instrumentality, or have a heritage condition placed on your mineral or petroleum title by DEMIRS, you should seek advice as to the requirement to use the NSHA for your proposed activity. The full ILUA documents, maps of the ILUA areas and the NSHA template can be found at <https://www.wa.gov.au/organisation/departments/departments-of-the-premier-and-cabinet/south-west-native-title-settlement>.

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Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Register

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Aboriginal Cultural Heritage Inquiry System

Map of Aboriginal Cultural Heritage (ACH) Historic

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APPENDIX 5: NOISE ASSESSMENT

Environmental Noise Assessment

**Gravel Pit Expansion
Lot 287 South Western Highway**

Reference: 18114706-01C

**Prepared for:
MGM c/- MBS Environmental**

Report: 18114706-01C

Lloyd George Acoustics Pty Ltd

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Date:	Rev	Description	Prepared By	Verified
24-Jan-19	-	Issued to Client	Olivier Mallié	Terry George
25-Feb-19	1	Minor edits	Olivier Mallié	-
21-Jul-21	2	Included Eastern pit area	Daniel Lloyd	-
19-Apr-22	B	Pit extents changed	Daniel Lloyd	-
20-Apr-22	C	Minor text change	Terry George	-

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Appendices

A	Terminology
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1 INTRODUCTION

It is proposed to expand the existing gravel pit located at Lot 287 South Western Highway, Gwindinup (Shire of Capel). *Figure 1-1* shows the location of the site as well as the lot boundary, the existing pit and potential expansion footprint, and the closest receivers (referred to as R1 to R4).

The existing operations consist of gravel extraction and crushing on-site, with the crushing plant located in the south-west corner of the existing pit. Product is understood to be hauled off-site using up to 65 trucks per day accessing the site via Lowrie Road, and entering the site from the north-west corner. The site is noted to operate only during daytime hours Monday to Saturday (excluding public holidays).

This report presents the assessment of the noise emissions from gravel extraction within the potential expansion, including gravel crushing, against the allowable levels of the *Environmental Protection (Noise) Regulations 1997*. Noise emissions associated with the loading and haulage of product is not considered in this assessment as there are no changes to these activities as part of the potential expansion.

Appendix A contains a description of some of the terminology used throughout this report.

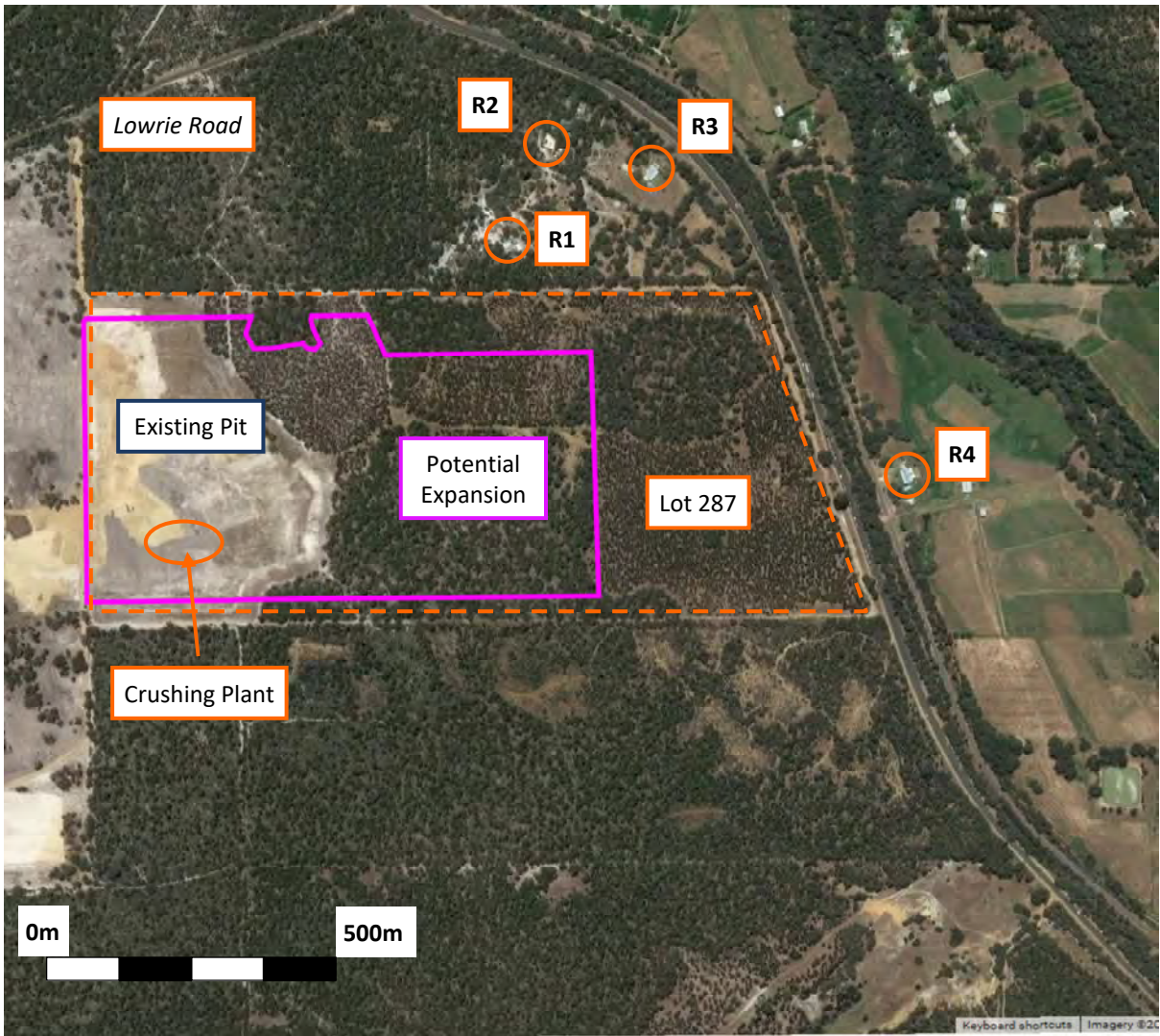


Figure 1-1 Project Locality and Closest Receivers

2 CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection Act 1986*, through the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

Regulation 7 defines the prescribed standard for noise emissions as follows:

“7. (1) Noise emitted from any premises or public place when received at other premises –

- (a) Must not cause or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and
- (b) Must be free of –
 - i. tonality;
 - ii. impulsiveness; and
 - iii. modulation,

when assessed under regulation 9”

A “...noise emission is taken to significantly contribute to a level of noise if the noise emission ... exceeds a value which is 5 dB below the assigned level...”

Tonality, impulsiveness and modulation are defined in Regulation 9. Noise is to be taken to be free of these characteristics if:

- (a) The characteristics cannot be reasonably and practicably removed by techniques other than attenuating the overall level of noise emission; and
- (b) The noise emission complies with the standard prescribed under regulation 7 after the adjustments of *Table 2-1* are made to the noise emission as measured at the point of reception.

Table 2-1 Adjustments Where Characteristics Cannot Be Removed

Where Noise Emission is Not Music			Where Noise Emission is Music	
Tonality	Modulation	Impulsiveness	No Impulsiveness	Impulsiveness
+ 5 dB	+ 5 dB	+ 10 dB	+ 10 dB	+ 15 dB

Note: The above are cumulative to a maximum of 15dB.

The baseline assigned levels (prescribed standards) are specified in Regulation 8 and are shown in *Table 2-2*.

Table 2-2 Baseline Assigned Noise Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L _{A10}	L _{A1}	L _{Amax}
Noise sensitive premises: highly sensitive area ¹	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80

1. **highly sensitive area** means that area (if any) of noise sensitive premises comprising —
- (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
 - (b) any other part of the premises within 15 metres of that building or that part of the building.

The closest sensitive receivers are located to the north and east of Lot 287. Lot 287 is zoned rural and the land surrounding the receivers is zoned rural or rural/residential. No significant commercial or industrial land uses were found within 450 metres of the receivers. However, it is noted that with the potential expansion, the excavation area will be located within 450 metres of the closest receivers (R1 to R3). As this area will be considered an industrial land use, the influencing factor therefore increases at these receivers due to the expansion.

In addition, South Western Highway is considered a secondary road given it carries more than 6,000 vehicles per day (Main Roads WA traffic 2017/18 count at site 15058, south of Bendall Road). As such, the influencing factor for sensitive receivers within 100 metres of the Highway will increase by 2 dB. It is noted this road also carries approximately 18% heavy vehicles.

The **existing and future** influencing factor applicable at each noise sensitive premises were determined as shown in *Table 2-3*. In the case of the 'highly sensitive area', the assigned noise levels apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces, but within 15 metres of the residence. However, it must be noted that assigned noise levels also apply at the boundary between the lots i.e. 'area other than highly sensitive'.

Table 2-3 Influencing Factor Calculation

Description	Within 100 metre Radius	Within 450 metre Radius	Total
Existing Scenario			
Industrial Land	R1 to R4 – 0 %	R1 to R4 – 0 %	R1 to R4 – 0 dB
Commercial Land	R1 to R4 – 0 %	R1 to R4 – 0 %	R1 to R4 – 0 dB
Transport Factor, R1 and R2			R1 and R2 – 0 dB R3 and R4 – 2 dB
Total			R1 and R2 – 0 dB R3 and R4 – 2 dB
Future Scenario (at full expansion)			
Industrial Land	R1 to R4 – 0 to 5 %	R1 – 25 % R2 and R3 – 20 % R4 – 0 %	R1 to R3 – 2 dB R4 – 0 dB
Commercial Land	R1 to R4 – 0 %	R1 to R4 – 0 %	R1 to R4 – 0 dB
Transport Factor, R1 and R2			R1 and R2 – 0 dB R3 and R4 – 2 dB
Total			R1 and R2 – 2 dB R3 – 4 dB R4 – 2 dB

Given the nature and proposed hours of operations, only the **daytime L_{A10} assigned noise level** is considered applicable. *Table 2-4* shows the assigned noise levels including the influencing factor and transport factor at each of the receiving locations.

Table 2-4 Assigned Noise Levels

Time Period	Receiver Highly Sensitive Area ¹	Assigned Level (dB)	
		Existing	Future
0700 to 1900 hours Monday to Saturday (Day)	R1	45 dB L_{A10}	47 dB L_{A10}
	R2	45 dB L_{A10}	47 dB L_{A10}
	R3	45 dB L_{A10}	49 dB L_{A10}
	R4	45 dB L_{A10}	47 dB L_{A10}
All hours	Lot Boundaries	60 dB L_{A10}	60 dB L_{A10}

1. **highly sensitive area** means that area (if any) of noise sensitive premises comprising —
- (a) a building, or a part of a building, on the premises that is used for a noise sensitive purpose; and
 - (b) any other part of the premises within 15 metres of that building or that part of the building.

As the assigned noise levels are statistical levels and therefore the period over which they are determined is important. The Regulations define the Representative Assessment Period (RAP) as *a period of time of not less than 15 minutes, and not exceeding 4 hours*, which is determined by an *inspector or authorised person* to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission. An *inspector or authorised person* is a person appointed under Sections 87 & 88 of the *Environmental Protection Act 1986* and include Local Government Environmental Health Officers and Officers from the Department of Environment Regulation. Acoustic consultants or other environmental consultants are not appointed as an *inspector or authorised person*. Therefore, whilst this assessment is based on a 4 hour RAP, which is assumed to be appropriate given the nature of the operations, this is to be used for guidance only.

2.1 Reversing Alarms on Mobile Plant

With regards to noise from reversing alarms, regulation 3(1)(h) states:

- (1) *Nothing in these regulations applies to the following noise emissions —*
- (h) *noise emissions from —*
- (i) *a reversing alarm fitted to a motor vehicle, mobile plant, or mining or earthmoving equipment;*
 - If -
 - (iii) *it is a requirement under another written law that such an alarm be fitted; and*
 - (iv) *it is not practicable to fit an alarm that complies with the written law under which it is required to be fitted and emits noise that complies with these regulations;*

It is considered that any reversing alarms fitted to the mobile plant and transport trucks are not necessarily exempt under the Regulations, since they are not specifically required under another written law.

The commonly used fixed noise output tonal reversing alarms also known as 'reversing beeper' emit, by their very nature, tonal and modulating noise at high levels. As such, this type of reversing alarm generally cannot comply with the Regulations even at distant receivers. Alternative alarms such as broadband alarms are commonly used to minimise the impact.

3 METHODOLOGY

Computer modelling has been used to predict noise levels at each nearby receiver. The advantage of modelling is that it is not affected by background noise sources and can provide the noise level for various weather conditions and operating scenarios.

The software used was *SoundPLAN 8.2* with the CONCAWE algorithms incorporating the ISO 171534-3 improved method selected. These algorithms have been selected as they include the influence of wind and atmospheric stability. Input data required in the model are:

- Meteorological Information;
- Topographical data;
- Ground Absorption; and
- Source sound power levels.

3.1 Meteorological Information

Meteorological information utilised is provided in *Table 3-1* and is considered to represent worst-case conditions for noise propagation. At wind speeds greater than those shown, sound propagation may be further enhanced, however background noise from the wind itself and from local vegetation is likely to be elevated and dominate the ambient noise levels.

Table 3-1 Modelling Meteorological Conditions

Parameter	Day (0700-1900)
Temperature (°C)	20
Humidity (%)	50
Wind Speed (m/s)	4
Wind Direction*	All
Pasquil Stability Factor	E

* Note that the modelling package used allows for all wind directions to be modelled simultaneously.

It is generally considered that compliance with the assigned noise levels needs to be demonstrated for 98% of the time, during the day and night periods, for the month of the year in which the worst-case weather conditions prevail. In most cases, the above conditions occur for more than 2% of the time and therefore must be satisfied.

3.2 Topographical Data

Topographical data for the natural ground surface was provided by the project in the form of 1 metre contour lines and also sourced from *GoogleEarth* in the form of spot heights. It is noted the land is undulating and slopes up in an eastward direction.

The existing pit was taken to be 2.5 metres deep.

3.3 Ground Absorption

Ground absorption varies from a value of 0 to 1, with 0 being for an acoustically reflective ground (e.g. water or bitumen) and 1 for acoustically absorbent ground (e.g. grass). In this instance, a value of 0.5 (mix of sand and gravel, wet soil) has been used as an average across the study area.

3.4 Source Sound Levels

The sound power levels used in the modelling are provided in *Table 3-2*.

Table 3-2 Source Sound Power Levels

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	31.5	63	125	250	500	1k	2k	4k	
Impact Crusher (Terex Finlay I-130)	110	120	117	111	112	109	106	101	114
Supertrak (Terex Finlay 693+)	108	107	107	106	108	106	102	99	110
Stacker (Terex Finlay 632)	94	95	93	94	88	93	90	78	96
CAT D9 Dozer ripping	108	112	117	115	106	107	103	98	112
CAT 980 Front End Loader	112	114	105	99	109	109	105	99	112
CAT 972 Front End Loader	110	112	103	97	107	107	103	97	110

The overall noise levels for the fixed plant (e.g. crusher, screen and the stacker) were taken from the previous noise study conducted by others (Herring Storer Acoustics, reference 15336-1-12146) for consistency, noting these are within the range of noise levels used by Lloyd George Acoustics. Spectral information were derived from data already on file for similar equipment.

With regard to the mobile plant e.g. CAT 980 FEL and CAT D9 dozer, the source sound levels were based on data already on file and vendor information.

In addition to the above, the following is noted in regard to each source:

- The sound power levels represent L_{10} source levels for normal operation; and
- All equipment were modelled as a point source located 2 metres above local ground/pit floor.

4 RESULTS

As there is an existing pit, excavation operations within the expansion area were assumed to start from the existing pit floor and progress in an eastward/northward direction towards receiver R1. The noise emissions from excavation operations in the future area were predicted based on the following assumptions:

- Excavation starts at an average depth of 1.5 metres pit depth from natural ground level, and progresses towards receiver R1. As such mobile plant (e.g. FEL or dozer) is considered to always operate from behind a pit face;
- The front end loader is used to excavate product and cart it to the crusher stockpile;
- The D9 dozer is used occasionally to break / rip gravel or harder soil;
- The fixed plant e.g. crusher, screen and stacker operate while excavation operations are occurring; and
- The fixed plant is located at its current location in the south-western part of the existing pit and remains there or is moved further away from the noise sensitive receivers.

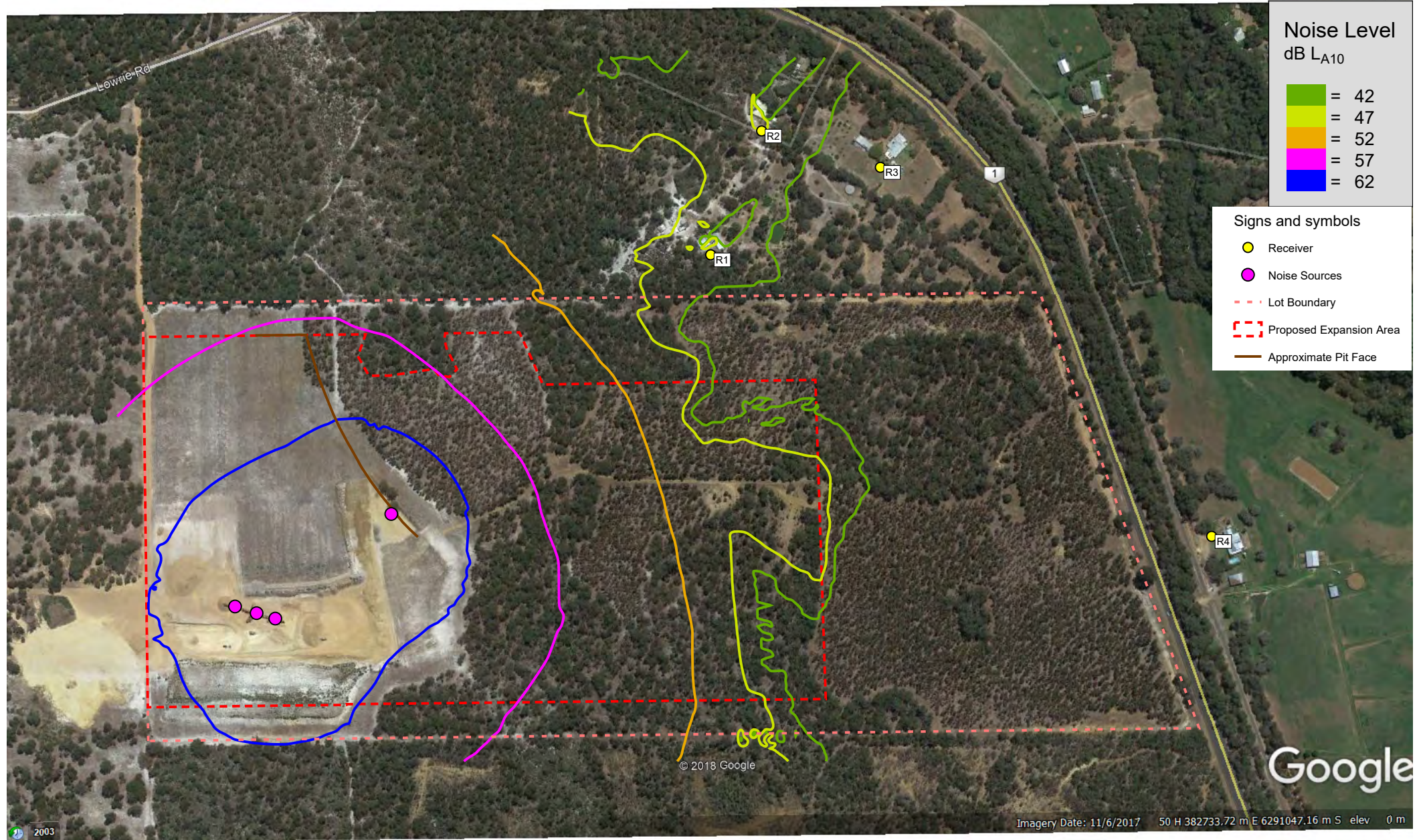
The noise emissions were predicted for various stages of expansion, starting from the existing pit and as excavation operations approach receiver R1 from the west/south. The results of the noise modelling are presented in *Table 4-1* with the noise contribution from the mobile plant alone also shown. *Figures 4-1 to 4-5* also show the predicted noise levels as noise contour maps at ground level as well as the location of each receiver.

Table 4-1 Predicted Noise Levels, dB LA10

Receiver	Excavation Within Existing Pit Approx. 500 m from R1		Excavation Approx. 250 m from R1		Excavation Approx. 200 m from R1		Excavation Approx. 150 m from R1		Excavation At Eastern Extents	
	Overall	Mobile	Overall	Mobile	Overall	Mobile	Overall	Mobile	Overall	Mobile
R1	44	43	54	54	56	56	58	58	59	59
R2	47	42	54	52	54	54	55	54	54	53
R3	40	38	50	50	50	50	53	53	55	54
R4	25	17	28	26	34	34	36	36	45	45

It can be seen from the above that receivers R1 to R3 are potentially the most affected by excavation operations.

Figure 4-1



Length Scale 1:6000

0 30 60 120 180 m

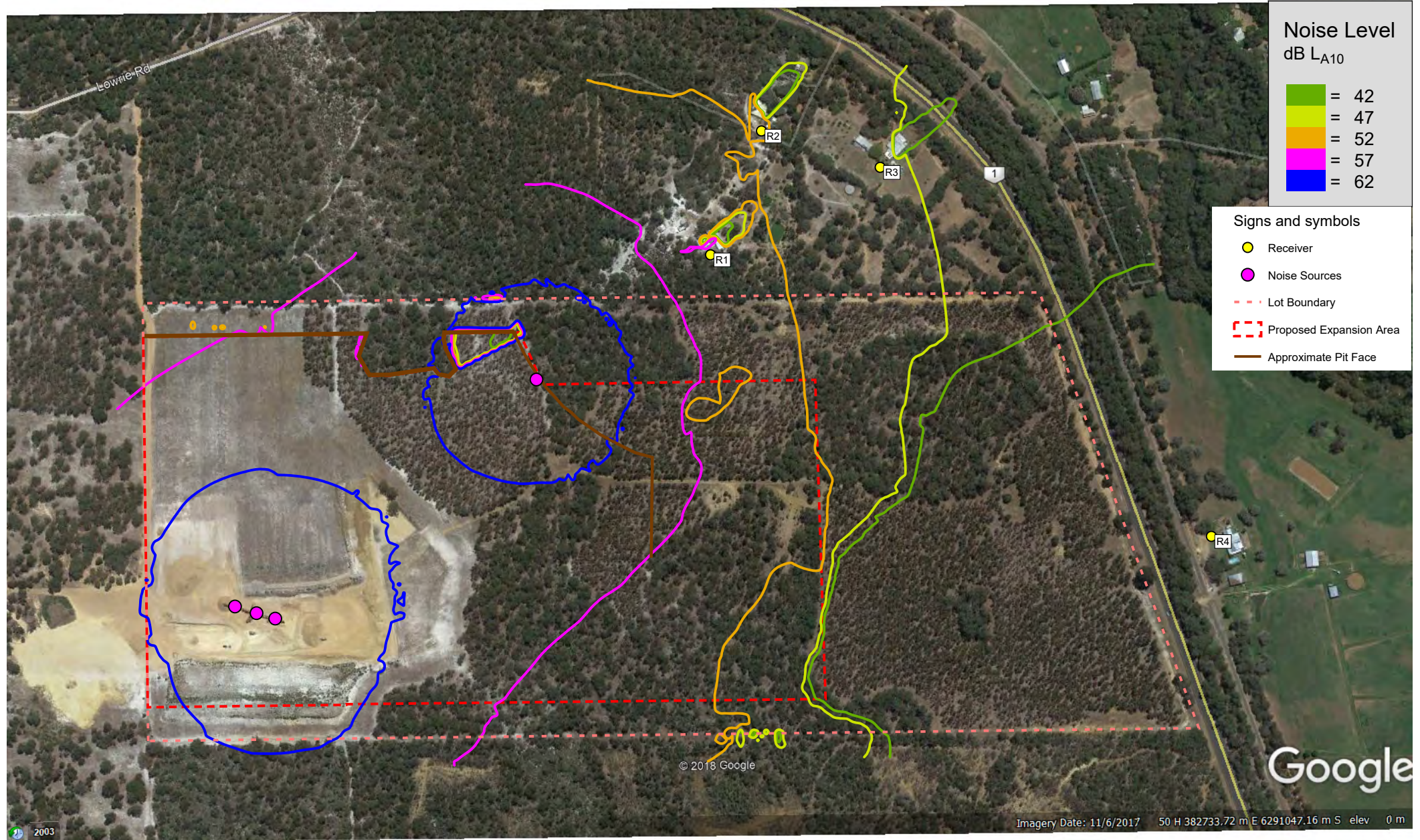


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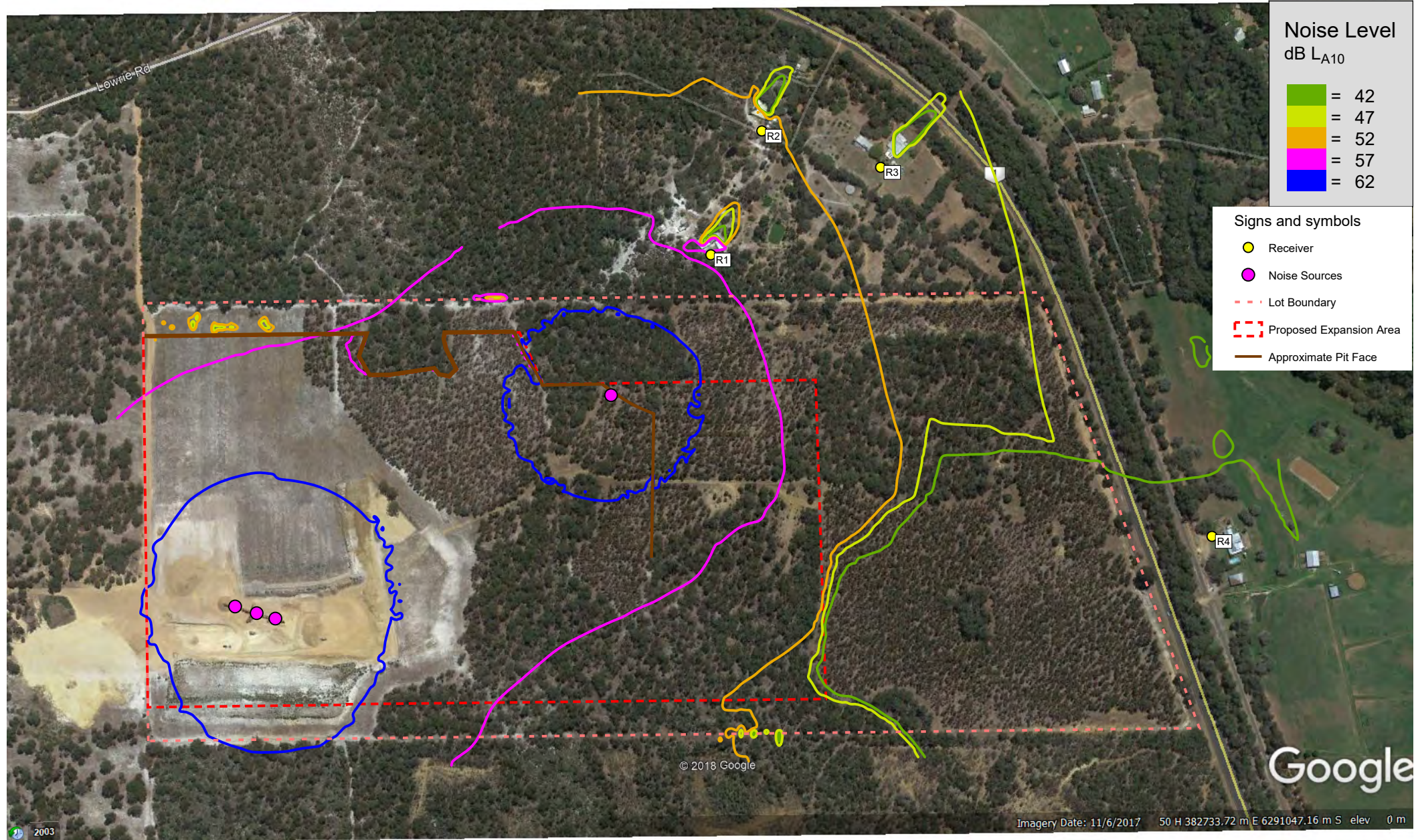
Figure 4-2



Length Scale 1:6000

0 30 60 120 180 m

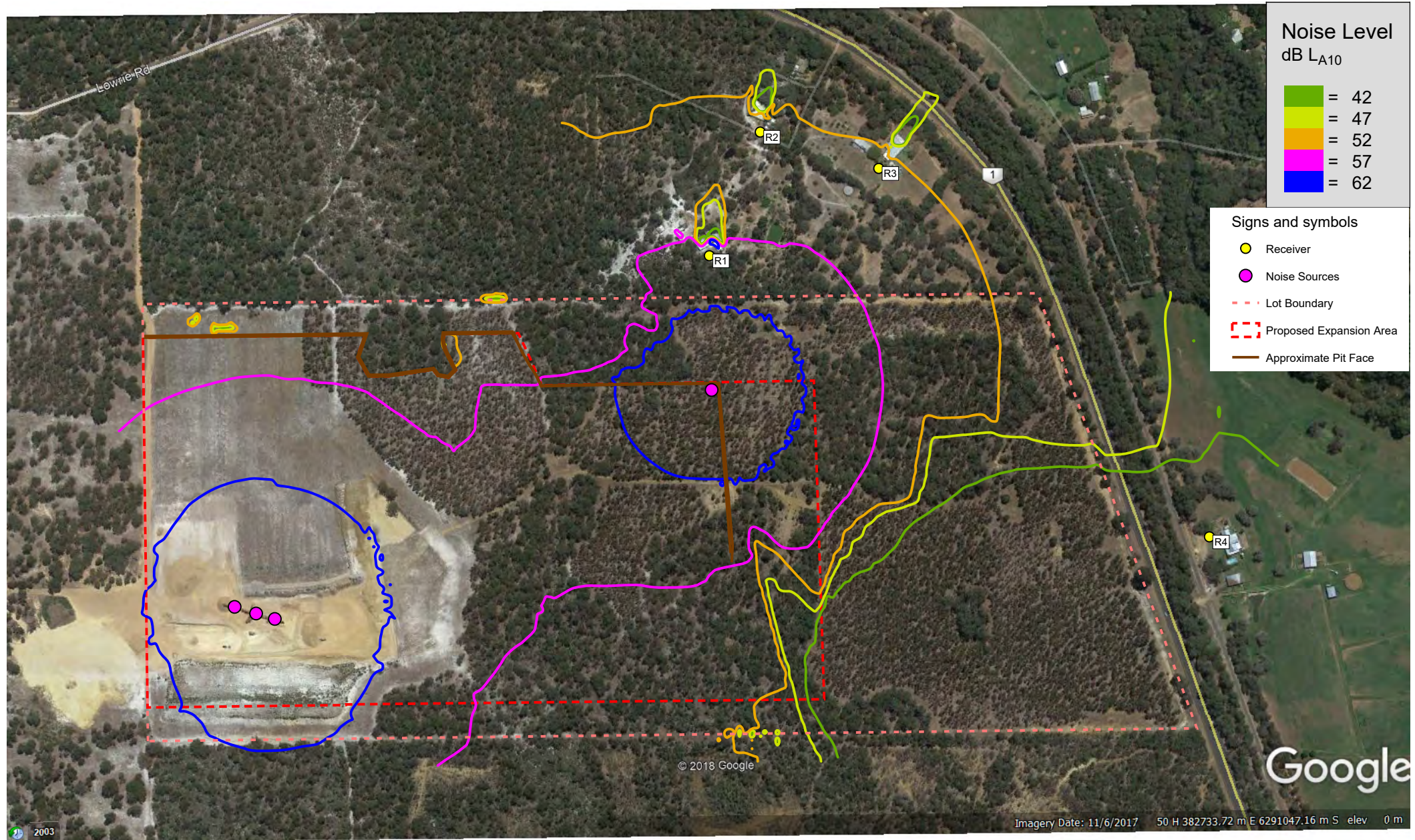
Figure 4-3



Length Scale 1:6000

0 30 60 120 180 m

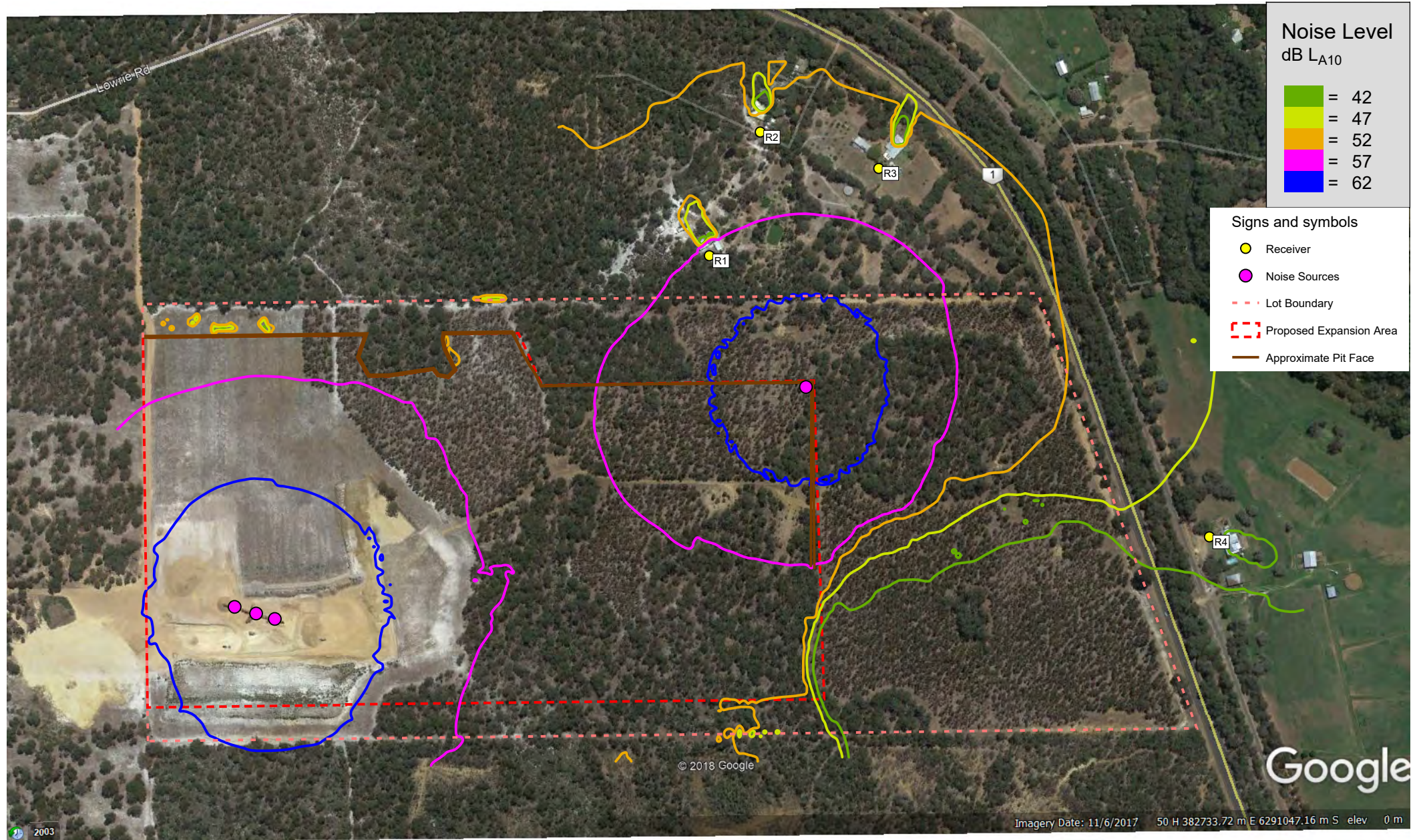
Figure 4-4



Length Scale 1:6000

0 30 60 120 180
m

Figure 4-5



Length Scale 1:6000

0 30 60 120 180 m

5 ASSESSMENT AND RECOMMENDATIONS

The receivers potentially most affected by the expansion are R1 to R3, where the applicable assigned noise level is 47 dB L_{A10} at R1 and R2, and 49 dB L_{A10} at R3.

As excavation operations progress closer to receiver R1, the mobile plant noise contribution becomes dominant over background, and therefore tonality was assumed to be present at the receivers.

Based on the above and the modelling results, compliance with the assigned noise level can be achieved from the start of excavation operations up until approximately 450 metres from receiver R1. Noise controls are then required to mitigate noise levels at R1 to R3 as excavation operations progress towards receiver R1.

The noise controls required vary with the distance to receiver R1 as follows:

- For excavation operations within 200-450 metres of receiver R1:
 - Provide a 4 metre high noise bund on the top edge of the pit at all times. The modelling indicates the foot of the bund can be up to 6 metres away from the pit's edge.
- For excavation operations within 150-200 metres of receiver R1:
 - Provide a 4 metre high noise bund on the top edge of the pit at all times. The modelling indicates the foot of the bund can be up to 6 metres away from the pit's edge;
 - Provide a 3.5m high bund to the north east of the crushing and screening plant; and
 - The dozer is not to be operated at the same time as the loader.
- For excavation operations at the eastern extents:
 - Provide a 5 metre high noise bund on the top edge of the pit at all times. The modelling indicates the foot of the bund can be up to 6 metres away from the pit's edge;
 - Provide a 3.5m high bund to the north east of the crushing and screening plant; and
 - Use the CAT 972 loader already on site as this item is 2 dB quieter than the CAT 980; and
 - The dozer is not to be operated at the same time as the loader and should not be operated for more than 24 minutes in any 4 hour period.

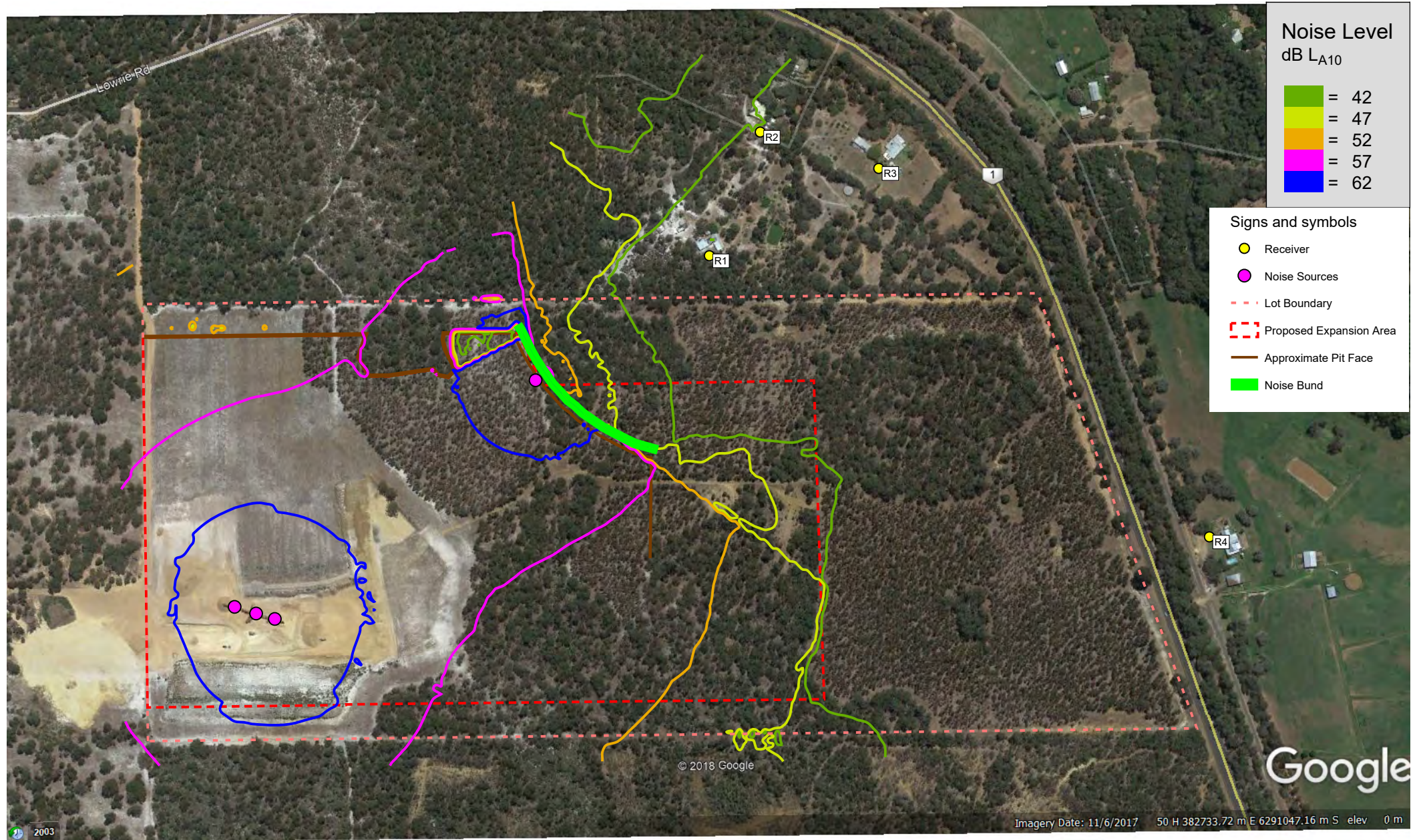
The predicted noise levels including the recommended mitigation, is provided in *Table 5-1* and shown graphically in *Figures 5-1 to 5-5*, as well as the recommended location and extent of the noise bunds for reference.

From *Table 5-1* it can be seen that compliance with the assigned noise level can be achieved at all receivers for the proposed operations.

Table 5-1 Predicted Noise Levels with Mitigation, dB LA10

Receiver	Excavation Approx. 250 m from R1		Excavation Approx. 200 m from R1		Excavation Approx. 150 m from R1		Excavation At Eastern Extents	
	Overall	Mobile	Overall	Mobile	Overall	Mobile	Overall	Mobile
R1	40	38	41	40	42	41	42	41
R2	41	36	39	37	42	40	42	35
R3	34	32	36	34	39	38	38	36
R4	25	19	30	29	32	31	32	31

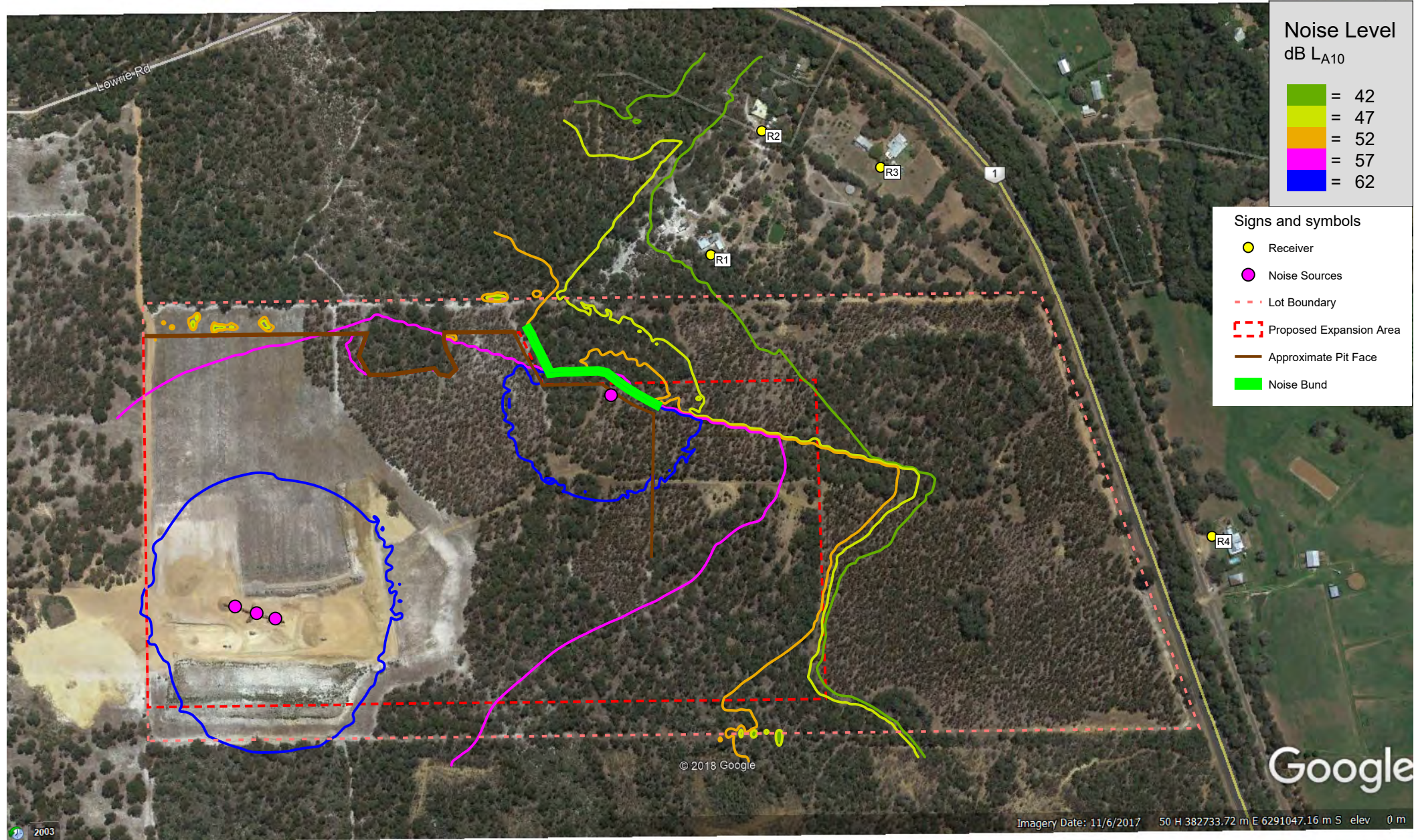
Figure 5-1



Length Scale 1:6000

0 30 60 120 180 m

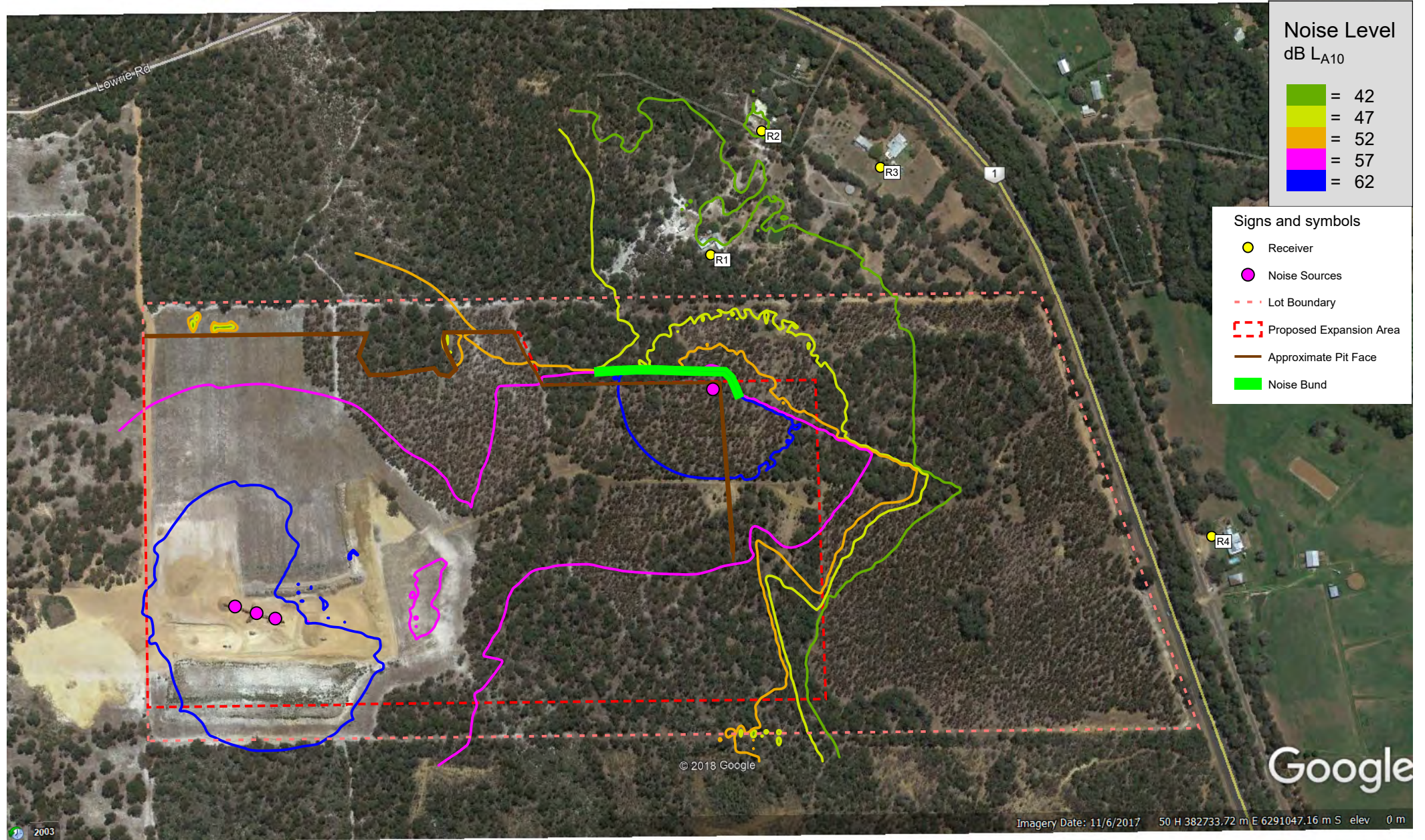
Figure 5-2



Length Scale 1:6000

0 30 60 120 180 m

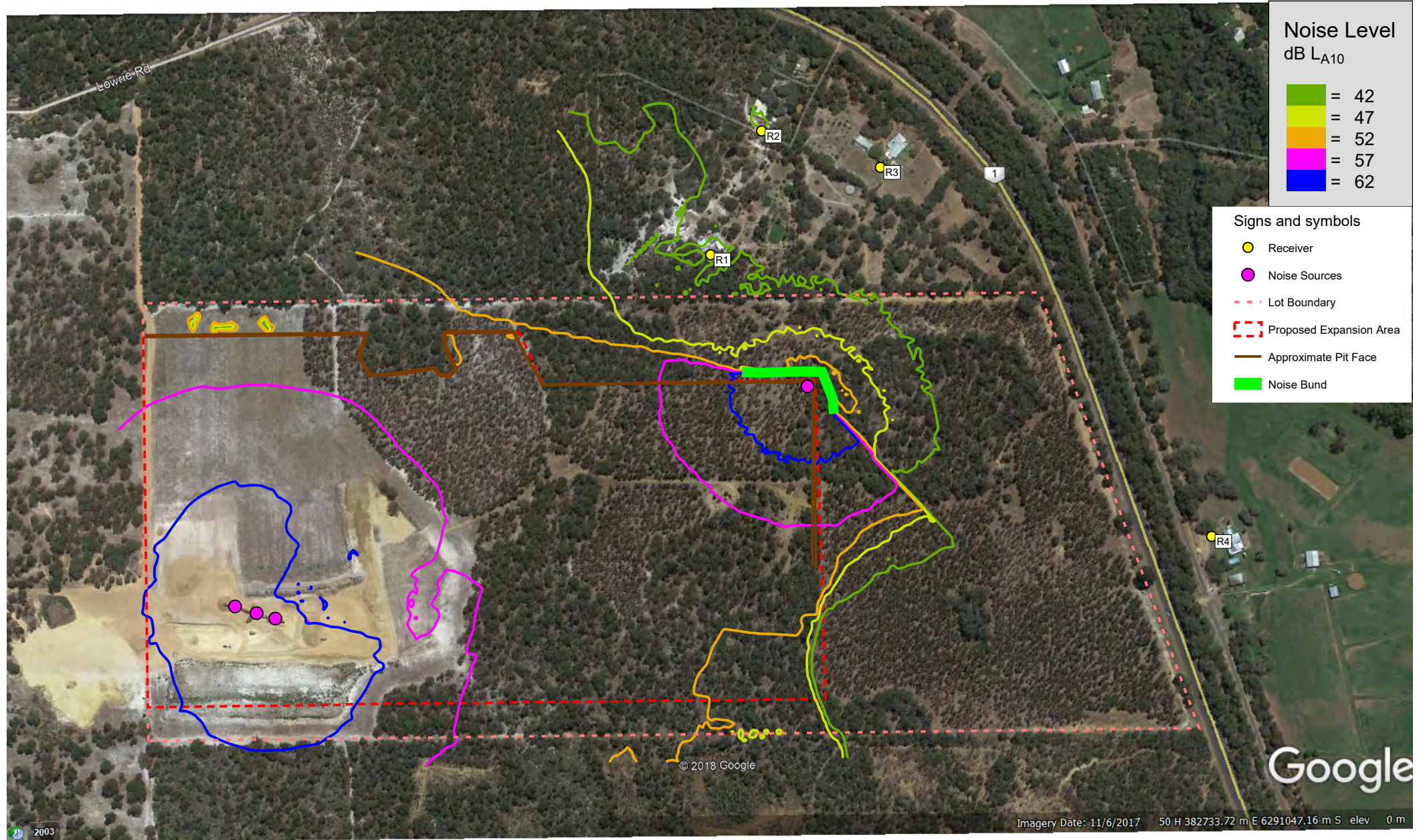
Figure 5-3



Length Scale 1:6000

0 30 60 120 180 m

Figure 5-4



Length Scale 1:6000

0 30 60 120 180 m

6 CONCLUSIONS

The noise emissions from the excavation operations in the future area to the east of the existing pit were assessed by means of noise modelling.

Based on the assumptions made and the modelling results, it is concluded that compliance with the applicable L_{A10} assigned noise level can be achieved at all receivers as operations approach the closest receivers, provided noise controls are put in place at various stages of operations as described in *Section 5*.

In addition, the following best practices should be implemented during the expansion to further minimise noise impacts:

- If reversing alarms are deemed necessary, all plant operating within 450 metres of receiver R1 are to be fitted with broadband reversing alarms;
- The pit should be developed from south to north, therefore slowly bringing the operations closer to receiver R1 and allowing for equipment to be located against the pit face;
- Local weather conditions should be taken into consideration in scheduling excavation operations and noise bund construction. Noise reductions of the order of 5 dB may be achieved while operating 'upwind' of receivers.
- Noise bunds to be built and maintained using the quietest practicable plant and construction methods e.g. loader working from behind the bund pushing material.

It is noted this assessment assumed that the crushing and screening plant is located in the existing pit (south-western corner) and remaining at this location following the expansion. Should it be desired to move the crushing and screening plant closer to the excavation area(s), additional noise controls will likely be required around the fixed plant, but also in relation to the haul trucks accessing site and loading activities e.g. noise bunds along travel route, truck number restrictions, and/or noise bunds around loading area.

Appendix A

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)

The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting

An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

Sound Power Level (L_w)

Under normal conditions, a given sound source will radiate the same amount of energy, irrespective of its surroundings, being the sound power level. This is similar to a 1kW electric heater always radiating 1kW of heat. The sound power level of a noise source cannot be directly measured using a sound level meter but is calculated based on measured sound pressure levels at known distances. Noise modelling incorporates source sound power levels as part of the input data.

Sound Pressure Level (L_p)

The sound pressure level of a noise source is dependent upon its surroundings, being influenced by distance, ground absorption, topography, meteorological conditions etc and is what the human ear actually hears. Using the electric heater analogy above, the heat will vary depending upon where the heater is located, just as the sound pressure level will vary depending on the surroundings. Noise modelling predicts the sound pressure level from the sound power levels taking into account ground absorption, barrier effects, distance etc.

L_{ASlow}

This is the noise level in decibels, obtained using the A frequency weighting and the S (Slow) time weighting as specified in IEC 61672-1:2002. Unless assessing modulation, all measurements use the slow time weighting characteristic.

L_{AFast}

This is the noise level in decibels, obtained using the A frequency weighting and the F (Fast) time weighting as specified in IEC 61672-1:2002. This is used when assessing the presence of modulation only.

L_{APeak}

This is the greatest absolute instantaneous sound pressure in decibels using the A frequency weighting as specified in IEC 61672-1:2002.

L_{Amax}

An L_{Amax} level is the maximum A-weighted noise level during a particular measurement.

L_{A1}

An L_{A1} level is the A-weighted noise level which is exceeded for one percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{A10}

An L_{A10} level is the A-weighted noise level which is exceeded for 10 percent of the measurement period and is considered to represent the “intrusive” noise level.

L_{Aeq}

The equivalent steady state A-weighted sound level (“equal energy”) in decibels which, in a specified time period, contains the same acoustic energy as the time-varying level during the same period. It is considered to represent the “average” noise level.

L_{A90}

An L_{A90} level is the A-weighted noise level which is exceeded for 90 percent of the measurement period and is considered to represent the “background” noise level.

One-Third-Octave Band

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20 000 Hz inclusive.

L_{Amax} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded at any time.

L_{A1} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period.

L_{A10} assigned level

Means an assigned level which, measured as a $L_{A\ Slow}$ value, is not to be exceeded for more than 10% of the representative assessment period.

Tonal Noise

A tonal noise source can be described as a source that has a distinctive noise emission in one or more frequencies. An example would be whining or droning. The quantitative definition of tonality is:

the presence in the noise emission of tonal characteristics where the difference between -

- (a) the A-weighted sound pressure level in any one-third octave band; and
- (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A\ Slow}$ levels.

This is relatively common in most noise sources.

Modulating Noise

A modulating source is regular, cyclic and audible and is present for at least 10% of the measurement period. The quantitative definition of modulation is:

a variation in the emission of noise that —

- (a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band;
- (b) is present for at least 10% of the representative.

Impulsive Noise

An impulsive noise source has a short-term banging, clunking or explosive sound. The quantitative definition of impulsiveness is:

a variation in the emission of a noise where the difference between $L_{A \text{ peak}}$ and $L_{A \text{ Max slow}}$ is more than 15 dB when determined for a single representative event;

Major Road

Is a road with an estimated average daily traffic count of more than 15,000 vehicles.

Secondary / Minor Road

Is a road with an estimated average daily traffic count of between 6,000 and 15,000 vehicles.

Influencing Factor (IF)

$$= \frac{1}{10} (\% \text{ Type A}_{100} + \% \text{ Type A}_{450}) + \frac{1}{20} (\% \text{ Type B}_{100} + \% \text{ Type B}_{450})$$

where:

% Type A₁₀₀ = the percentage of industrial land within
a 100m radius of the premises receiving the noise

% Type A₄₅₀ = the percentage of industrial land within
a 450m radius of the premises receiving the noise

% Type B₁₀₀ = the percentage of commercial land within
a 100m radius of the premises receiving the noise

% Type B₄₅₀ = the percentage of commercial land within
a 450m radius of the premises receiving the noise

+ Traffic Factor (maximum of 6 dB)

= 2 for each secondary road within 100m

= 2 for each major road within 450m

= 6 for each major road within 100m

Representative Assessment Period

Means a period of time not less than 15 minutes, and not exceeding four hours, determined by an inspector or authorised person to be appropriate for the assessment of a noise emission, having regard to the type and nature of the noise emission.

Background Noise

Background noise or residual noise is the noise level from sources other than the source of concern. When measuring environmental noise, residual sound is often a problem. One reason is that regulations often require that the noise from different types of sources be dealt with separately. This separation, e.g. of traffic noise from industrial noise, is often difficult to accomplish in practice. Another reason is that the measurements are normally carried out outdoors. Wind-induced noise, directly on the microphone and indirectly on trees, buildings, etc., may also affect the result. The character of these noise sources can make it difficult or even impossible to carry out any corrections.

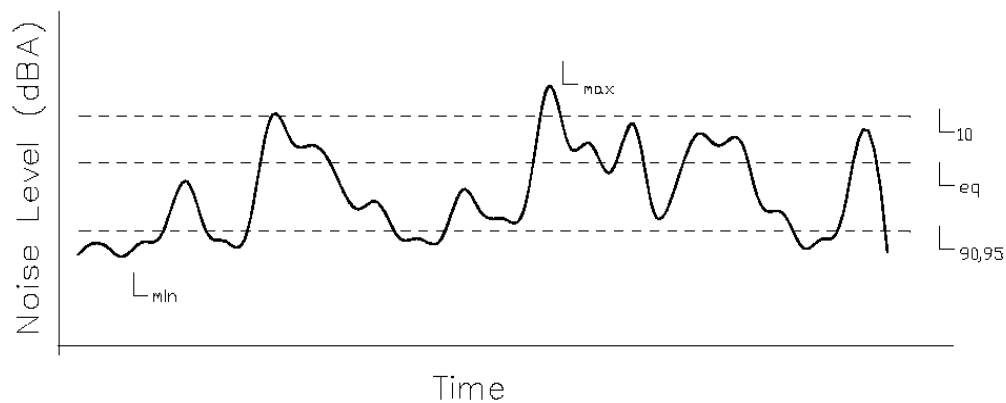
Ambient Noise

Means the level of noise from all sources, including background noise from near and far and the source of interest.

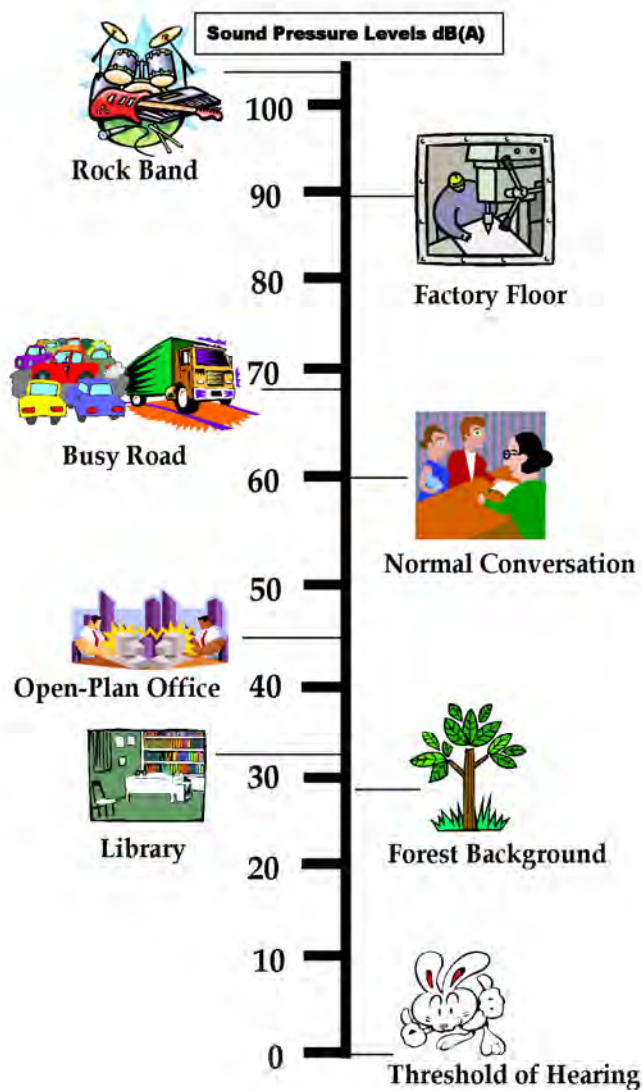
Specific Noise

Relates to the component of the ambient noise that is of interest. This can be referred to as the noise of concern or the noise of interest.

Chart of Noise Level Descriptors



Typical Noise Levels



APPENDIX 6: TRAFFIC IMPACT STATEMENT



Transport Impact Statement

MGM Bulk Pty Ltd Lot 393 Lowrie Road
Gwindinup

CW1200811_300306977

29 August 2023

Prepared for:

MGM Bulk Pty Ltd

Prepared by:

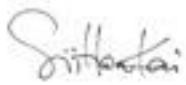
Stantec Australia Pty Ltd



Revision	DATE	Description	Author	Reviewed by	Approved by
A	03/08/2023	For Issue	SV	BS	SJL
B	29/08/2023	For Issue	SV	BS	SJL
C					



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Reviewed by  _____
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Scott Lambie

Approved by  _____
(signature)

Ray Cook



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1.0 INTRODUCTION

1.1 BACKGROUND

Stantec has been commissioned by MGM Bulk Pty Ltd ('the Client') to undertake a Transport Impact Statement for a Sand & Gravel Extraction Site located at Lot 393 Lowrie Road within Gwindinup, Shire of Capel (the 'Site'). This report aims to assess the impact of the development on the adjacent road network and focus on access arrangements to and from the Site.

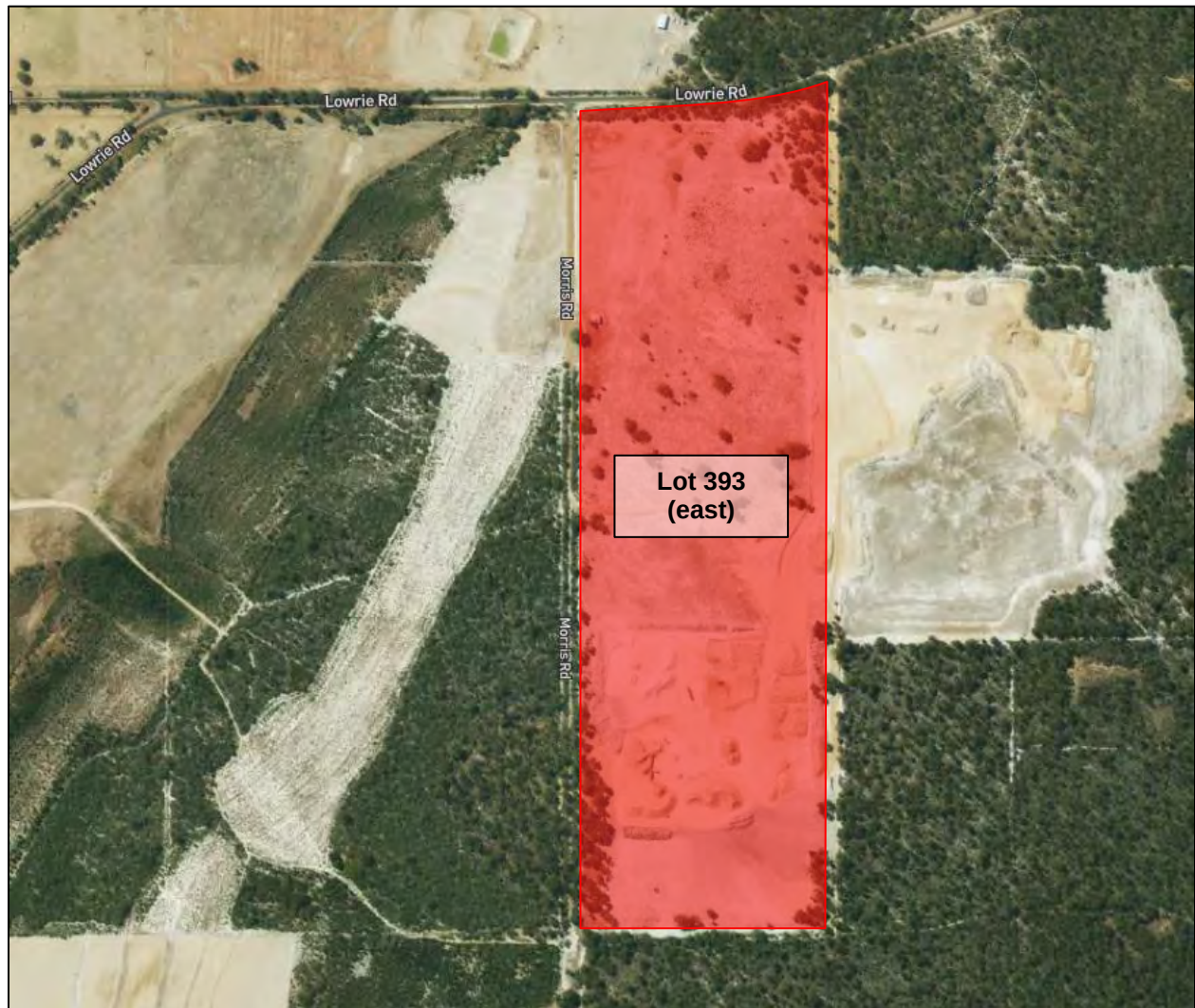
This report has been prepared following the *Western Australian Planning Commission (WAPC) Transport Impact Assessment Guidelines for Developments: Volume 4 – Individual Developments (2016)* and the checklist is included in **Appendix A**.



1.2 SITE LOCATION

The proposed development site Lot 393 (eastern portion) is located east of the intersection with Lowrie Road and Morris Road. The roads fronting the site are Lowrie Road and Morris Road as shown in **Figure 1-1**.

Figure 1-1 Aerial Overview of the Site



Source: Metromap

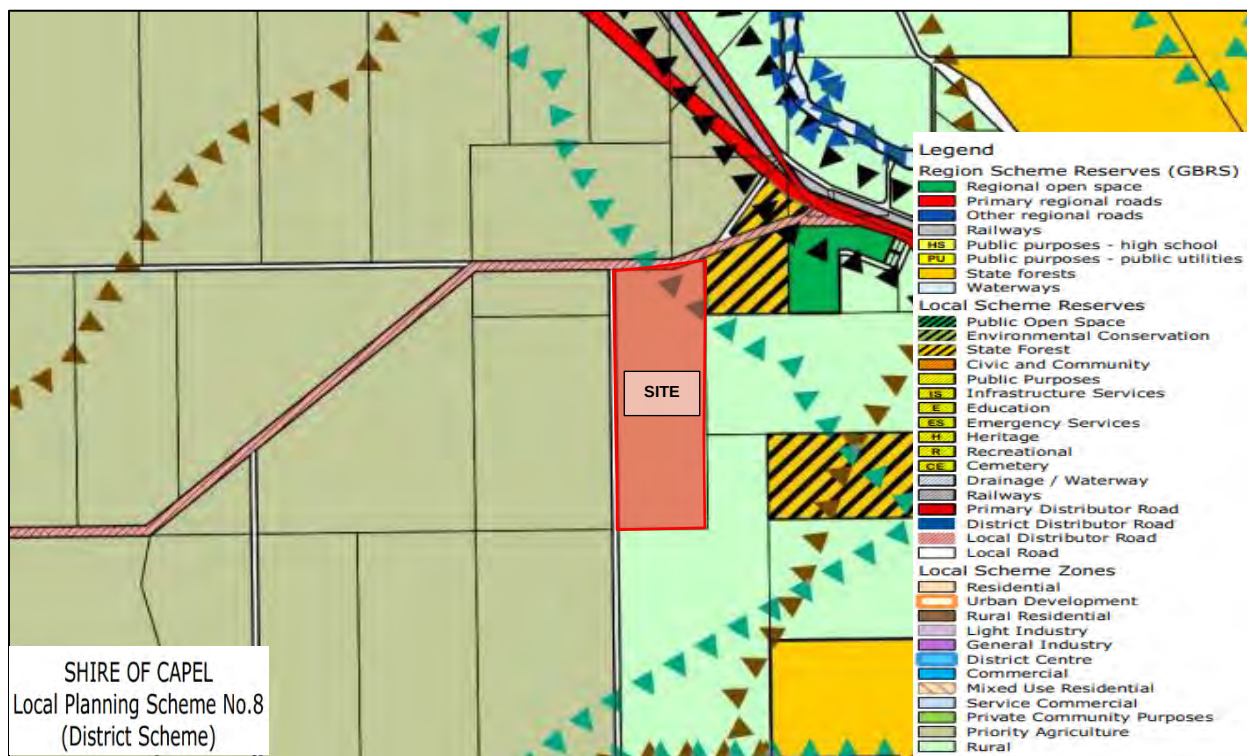


2.0 EXISTING SITUATION

2.1 EXISTING LAND USES

According to the *Shire of Capel's Local Planning Scheme No. 8*, the subject Site is zoned as a 'Rural' area as shown in **Figure 2-1**. The majority of the properties surrounding the Site are zoned as Priority agriculture and Rural areas whereas properties on North-East to the site are zoned for State forest and Regional open space.

Figure 2-1 Site Zoning Map



Source: Shire of Capel LPS No.8



2.2 EXISTING ROAD NETWORK

Road types are defined in the Main Roads Functional Hierarchy as follows:

- **Primary Distributors (Light blue):** These roads provide for the major regional and inter-regional traffic movement and carry large volumes of fast-moving traffic. Some are strategic freight routes, and all are State roads. They are managed by Main Roads.
- **Regional Distributors (Red):** These are the Roads that are not Primary Distributors but link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by Local Government.
- **District Distributor A (Green):** These roads carry traffic between industrial, commercial, and residential areas and connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.
- **District Distributor B (Dark blue):** These roads perform a similar function to District Distributor A but with reduced capacity due to flow restrictions from access to and roadside parking alongside the adjoining property. These are often older roads with a traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and generally not through them, forming a grid that would ideally space them around 1.5 kilometres apart. They are managed by Local Government.
- **Local Distributors-Rural (Orange):** These roads connect to other Rural Distributors and to Rural Access Roads. These are Regional Distributors, but which are designed for efficient movement of people and goods within regional areas. They are managed by the Local government.
- **Access Roads (grey):** These roads provide access to abutting properties with amenity, safety, and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by the Local government.

The Site is accessed via Lowrie Road at the north-east corner of the Site. This access to Lowrie Road is used for all the vehicle movements to and from the Site, and provides a connection to South Western Highway. The surrounding road network is further characterised in **Table 2-1** and **Figure 2-2** shows the hierarchy as per Main Roads WA Road Information Mapping System.

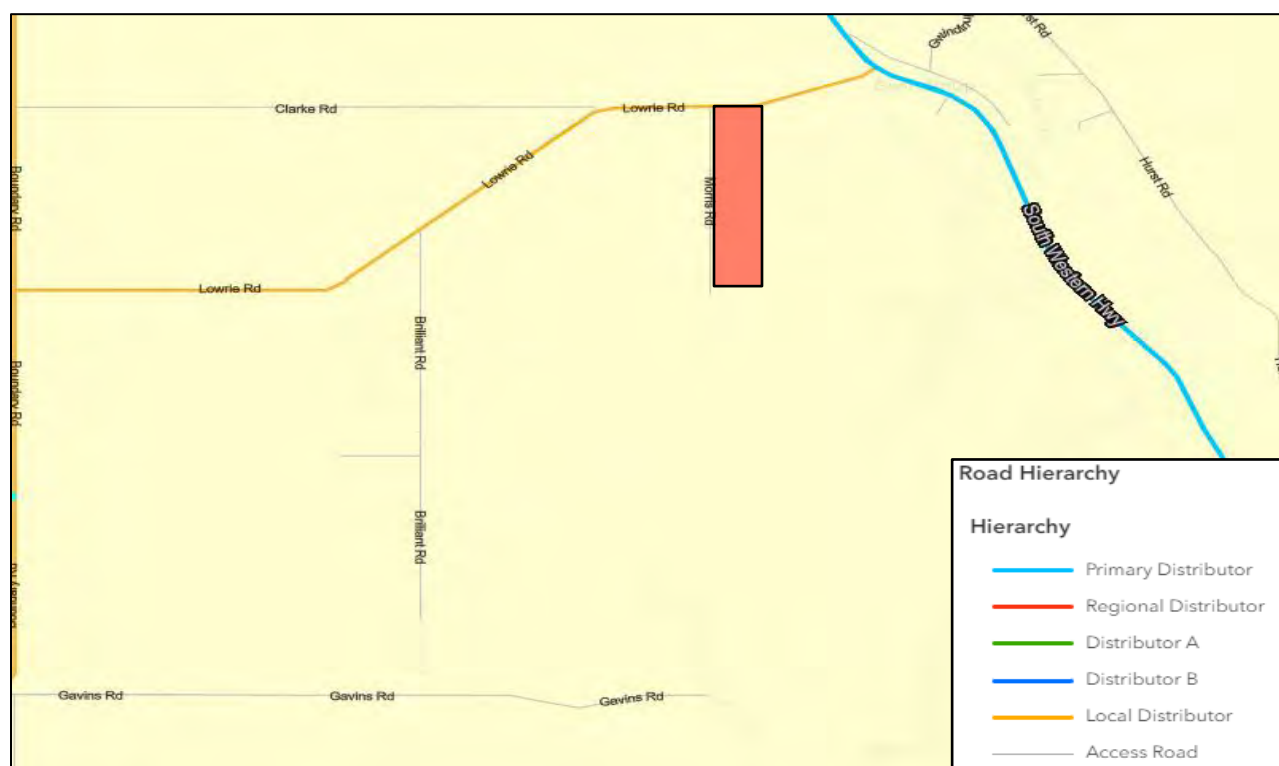


Table 2-1 Road Hierarchy and Characteristics

Road Name (Road ID)	Road Hierarchy			Road Characteristics		
	Road Hierarchy	Road Jurisdiction	No. of Lanes	No. of Footpaths	Road Width (m)	Posted Speed (km/h)
Lowrie Road (2060005)	Local Distributor	Local Government	2 <i>(two-way undivided)</i>	N/A	7.0	110
Clarke Road (2060010)	Access Road	Local Government	1 <i>(two-way undivided)</i>	N/A	4.0	110
South Western Highway (H009)	Primary Distributor	MRWA	2 <i>(one lane in each direction, undivided)</i>	N/A	12.0	110

Source: MRWA Road Information Mapping System

Figure 2-2 Road Hierarchy around the Site



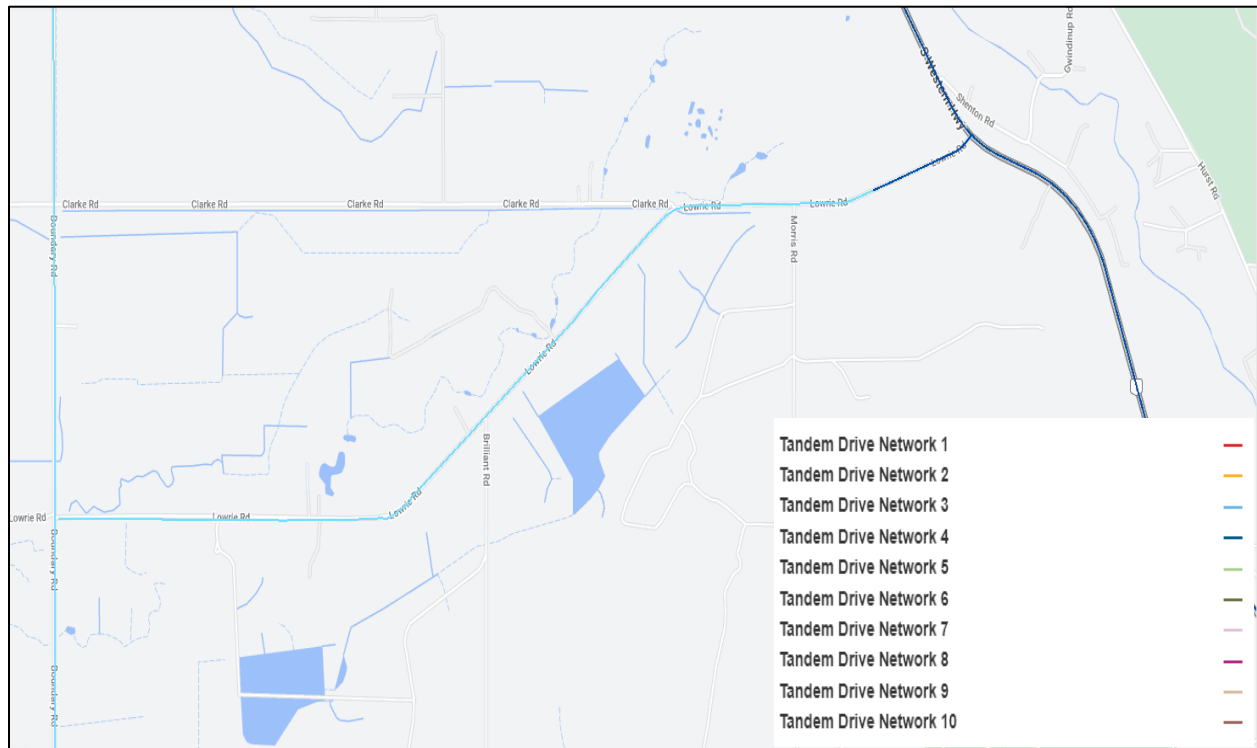
Source: MRWA Road Information Mapping System



2.3 EXISTING RESTRICTED ACCESS VEHICLE (RAV) NETWORK

Figure 2-3 shows the existing RAV network nearest to the Site. Currently, Lowrie Road has RAV 4 permit access that extends to the northeast edge of the Site till SLK 0.507 and RAV 3 permit access westwards connecting Lowrie Road (SLK 0.507) to Boundary Road.

Figure 2-3 Existing RAV Network



Source: MRWA HVS Network Map



2.4 EXISTING TRAFFIC VOLUMES

Existing traffic data were sourced from MRWA's Traffic Map and are summarised below in **Table 2-2**. The traffic volumes were collected relative to the location of the Site along with the hourly peak data for both of these sites during AM and PM.

Table 2-2 Traffic Volumes

Site No.	Road Name	Source	Year	Traffic Volume (% of Heavy Vehicles)	AM Hourly Peak	PM Hourly Peak
1	South Western Highway <i>South of Bridge St (SLK 170.55)</i> Site 15241	MRWA Traffic Map	2018/2019	7,796 (11.8%)	11AM 589 vehicles (308 N & 281 S)	3PM 683 vehicles (337 N & 346 S)
2	South Western Highway <i>South of Knights Rd (SLK 179.23)</i> Site 53535	MRWA Traffic Map	2021/2022	7,465 (16.2%)	11AM 591 vehicles (305 N & 286 S)	3PM 607 vehicles (278 N & 329 S)
3	Lowrie Road 100m East of Clarke Rd. SLK 1340	Shire of Capel	July 2015	237.4 (35.38%)	15.6 vehicles	24.7 vehicles
4	Lowrie Road 250m from South Western Hwy	Shire of Capel	July 2020	333 (35.4%)	33.2 vehicles	36.5 vehicles

Source: MRWA Traffic Map

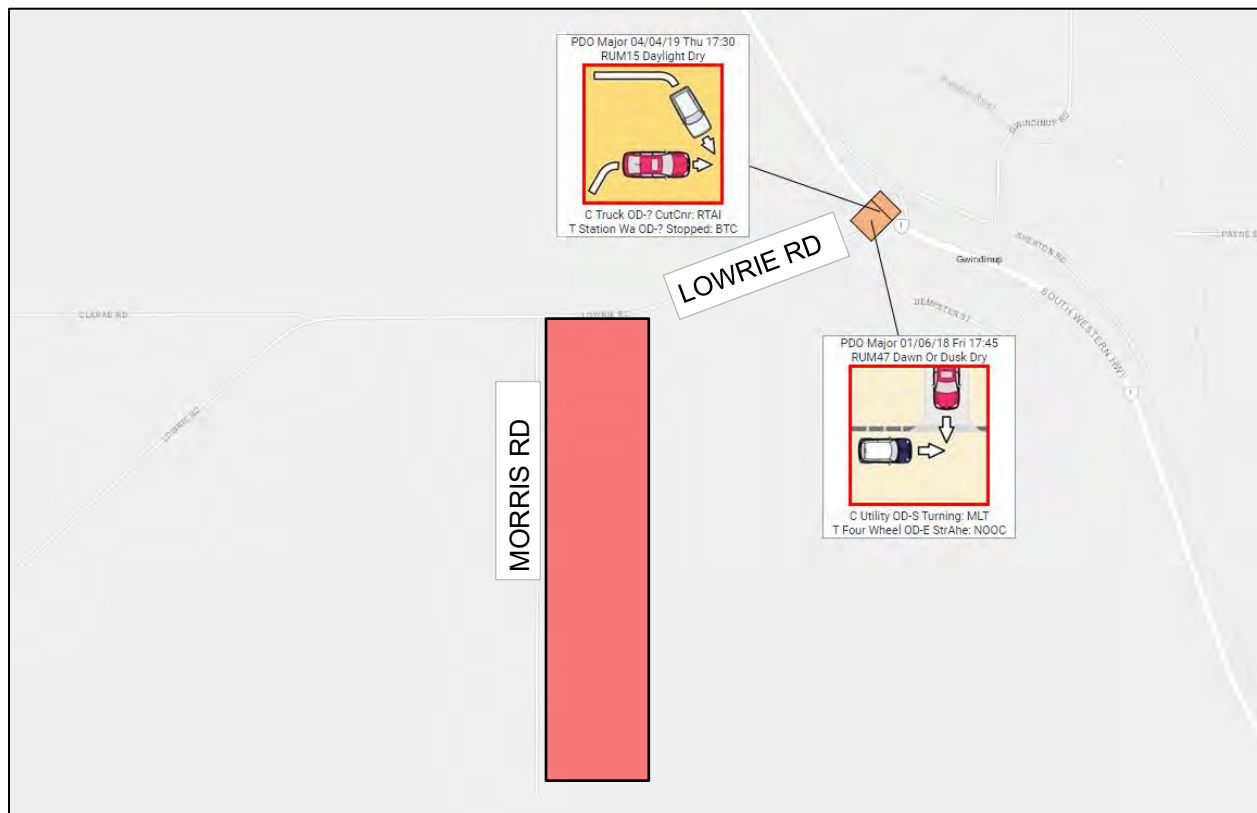
The traffic count data was also obtained from the Shire of Capel for the year 2015 and 2020 at two different sites located on Lowrie Road near the subject Site.



2.5 CRASH ASSESSMENT

Recorded crashes on the road network surrounding the Site were extracted from the available MRWA database between 2018 and 2022. Results of the crash assessment are presented in **Table 2-3**. **Figure 2-4** illustrates the location and severity of these crashes.

Figure 2-4 Crash Location



Source: MRWA Crash Reporting Centre

Table 2-3 Total Crashes

Type of Crash (RUM Code)	Fatal	Hospital	Medical	Major Property Damage	Minor Property Damage	Total Crashes
Right Angle	-	-	-	2	-	2
Total	-	-	-	2	-	2

From the assessment conducted, two (2) crash incidents were recorded along the surrounding road network; observations are summarised as follows:

- The two (2) recorded were all Right-Angle crashes at the intersection;
- Both crashes resulted in major property damage only;
- These incidents occurred along South Western Highway and Lowrie Road; and
- No crash incidents were recorded along Morris Road, Clarke Road, and Brilliant Road.

A history of similar type of crashes occurring within the same road section suggests further investigation should be undertaken to identify the underlying cause. It is noted that all the crashes occurred near the intersection of SWH and Lowrie Road. However, both crashes are Major Property Damage only with no casualty. The existing Basic right turn and the Auxiliary left turn lanes with good Safe Intersection Sight Distance (SISD) significantly reduces the risk of major crashes. As such, the additional truck movements in and out of this intersection may be less likely to contribute to additional crashes.

2.6 INTERSECTION ASSESSMENT

An intersection assessment has been carried out for the Lowrie Road and South Western Highway intersection as shown in **Figure 2-5**. For a robust assessment, the design speed of truck and car of 110 km/h and 120 km/h has been adopted from the Austroads Guide to Road Design. The minimum required safe intersection sight distance (SISD) for the trucks turning onto South Western Hwy from Lowrie Road is 302m for both north and south directions (for the design speed of 110 km/h). The minimum required safe intersection sight distance (SISD) for cars turning onto South Western Hwy from Lowrie Road is 341m for both north and south directions (for the design speed of 120 km/h). After carrying out the assessment, it is noted that the available SISD from both directions is as much as 500m, thus satisfying the Austroads minimum requirements.

Austroads Guide to Road Design Part4A Section A.10 was reviewed where it is suggested that an acceleration lane may be preferable where SISD is insufficient and/or traffic volumes on the road and the number of trucks entering are relatively high. According to the MRWA Standard Restricted Access Vehicle Route Assessment Guidelines, the required sight distance for posted speed limit of 100km/h for RAV is 252m, which can be achieved at this intersection. As the sight distance available on the through road is



good, it is relatively easy for through drivers to perceive the slow movement of these vehicles and to slow for them.

According to the historical traffic volume data, the through traffic in during the peak hours along South Western Highway is between 300-350vph in one direction. This would translate to approximately 6 vehicles per minute, or 1 car per 10 seconds in any direction.

This indicates that a turning vehicle/truck would have an average gap of 10 seconds, (approximately 300m on 110km/h posted speed). This gap is more than sufficient for through drivers to perceive the slow movement of these vehicles and to slow for them if required.

Table 2-4 Sight Distance Requirements

Sight Distance Type	Vehicle Type	Design Speed (km/h)	Reaction Time (R _T)	Distance (m)
SISD	Truck	110	2.5 sec	302m (minimum)
SISD	Car	120	2.5 sec	341m (minimum)
ASD	Car	120	2.5 sec	241m (minimum)

Source: Guide to Road Design Part 4A



Figure 2-5 Lowrie Rd-South Western Hwy Intersection



Source: Metromap

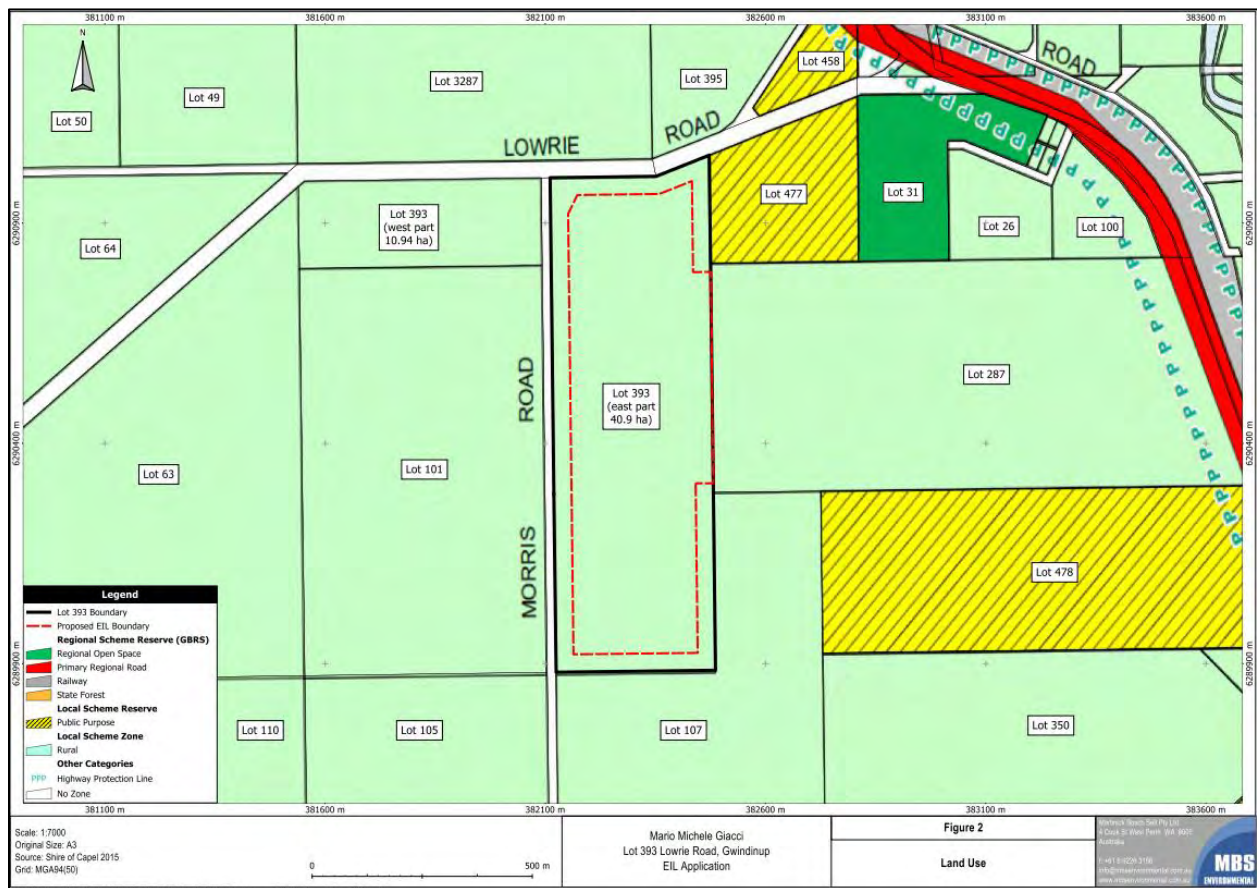
3.0 PROPOSED DEVELOPMENT

3.1 PROPOSED LAND USES

A portion of the Site Lot 393 is currently being used for the extraction of sand and gravel located to the eastern end of Lowrie Road. The indicative extraction area of the Site is 31.4 hectares, as shown in **Figure 3-1** (also provided in **Appendix B**).



Figure 3-1 Proposed Development Area



Source: MBS Environmental

3.2 ACCESS ARRANGEMENTS

Although the Site (Lot 393) can be accessed via Morris Road, the extractive operations will only utilise the access onto Lowrie Road at the North East corner of the site. This access is currently being used by both Lot 393 and the adjacent Lot 287 as illustrated in **Figure 3-2**.



Figure 3-2 Site Access Arrangement



Source: Metromap

3.3 PROPOSED HAULAGE ROUTE

Trucks leaving the Site drive in both directions on Lowrie Road, South Western Highway is only accessible with a RAV 4 permit (east) or RAV 3 permit (west). All hauling activities will be conducted by several truck configurations such as 6 wheelers, semi's, rigid trucks, dog trailers and semi-trailers up to 27.5m.



3.4 HOURS OF OPERATION

The proposed development site will operate between 7:00 am to 6:00 pm Monday to Friday and 7:00 am to 1:00 pm on Saturday. Days of operation will be from Monday to Saturday with an expected maximum movement of up to 150 truck trips per day (weekdays).



4.0 SWEPT PATH ANALYSIS

Swept path checks were conducted to assess the manoeuvrability of transport trucks along the haulage route of the proposed development. Swept path checks were conducted using the 27.5 RAV truck as design vehicles to emulate the trucks moving in and out of the proposed development.

4.1 SWEPT PATHS ON THE SITE ACCESS

Figure 4-1 Swept Path - Site Access

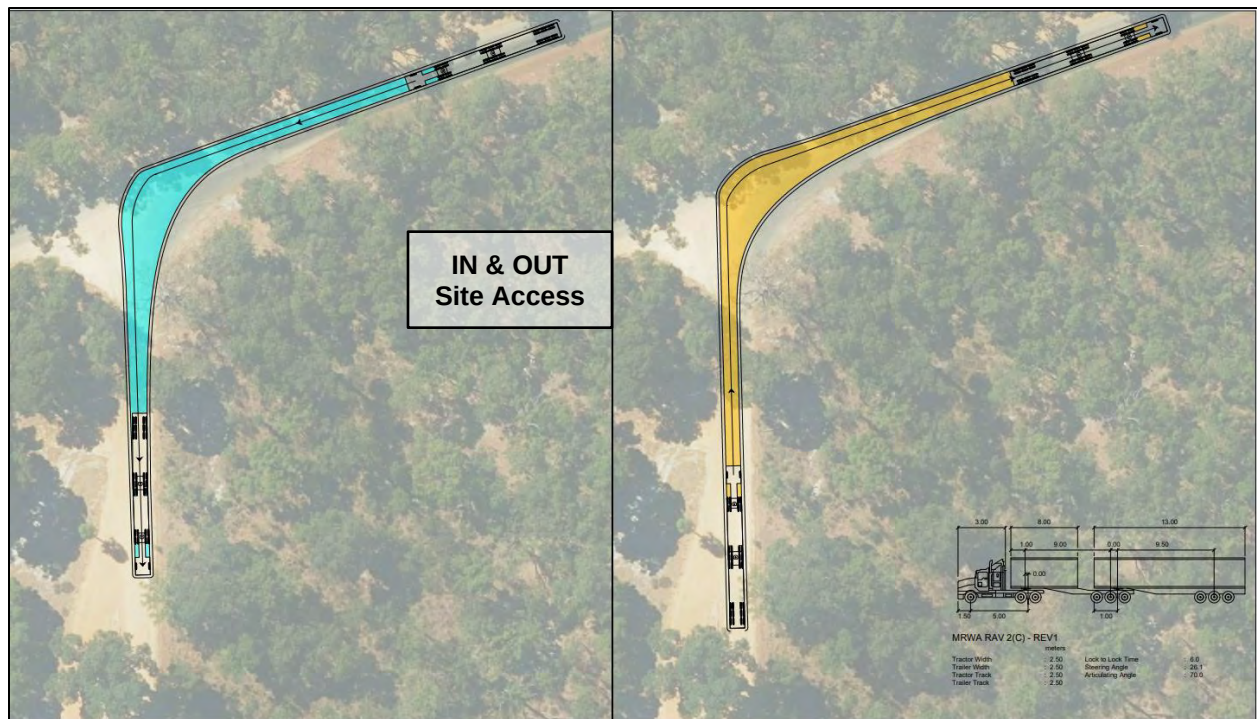


Figure 4-1 above shows the indicative swept path at the Site's access point, approximately 500m West of the intersection of Lowrie Road and South Western Highway. The crossover from Lowrie road to the site track is sealed and caters for road train truck configuration. Swept path analysis on the aerial image suggests that the existing access is adequate to accommodate one way movement only. A layby area has been provided approximately 65m south of the intersection, allowing for exiting vehicles to give way to entering vehicles if required.



5.0 TRIP GENERATION

5.1 ESTIMATED TRAFFIC GENERATION

For this assessment, a generated trip is defined by the ingress and egress movement of vehicles relative to the Site. If a vehicle is to enter and exit the Site on the same day, the vehicle is considered to generate 2 trips per day.

The maximum daily truck movements to and from the Site are proposed to be, 75 loaded trucks per day. Therefore, the Site is expected to generate up to 150 truck trips per day, which could be translated to approximately 14 truck trips/hour on average. **Table 5-1** provides a tabular summary of the estimated trips for the proposed development.

Table 5-1 Estimated Traffic Generation

Estimated Site-generated Trips	No. of Vehicles (11 hours of operation per day)	
	Daily	Hourly
Truck Trips	150	14 (7 IN & 7 OUT)

Note that the values above were based on maximum extraction. The actual number of trips generated by the development will vary based on time of day and extraction requirements through the life of the Site.

Based on the estimated site-generated trips, 14 hourly trips = approximately 1 truck per 5 minutes.

- Traffic management, such as the use of intercom, could be put in place to manage the inbound and outbound movements to minimise potential conflict at the access.
- Due to Low background traffic on Lowrie Road, additional truck traffic from the Site is unlikely to generate any significant delays to the existing traffic using the road.
- Existing intersection turning facilities (auxiliary lanes) minimise the delay for through traffic on South Western Highway even with the increased entering volumes. Some queueing may occur on Lowrie Road leg, but the delay is unlikely to significantly impact the overall operation of the intersection.



6.0 SUMMARY

This Transport Impact Statement outlines the transport aspects of the proposed development focusing on traffic operations and access. Included are discussions regarding traffic generation and potential issues.

This statement has been prepared following the *WAPC Transport Assessment Guidelines for Developments: Volume 4 – Individual Developments (2016)*.

The following conclusions are made for the proposed development:

- The proposed development is a Sand & Gravel extraction site located at the eastern end of Lowrie Road within Gwindinup, Shire of Capel;
- The proposed truck movements in and out of the Site are expected to be up to 150 daily truck movements in and out of the Site which translate to approximately 14 truck trips per hour on average.
- Two crashes over five years were recorded at the intersection of Lowrie Road and South Western Highway and both crashes are Major Property Damage only. The existing Basic right turn and the Auxiliary left turn lanes with good Safe Intersection Sight Distance (SISD) significantly reduces the risk of major crashes. Therefore, the additional truck movements in and out of this intersection are less likely to contribute to additional crashes.
- Swept path analysis of 27.5m trucks have been conducted for the assessment. The analysis suggests that 27.5m trucks could be accommodated to access the site from northeast corner of Lowrie road.

Overall, the traffic assessment has been conducted for the worst-case scenario for the Sand & Gravel extraction site- Lot 393 Lowrie Road Gwindinup. On normal days, the truck volumes are likely to be much lower than assessed and is unlikely to have a substantial long-term impact on traffic operations and the overall safety of the road network around it.



APPENDICES

APPENDIX A WAPC CHECKLIST

Item	Status	Comments/Proposals
Proposed Development		
Proposed Land Use	Section 3	
Existing Land Uses	Section 2	
Context with Surrounds	Section 2	
Vehicular Access and Parking		
Access Arrangements	Section 3	
Public, Private, and Disabled Parking Set Down / Pick-up	N/A	
Service Vehicles (non-residential)		
Access Arrangements	Section 3	
On/Off-site Loading Facilities	N/A	
Service Vehicles (residential)		
Rubbish Collection and Emergency Vehicle Access	N/A	
Hours of Operation (non-residential only)	Section 3	
Traffic Volumes		
Daily or Peak Traffic Volumes	Section 2	
Type of Vehicles (e.g., cars, trucks)	Section 2	
Traffic Management on Frontage Streets	N/A	
Public Transport Access		
Nearest Bus/Train Routes	N/A	
Nearest Bus Stops/Train Stations	N/A	
Pedestrian/Cycle Links to Bus Stops/Train Station	N/A	
Pedestrian Access/Facilities		
Existing Pedestrian Facilities Within The Development (If Any)	N/A	
Proposed Pedestrian Facilities Within Development	N/A	
Existing Pedestrian Facilities On Surrounding Roads	N/A	
Proposals To Improve Pedestrian Access	N/A	
Cycle Access/Facilities		
Existing Cycle Facilities Within The Development (If Any)	N/A	
Proposed Cycle Facilities Within The Development	N/A	
Existing Cycle Facilities On Surrounding Roads	N/A	
Proposals To Improve Cycle Access	N/A	
Site-specific Issues	N/A	
Safety Issues		
Identify Issues	N/A	
Remedial Measures	N/A	



APPENDIX B PROPOSED DEVELOPMENT AREA



Appendix 9

Existing Contours and Features
(Verified 1:2000 version of Figure 3)

Mario Michele Giacchi
Lot 393 Lowrie Road, Gwindinup
EIL Application

0100 m

Scale: 1:2000
Original Size: A1
Air Photo Date: November 2020 for southern part of
Lot 393 and Lot 287, January 2019 for rest.
Grid: MGA94(50)

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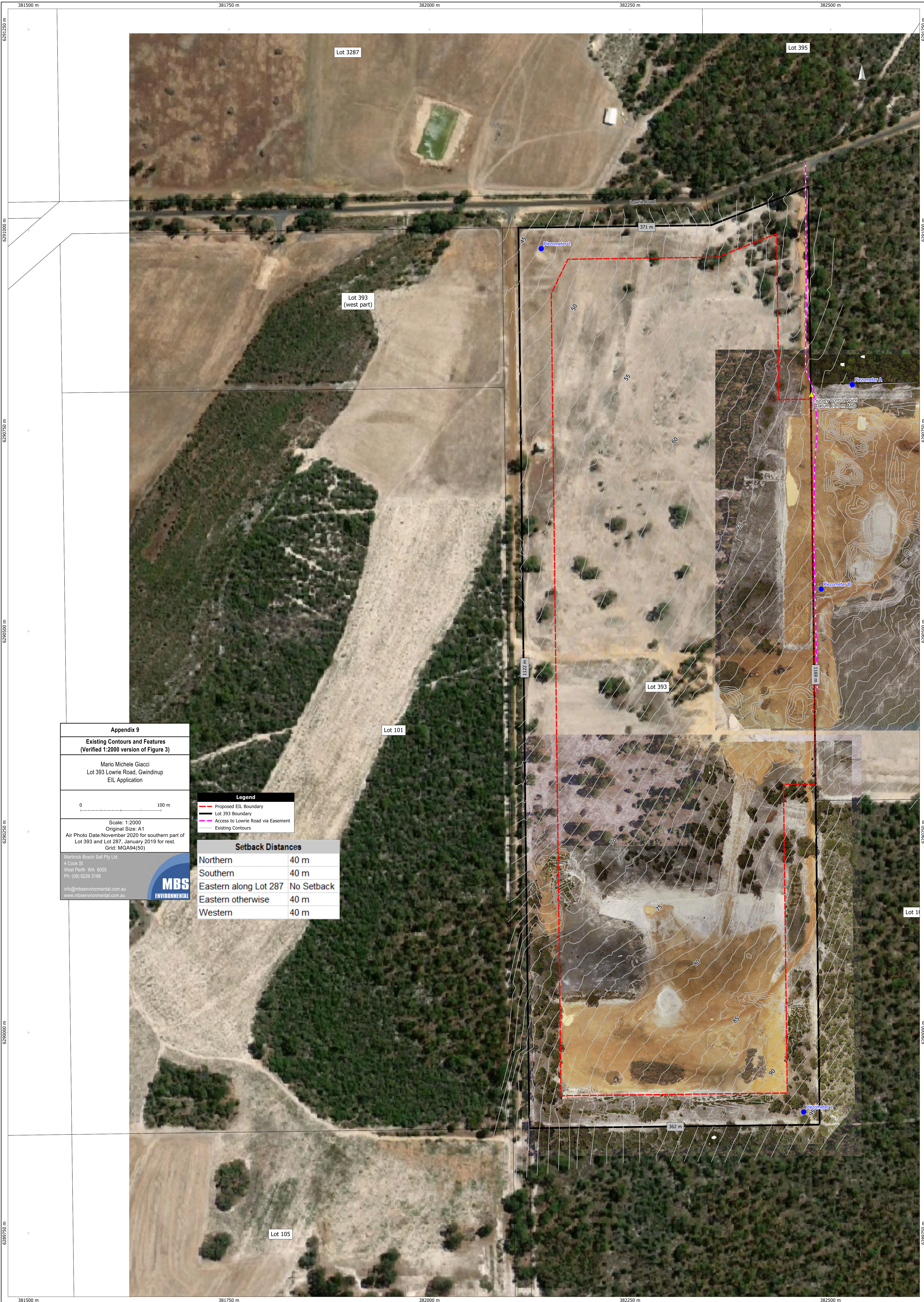
- Legend
- Proposed EIL Boundary

Lot 393 Boundary

Access to Lowrie Road via Easement

Existing Contours

Setback Distances	
Northern	40 m
Southern	40 m
Eastern along Lot 287	No Setback
Eastern otherwise	40 m
Western	40 m



Appendix 10

Finished Development Plan

Mario Michele Giacci
Lot 393 Lowrie Road, Gwindinup
EIL Application

0100 m

Scale: 1:2000
Original Size: A1
Air Photo Date: November 2020 for southern part of
Lot 393 and Lot 287, January 2019 for rest.
Grid: MGA94(50)

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Legend

Lot 393 Boundary

Proposed EIL Boundary

Proposed Finished Surface Contours

Interval (m)

1

5

Permanent Retention Pond

Rehabilitation to Native Vegetation

Rehabilitation to Pasture



APPENDIX 7: SURVEY VERIFICATION

Ian Cocker

From: Admin <admin@bcesurveying.com.au>
Sent: Thursday, 7 April 2011 10:09 AM
To: Ian Cocker
Subject: Site Survey Lot 287 Sth Western Highway Gwindinup (E3205)
Attachments: E3205 Final DF_LTYPE.shx; E3205 Final DF.dwg

Dear Ian

Please confirm receipt of the attached file via return email.

Regards,

Don Forrest
Supervising Surveyor
BCE Surveying Pty Ltd

Ph : 9791 7411 / 0417 182 863

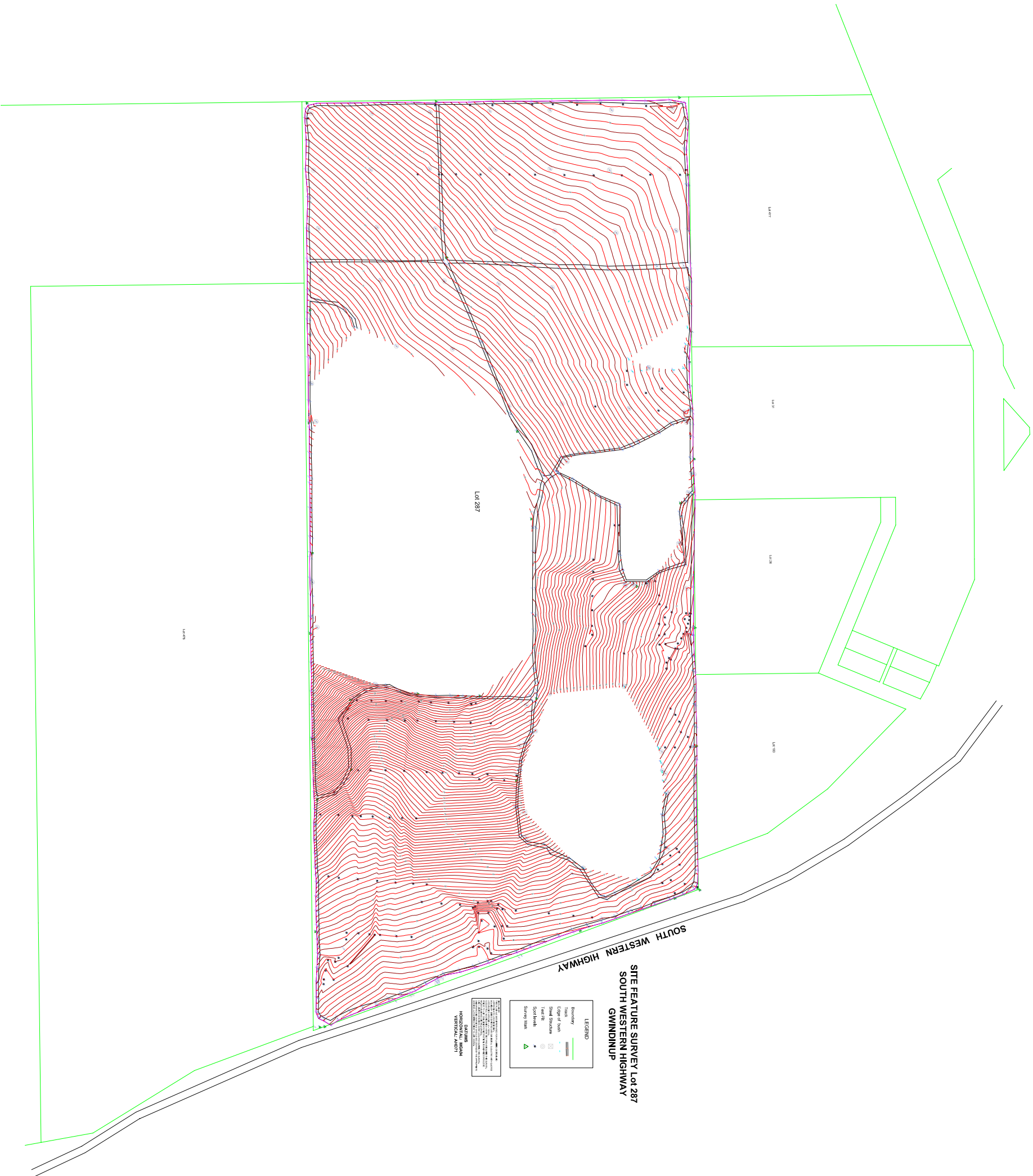
Fax : 9791 9315

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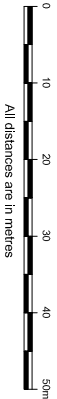


SITE FEATURE SURVEY Lot 287
SOUTH WESTERN HIGHWAY
GWINDINUP

LEGEND

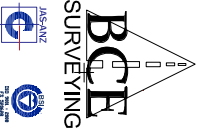
- Boundary
- Trails
- Edge of bush
- Shed structures
- Tree pit
- Spot Height
- Survey data

PROJECTION
HORIZONTAL: MGA94
VERTICAL: AHD



All distances are in metres

REV	DATE	DESCRIPTION	DRAWN	SURVEYOR	APPROVED
A	8/6/2012	Initial Issue	P.SZALLA	I. THOMSON	P. FANTASHA
CLIENT:			PROJECTION	NORTHING	
MGM Limestone			HORIZONTAL: MGA94 VERTICAL: AHD	DISCLAIMER This plan has been prepared for building design only. The plan shows visible services only. Any underground services should be located by the appropriate service authorities prior to any works. All dimensions shown are subject to final survey calculations.	



BCE

SURVEYING

Contour & Feature Survey

Lot 287, South West Highway, Boyanup

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JOB No.

E3205

PLAN No.

E3205-01A

SCALE:

1 : 500 @ A3

REVISION:

A

APPENDIX 8: STORMWATER MANAGEMENT PLAN

STORMWATER MANAGEMENT PLAN

LOT 393 LOWRIE ROAD AND
LOT 287 SOUTH WESTERN HIGHWAY,
GWINDOW
(REV 7)

PREPARED FOR:

MARIO MICHELE GIACCI

FEBRUARY 2024

PREPARED BY:

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LOT 393 LOWRIE ROAD AND LOT 287 SOUTH WESTERN HIGHWAY STORMWATER MANAGEMENT PLAN

Distribution List:

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Document Control for Job Number: MGML393

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Draft Report	Michael Dufty	Kirsi Kauhanen	14 January 2024
Final Report	Michael Dufty	Kirsi Kauhanen	27 February 2024

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APPENDICES

Appendix 1:	Hydrological Calculations — Lot 393 Lowrie Road
Appendix 2:	Hydrological Calculations — Lot 287 Southwestern Highway

1. INTRODUCTION

1.1 BACKGROUND AND SCOPE

Mario Michele Giacci is the owner of Lot 393 Lowrie Road (Lot 393) and Lot 287 South Western Highway (Lot 287) (the properties) in Gwindinup, located within the Shire of Capel (Figure 1). Mr Giacci holds Development Approvals (DA) and Extractive Industry Licences (EIL) from the Shire of Capel for extraction of sand and gravel on the properties. The most recent DA/EIL application for Lot 287 provides for the extension of extraction further to the east.

Shire of Capel Local Planning Policy LPP6.2 Extractive Industries specifies that DA and EIL applications include a Stormwater Management Plan. Previous DA condition (e) for Lot 393 (from 2022) also states following:

- e) *Prior to Commencement a detailed Engineering design plan of the stormwater disposal system shall be submitted for approval of the Shire of Capel, and thereafter implemented in accordance with the approved plan to the satisfaction of the Shire of Capel.*

This Stormwater Management Plan (SMP) has been prepared to address the above requirements. It has been developed with reference to the Department of Water and Environmental Regulation (DWER) submission to the 2019 DA/EIL applications, which recommend:

- Cut-off bunds will be constructed along boundaries to the Extractive Industry (EI) area to prevent any external runoff from entering active EI areas.
- All stormwater runoff from active EI areas shall be contained onsite initially, through detention ponds and settling pits, to achieve effective removal of sediment and turbidity.
- All runoff from active EI areas shall be contained onsite initially, through the detention pond (as described) to achieve effective removal of sediment and turbidity.
- Stormwater management structures shall be designed to manage at minimum the calculated runoff, with detention ponds / sediment traps designed and built to an adequate standard and capacity, prior to extraction beginning.
- Any EI licence include a condition whereby following the occurrence of a rainfall event greater than the 10-year / 2-hour Average Recurrence Interval, the proponent shall inspect the site and within 48 hours report to the Shire, with details of impacts and remediation actions (if required).
- Stormwater detention ponds include an overflow spillway, or acceptable alternative, to manage discharge of excess water in events up to and including the 100-year Average Recurrence Interval / 1% annual exceedance probability.
- A 'Stormwater Management Plan' be prepared, including details of the proposed measures taken to manage and contain calculated runoff within each stage of the proposed extractive activity.

This SMP (Rev7) supersedes all previous revisions of the plan. It includes amendments made following a review of stormwater leaving the site on Lot 393 in 2022 during high rainfall events. Key amendments include changing assumptions regarding soil profile and runoff coefficients (see Section 2.3) and pit depth (see Section 3), and increasing the size of the retention ponds (see Section 3.3). Indicative proposed locations for ponds and drains have been amended to match installation in areas that have been completed. At the time of preparation of this SMP, Stages 1 to 11 of Lot 287 and Stages 1 and 2, and most of 4 and 5 of Lot 393 have had extraction activities completed and rehabilitation works commenced.

1.2 OBJECTIVE

The objective of this SMP is to reduce the potential of impacts from extractive activities on downstream waters, specifically sediment and turbidity impacts caused by stormwater runoff from disturbed areas.

This will be achieved by the construction of stormwater management structures to contain initial runoff from extraction areas from rainfall events up to 10% Annual Exceedance Probability (AEP) and 2 hours duration. AEP is the currently preferred terminology for rainfall event probability, as used in the current edition of Australian Rainfall and Runoff (Ball et al. 2019). A 10% AEP event is equivalent to a 10-year Average Recurrence Interval specified in the DWER comments (see Section 1.1).

2. HYDROLOGY AND CATCHMENTS

2.1 CATCHMENTS

The project site is situated at the eastern edge of the catchment of Gynudup Brook, a tributary of the Capel River that discharges into the Indian Ocean at Geographe Bay. There are no watercourses at the site due to the well-draining soil and lack of upstream catchment area (the site is within 500 m of the upstream watershed). Almost the entire extraction area is within the Gynudup brook catchment, which drains west. A small area of proposed extraction (approximately 1.3 ha) at the eastern limit of the extraction area on Lot 287 is within the Preston River Catchment and drains east toward the Preston River. The location of the project site and relevant catchments are shown in Figure 1. Most of the Lot 287 extraction area is within the upstream catchment of Lot 393.

The extraction areas within the Gynudup Brook catchment slope to the northwest, while extraction areas in the Preston River catchment slope northeast and east (Figure 2). Surface flow is only likely to occur during intense rainfall events. Any surface flow leaving the extraction areas of Lot 287 does so across the western boundary into Lot 393, with the exception of the 1.3 ha in the Preston River catchment.

Any surface flow leaving Lot 393 does so across the western boundary adjacent to Morris Road. On the northern half of Lot 393, Morris Road has shallow open drains that direct runoff under the road and into the adjacent property through 300-mm culverts (Figure 2). This property contains the completed Gwindinup North mineral sand mine. The reconstructed landform includes a drainage/sumpland that flows southwest through minor water courses and drains to join Gynudup Brook. On the southern half of the boundary, Morris Road is an unformed dirt road and natural surface flow across the road to the west is possible as no roadside drainage is in place.

On Lot 287, any water leaving the extraction area that is located within the Preston River Catchment will drain toward the eastern property boundary, which adjoins the South Western Highway Road reserve — approximately 300 m from the extraction area. Any natural runoff from the eastern portion of Lot 287 (within Preston River catchment) also drains this way. Any flow leaving the property will be intercepted by the highway's drainage infrastructure, where it would mix with road and railway runoff that flows toward the Preston River, a further 200 m to the east.

The Gynudup Brook catchment downstream of the project site is almost entirely cleared agricultural land. Land use is primarily beef and dairy grazing. The hydrology of the catchment has been extensively modified as a result of agriculture and includes many artificial drains constructed to alleviate water logging. The Elgin Main Drain, located 12 km downstream of the project area, diverts all flow in Gynudup Brook at that point.

Nutrient concentrations in Gynudup Brook are elevated due to poor soils and agricultural land use. It is categorised as a 'recovery waterway' in the Revitalising Geographe Waterways initiative as nutrient concentrations do not meet water quality targets (DWER/DPIRD 2018).

The Preston River catchment is 1,136 km² with headwaters 80 km inland in the Darling Range and flows to Leschenault Estuary at Vittoria Bay near Bunbury. The hydrology is significantly altered via river straightening near the Bunbury township and a water supply dam (Glen Mervyn Dam). The Lower Preston catchment is about two thirds cleared. The catchment contains multiple sources of nutrient pollution including urban areas, beef and dairy grazing, abattoirs, Dardanup wastewater treatment plant, and septic tanks (DWER/DPIRD 2024).



2.2 RAINFALL AND CLIMATE

The properties experience warm summers and cold winters with a winter dominant rainfall pattern (BoM 2016a). Mean annual rainfall recorded by the Bureau of Meteorology (BoM) at Donnybrook (9 km southeast of Lot 393) is 970.4 mm (BoM 2024).

Rainfall Intensity Frequency Duration (IFD) data for the project site from the BoM is shown in Table 1. This data is from the 2016 revision of design rainfalls by BoM (BoM 2016b).

Table 1: Rainfall Intensity Frequency Duration Data for Lot 393 and Lot 287

Duration	Annual Exceedance Probability					
	50%	20%	10%	5%	2%	1%
1-h	19.9	25.8	30.0	34.5	40.8	46.0
2-h	25.4	32.8	38.3	44.0	52.2	58.9
3-h	29.3	37.9	44.3	51.0	60.6	68.6
6-h	37.5	48.7	57.2	66.1	78.8	89.4
12-h	47.7	62.1	73.0	84.5	101.0	115.0
24-h	59.6	77.2	90.3	104.0	124.0	141.0
48-h	73.2	93.0	107.0	122.0	144.0	161.0
72-h	82.5	103.0	118.0	132.0	153.0	170.0
96-h	90.5	112.0	126.0	140.0	161.0	177.0
120-h	98.1	120.0	134.0	148.0	168.0	183.0
144-h	106.0	128.0	142.0	156.0	175.0	190.0

Source: Bureau of Meteorology (BoM 2016b)

2.3 RUNOFF COEFFICIENT AND CATCHMENT YIELD

Over the various revisions of this SMP, guidance regarding runoff estimation methods has changed and therefore the runoff estimates have varied. This SMP Rev7 follows guidance provided in the revised Water Quality Protection Note No. 15 Basic Raw Materials Extraction (DWER 2019). This specifies that for calculation of runoff from the 10% AEP 2-hour rainfall event, a minimum runoff coefficient of 0.1 should be adopted for sand pit floors and 0.8 for gravel pits.

The soil profile in the extraction areas at both Lots 287 and 393 is sand over gravel, with material of higher clay content underneath. Majority of the sand and gravel will be removed by the planned excavation, with some sandy topsoil and overburden returned as part of rehabilitation. Based on this and supported by observations of high runoff from excavated areas in August 2022, the gravel pit coefficient has now been adopted for revised pond designs for the active and completed pit areas.

All calculations are provided in Appendix 1 and Appendix 2.

2.4 PEAK FLOW

Peak flows were estimated for a 1% AEP event for spillway design and drain capacity using the empirical rational method for the cleared catchment and using the Regional Flood Frequency Estimation (RFFE) model of the current edition of Australian Rainfall and Runoff (Ball et al. 2019) for rehabilitated or natural catchments. For the empirical method, a runoff coefficient of 0.54 was adopted based on a rolling catchment with bare ground in line with methods

in Carey et al. (2015). The time of concentration was calculated based on Horton's n of 0.275 (bare ground) (Carey et al. 2015).

Calculated flows are given in Table 2. All calculations are provided in Appendix 1 and Appendix 2.

Table 2: Calculated 1% AEP Peak Flows

Catchment	Area (ha)	1% AEP flow (m ³ /s)	Method
Upstream Catchment	31.9	0.25	RFFE
Lot 287 EIL Stages 1–19 (west)	32.9	4.5	Empirical Rational
Lot 287 Stage 20 (northeast)	1.8	0.3	Empirical Rational
Lot 287 Stage 21 (southeast)	0.5	0.1	Empirical Rational
Lot 393 Stages 1 and 2 combined.	3.2	0.53	Empirical Rational
Lot 393 Stage 3 and Lot 287 Stage 8 combined	2.9	0.53	Empirical Rational
Lot 393 Individual Stages (4 – 18)	2 (maximum)	0.41	Empirical Rational
Lot 393 Complete Excavation (bare ground)	31.4	4.20	Empirical Rational
Lot 393 Complete Excavation (rehabilitated)	31.4	0.26	RFFE

3. STORMWATER MANAGEMENT

3.1 OPERATIONAL CONTEXT

As described in the DA/EIL applications, extraction in Lot 393 is being carried out in 18 stages of approximately 2 ha each, commencing at the southern (upstream) end of the site and gradually moving north. Stages 1 and 2, and most of stages 4 and 5 have had extraction activities completed and rehabilitation works are underway. Operations are currently active in stages 6 to 9, including crushing and screening plant, material stockpiles, access track and turnaround area. Rehabilitation of these stages has commenced where possible, particularly along eastern batter slopes. Stage 3, at the common boundary of the properties, was cleared together with Stage 8 of Lot 287 and remains partly open to facilitate access to both properties. Going forward, extraction will proceed stage by stage, with a new stage commencing as an open stage is rehabilitated (landform reinstated, topsoil returned). Each stage will be excavated to full depth before commencement of the next stage of extraction.

Extraction in Lot 287 is being carried out in 21 stages, with each stage a maximum 2 ha in size, commencing at the western end of the property. At the time of writing of this plan, stages 1 to 11 have been excavated and are undergoing rehabilitation. Stages 12 to 21 are an extension to the previously approved pit and subject to a current DA/EIL application. Extraction is proposed to proceed stage by stage, with a new stage commencing as an open stage is rehabilitated (landform reinstated, topsoil returned).

3.2 DIVERSION BANKS

To divert 'clean' runoff from upstream catchments around the active extraction area, diversion banks will be constructed along sections of the eastern boundary of the Lot 393 extraction area and the southern boundary of the Lot 287 extraction area, with indicative alignments shown in Figure 2. Stage 3 of Lot 393 and Stage 8 of Lot 287 were developed together to connect the extraction area between the two properties and therefore no diversion banks are necessary along this section of property boundary. An additional diversion bank will be constructed along the northeast boundary of Lot 287 to prevent runoff from exiting the northern boundary (in line with pre-existing drainage management), instead diverting it to the eastern boundary (Figure 2).

Banks are to be constructed to the following specifications:

- Only clean material that is free of roots, stumps, or debris to be used.
- Minimum crest width — 0.5 m.
- Maximum bank grade — 2:1 (horizontal to vertical).
- Minimum height — 0.5 m.
- Aligned to ensure positive drainage.
- Runoff discharges downstream of active stage.

As the purpose of the diversion banks is to divert clean water from active extraction areas, the diversion banks will be removed when rehabilitation earthworks on the adjacent stage are completed. A maximum of two stages (250 m) in Lot 393 are expected to require diversion banks in place at any time. Diversion banks are not required on the south, west, or north sides of the Lot 393 extraction area as on those sides the natural topography of the site will result in no substantial surface flow into the extraction area. The diversion bund on the northeast boundary of Lot 287 will be kept permanently as it will support the pre-existing drainage arrangements along this boundary.

Maximum flood flow for the entire upstream catchment of the excavation area for a 1 % AEP flood event is 0.25 m³/s. This corresponds to a flow depth of 0.16 m at the diversion bund, providing 0.34 m freeboard. Since the flow diversion banks are split along the eastern boundary, they will not intercept runoff from the entire upstream catchment and peak flows experienced at the banks will be less than half the whole catchment flow. Flow calculations are provided in Appendix 1 and Appendix 2.

3.3 RETENTION PONDS AND CATCH DRAINS

On Lot 287, a major retention pond has been constructed in the northwest part of the extraction area (mainly stages 4 and 6), where extraction has already been completed. This pond has capacity to provide retention for runoff from the other west draining stages on Lot 287. Two smaller ponds are required in the future at the downstream edges of stages 20 and 21, as these stages drain eastwards away from the major retention pond. These two stages have separate catchments from the rest of the extraction area on Lot 287 and do not receive runoff from any other stages. Some minor runoff from the western edges of Lot 287 will enter stage 3 of Lot 393 and so, in this case, the pond catchments do not precisely match the stage areas. Further information on retention pond specifications is provided in Appendix 2 and Section 3.3.1.

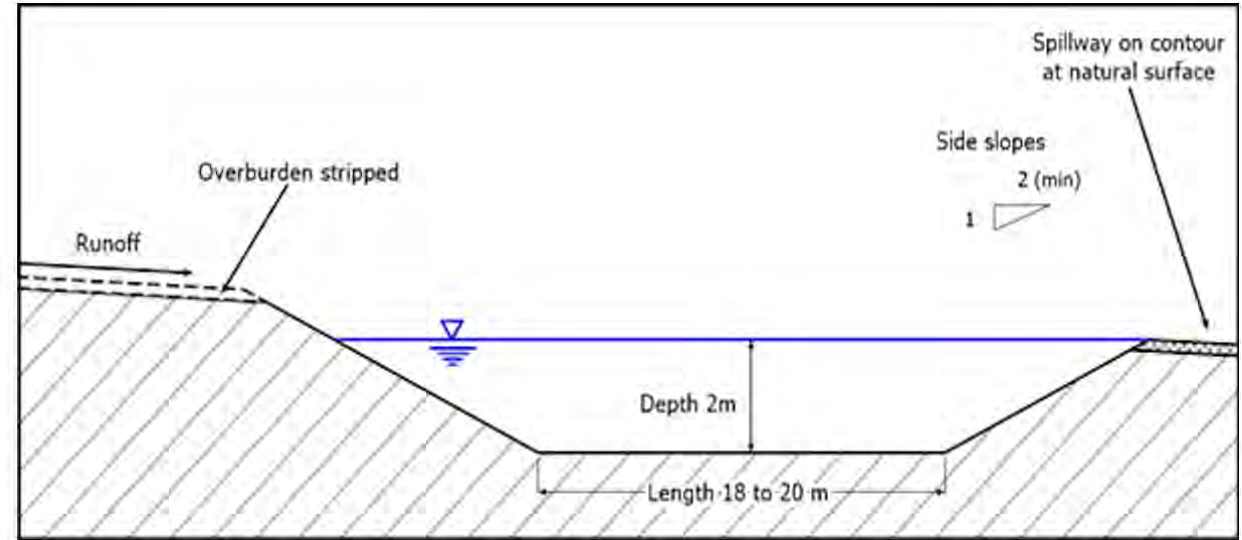
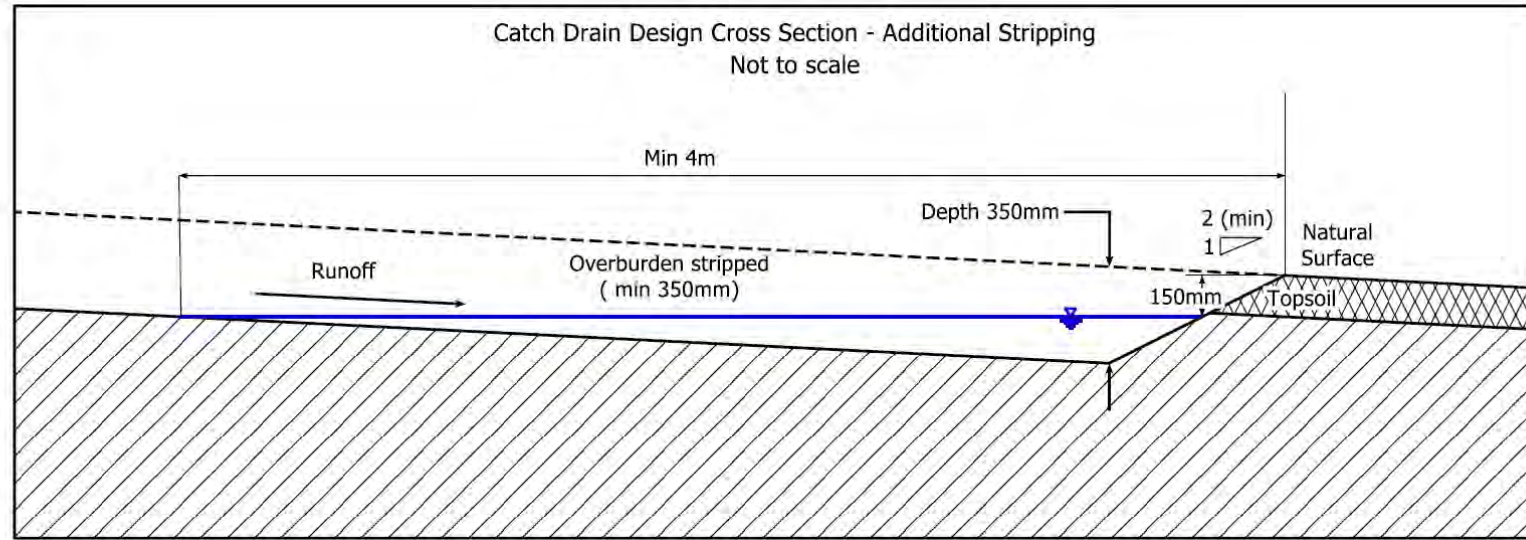
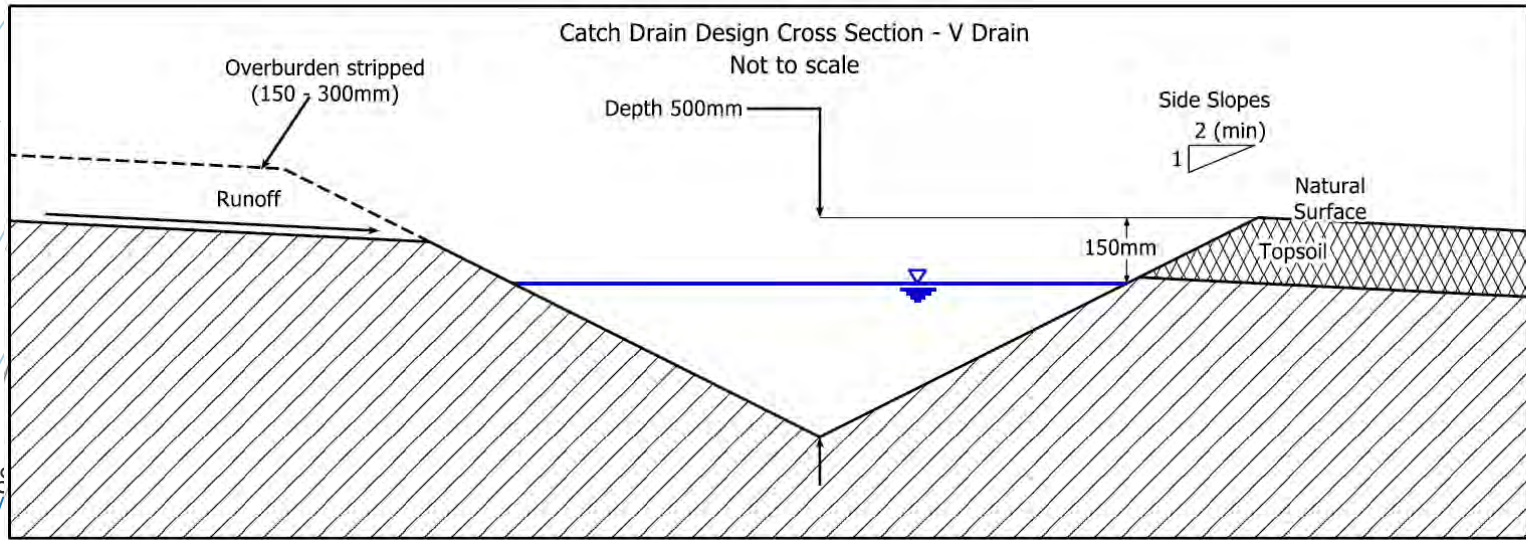
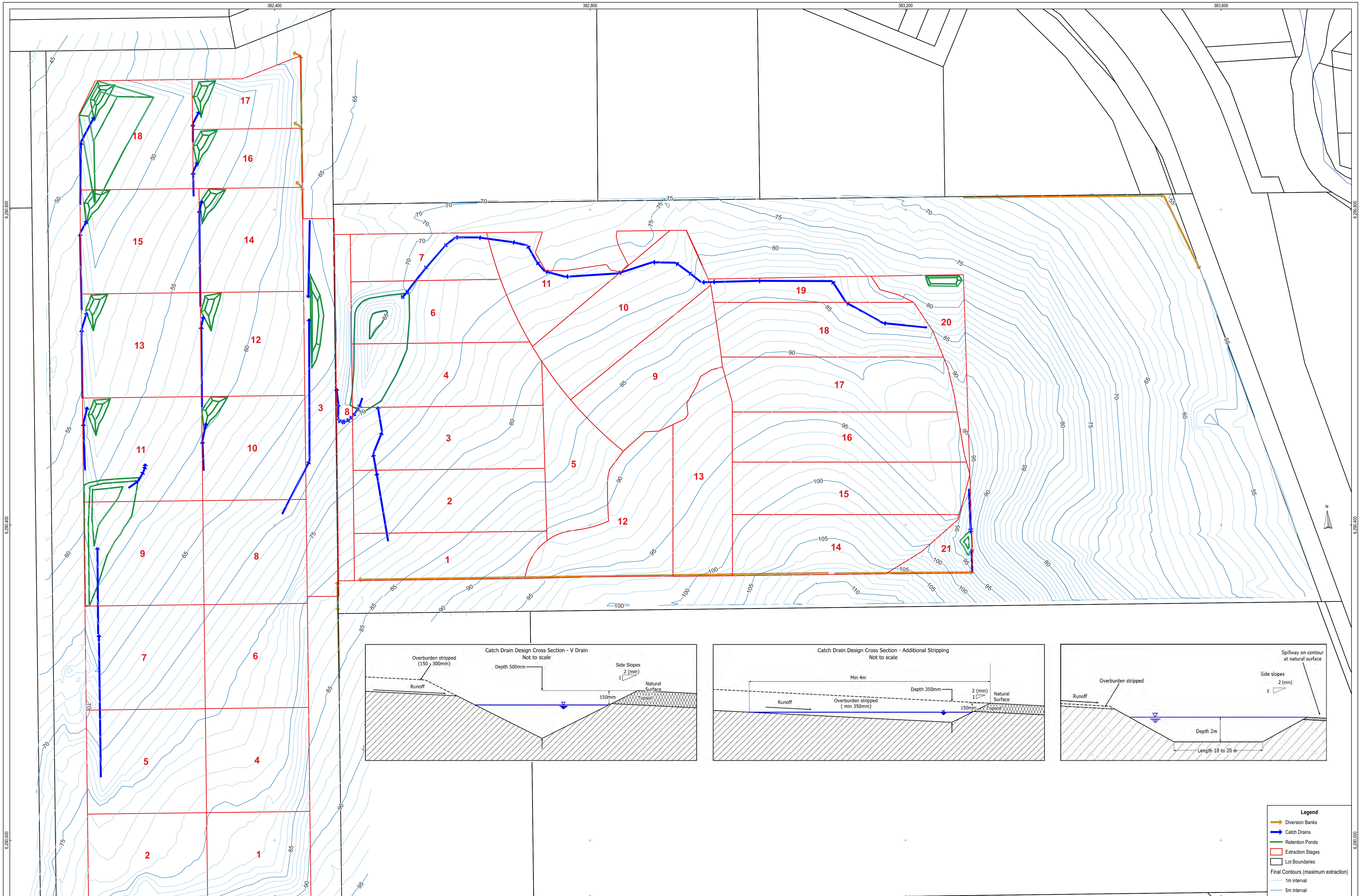
As extraction on Lot 393 commenced at the upstream (southern end) of the site, the approach to stormwater management is different to Lot 287. As presented in the previous revisions of the SMP, the initial calculations based on extraction to the maximum approved depth indicated that the resulting pit landform on Lot 393 would have sufficient water storage capacity to provide the required runoff retention. Additional retention was only expected to be required temporarily in the active stages that had not yet reached the final depth. However, extraction to August 2022 indicated that sand and gravel resource is not consistently present to the full approved depth of the pit, resulting in a shallower final pit depth that has insufficient capacity for runoff retention. Therefore, the stormwater management measures have been revised to increase runoff retention.

A large retention pond will be used to capture runoff from most of stages 1 to 9 (excluding stage 3) totalling approximately 15 ha. This pond is currently in stage 9, however the location may be adjusted as part of rehabilitation once the active operational areas move further north. This pond could be removed completely in the future if sufficient containment is installed downstream. Details of the retention volume and spillway size for this catchment are provided in Appendix 1 and Section 3.3.1.

For the remaining stages 10 to 18 on Lot 393, small ponds will be constructed gradually for each stage as the stage is commenced. Approximately 2-m depth containment ponds will need to be retained at each stage or alternatively, these ponds can be removed if downstream ponds are constructed to a larger size able to contain the runoff from upstream stages. The construction of small ponds for each stage could be avoided all together by constructing a large retention pond in the northwest (downstream) corner of the extraction area prior to proceeding with further stages. This option has been tentatively shown in Figure 2 in addition to the option of smaller ponds for each stage.

Catch drains will be constructed on the downstream boundaries of each stage to direct runoff to the corresponding retention pond (Figure 2). Stripping of topsoil and the removal of overburden at the time of clearing (and stockpiling this material on the downstream side, as described in the EIL application) will be sufficient to direct any runoff reaching the boundary of a stage into the retention pond.

Figure 2 shows the locations of stormwater management measures.



- Legend**
- ➡ Diversion Banks
 - ➡ Catch Drains
 - ▭ Retention Ponds
 - ▭ Extraction Stages
 - ▭ Lot Boundaries
 - ▭ Final Contours (maximum extraction)
 - ▭ 1m interval
 - ▭ 5m interval

Scale: 1: 2,090
Original Size: A1
Grid: GDA94 / MGA zone 50 (EPSG:28350)
0 100 200 m

Mario Michele Giacci
Lot 393 Lowrie Road and
Lot 297 Southwestern Highway
Stormwater Management Plan

Figure 2
Stormwater Management Measures

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MBS
ENVIRONMENTAL

3.3.1 Retention Pond Specification

Retention ponds are to be constructed with sufficient capacity to retain the 10% AEP 2-hour duration runoff volume from the upstream cleared area, assuming a runoff coefficient of 80%. Table 3 presents the required capacity for each retention pond. Details of calculations are provided in Appendix 1. The storage requirements can be met by constructing a 600 m³ capacity pond for each stage except Lot 287 Stages 20 and 21 (which require 260 m³ and 140 m³) and the major retention pond for Lot 287, which requires 10,400 m³. As the retention ponds are to be created by excavation of the natural surface, there is no embankment subject to failure due to overtopping and no requirement to maintain freeboard.

Lot 393 Stages 1 to 9 (excluding 3) are now directed to a retention pond in stage 9. This has an estimated capacity of 6,000 m³ to a full level of 61.5 m Australian Height Datum (mAHD). This is sufficient capacity for the upstream catchment of the pond, comprising most of Stages 1 to 9 (15 ha), which has a required containment volume of 4,596 m³. If retained, as this pond is constructed above-ground it will need freeboard to be maintained to avoid overtopping and potential wall failure. A spillway will be required to achieve this and should be constructed in natural ground to the east of the embankment at least 0.5 m below the minimum crest level of the embankment. The embankment should be constructed from selected material placed and compacted in controlled layers.

Table 3: Runoff Capacity Required for Retention Ponds

Lot	Stage	Area (ha)	10% AEP 2 hour Runoff Volume (m ³)
Lot 393	1 [#]	1.5	459.6
	2 [#]	1.7	520.9
	3*	2.9	888.6
	4 [#]	1.7	520.9
	5 [#]	2.0	612.8
	6 [#]	1.8	551.5
	7 [#]	2.0	612.8
	8 [#]	1.8	551.5
	9 [#]	2.0	612.8
	10	1.8	551.5
	11	1.9	582.2
	12	1.8	551.5
	13	1.9	582.2
	14	1.8	551.5
	15	1.9	582.2
	16	1.0	306.4
	17	1.0	306.4
	18	2.0	612.8
	Total to Stage 9 [#]	15.0	4,596
	Total 1 to 18	31.5	9,958
Lot 287	1 to 19*	32.5	9,970
	20	0.8	257
	21	0.5	139
	Total 1 to 21	33.8	10,367

* Stage 3 Lot 393 and stage 8 Lot 287 adjusted as some runoff flows between them.

[#] Stages 1 to 9 excluding Stage 3 directed to combined retention pond as of 2023.

Ponds other than the existing Lot 287 pond and Lot 393 Stage 9 pond are to be constructed to the following specification:

- Pond to be excavated below the natural surface.
- The downstream side of the pond to be constructed along the natural contour for a distance of at least 4 m to provide a level spreader discharge spillway in event of overtopping.
- Side slopes to be no steeper than 2:1 (horizontal to vertical).

Recommended pond depth is 2 m below surface, which will result in the pond dimensions shown in Figure 2, but deeper or shallower ponds are acceptable provided the specifications for containment volume and spillway are met. The designs shown in Figure 2 achieve the specification for ponds that are 2 m deep, with a spillway of 20-m length, and floor length of 18 m (20 m for stage 3).

As removal of product during excavation will result in a lowering of the surface level surrounding the retention ponds in the eastern stages of Lot 393, the ponds will need to either be excavated initially to a greater depth to allow for this, or deepened once excavation of the adjoining stage to the west commences. Alternatively, as described in Section 3.3, these small ponds can be removed or not constructed at all, if other sufficiently large containment is available downstream within the extraction area.

An effective level spreader spillway for the retention ponds is provided by the construction of the downstream edge on contour for a minimum length of 4 m. The 1% AEP flood flow is 0.53 m³/s for the largest catchment (Lot 393 Stage 3). Calculated flow depth for the minimum level spillway length of 4 m at this flow is 0.061 m. As the ponds are excavated, there is no possibility of embankment failure due to spillway erosion (see Appendix 1).

A schematic cross section of a retention pond meeting the specification is shown in Figure 3.

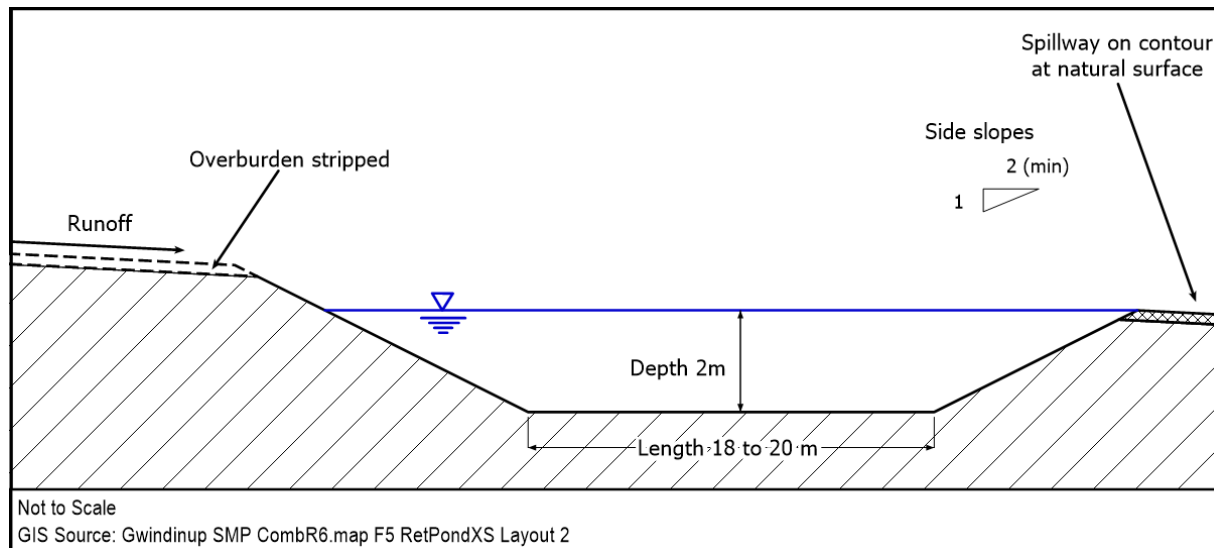


Figure 3: Retention Pond Design Cross-section

The main retention pond on Lot 287 was constructed during 2023 (Figure 4). This was constructed by a combination of excavation and building up of a downstream wall and provides retention volume for Stages 1 to 19 of Lot 287. The pond has a storage volume to full level (69 mAHD) of approximately 10,000 m³ with 1 m freeboard. This is sufficient to contain the design runoff for a 10% AEP 2-hour rainfall event, which is 9,970 kL (Table 3). This volume has been calculated based on DWER guidance for bare ground pit floors (Appendix 2). Actual runoff is expected to be much lower considering rehabilitation works will be completed progressively as extraction activity progresses. Furthermore, extraction activities have already been completed for Stages 1 to 11. The pond spillway is a channel

cut into natural ground to the south of the dam wall, maintaining separation between overflows and the dam wall to avoid risk of wall failure during overflow. This spillway needs to pass a 1% AEP flood peak flow of 4.5 m³/s with a maximum flow depth of 0.5 m.

The access track from Lowrie Road to Lots 393 and 287 currently runs immediately downstream (west) of the major retention pond. The access track includes drains and a culvert, which will act to concentrate any overflow from the pond. In order to manage and diffuse these flows, outflow from the culvert is directed to the retention pond in Lot 393 Stage 3, which, via a drain and spreader bunds, will discharge across the undisturbed pasture of Lot 393. The drain and spreader bunds will be moved as extraction on Lot 393 progresses to ensure discharge is not directed into active stages. Discharge will eventually move to completed areas once contour bunds are installed and vegetation reestablished.

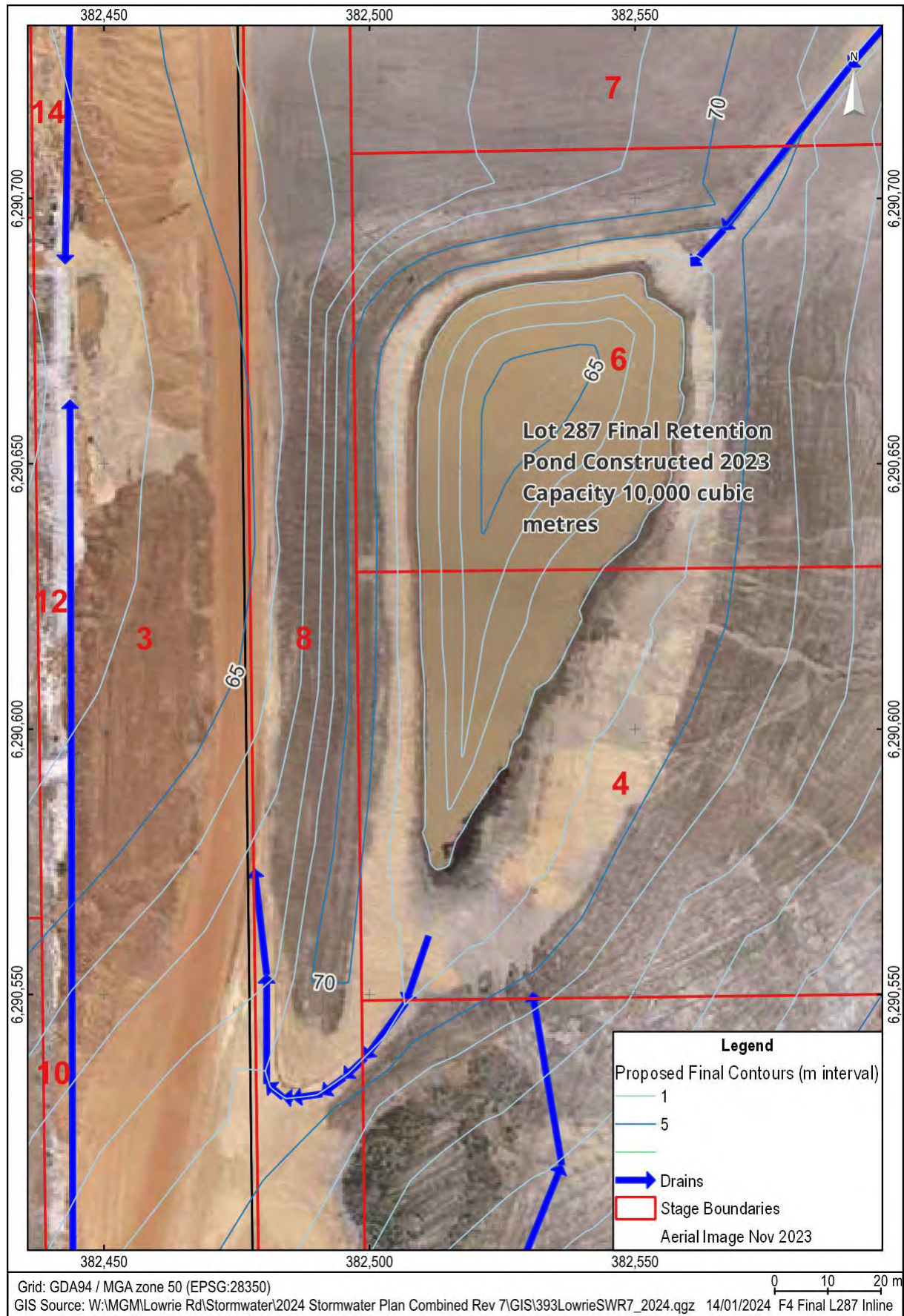


Figure 4: Major Retention Pond Lot 287

3.3.2 Catch Drain Specifications

Catch drains are to be constructed to the following specifications on each stage in Lot 393:

- Drains to follow the downstream external boundary of the stage (slope 3% to 4%, up to 20 m inside the boundary once final excavation is completed, as shown in Figure 2).
- Drains are to be constructed by excavation with side slopes no steeper than 2:1 (horizontal to vertical).
- Drains to have a constant fall from south to north.
- Drains to discharge into retention ponds.
- Drains to have capacity to transfer the 1% AEP peak flow from the adjacent stage with 150 mm freeboard.

The 1% AEP peak flow for the largest stage (stage 3: 0.53 m³/s) (Appendix 1). Either of the two options below for drain dimensions will satisfy the capacity requirements for all stages.

- V drain 500 mm depth below the natural ground surface with 2:1 (horizontal to vertical) side slopes (Figure 5).
- Additional stripping with removal of a minimum 350 mm overburden for at least 4 m to the east, with 2:1 (horizontal to vertical) side slope on the west side (Figure 6).

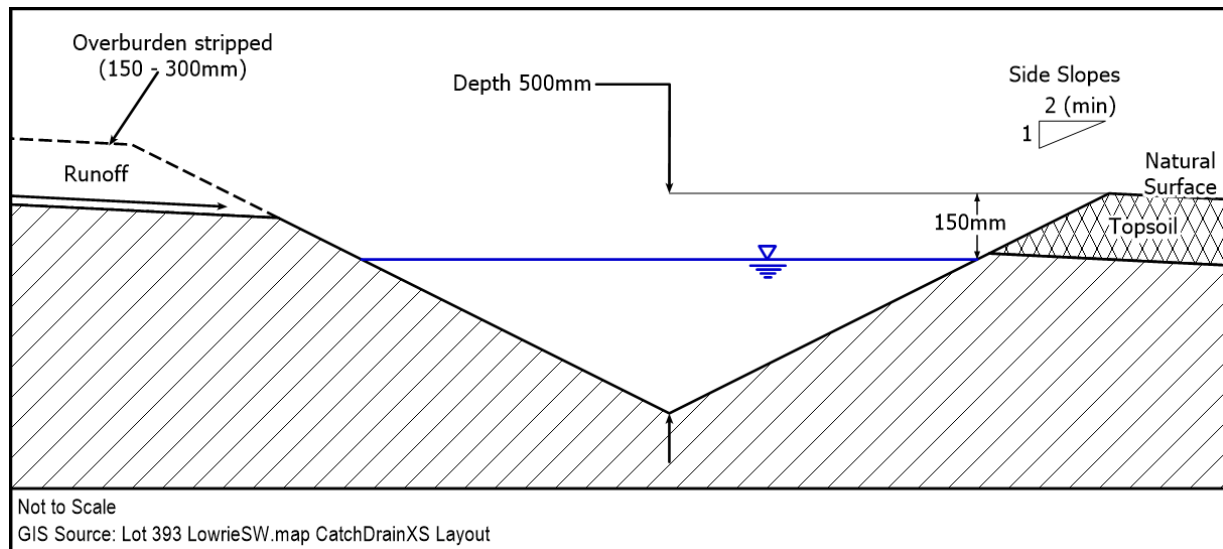


Figure 5: Catch Drain Design Cross-section — V Drain

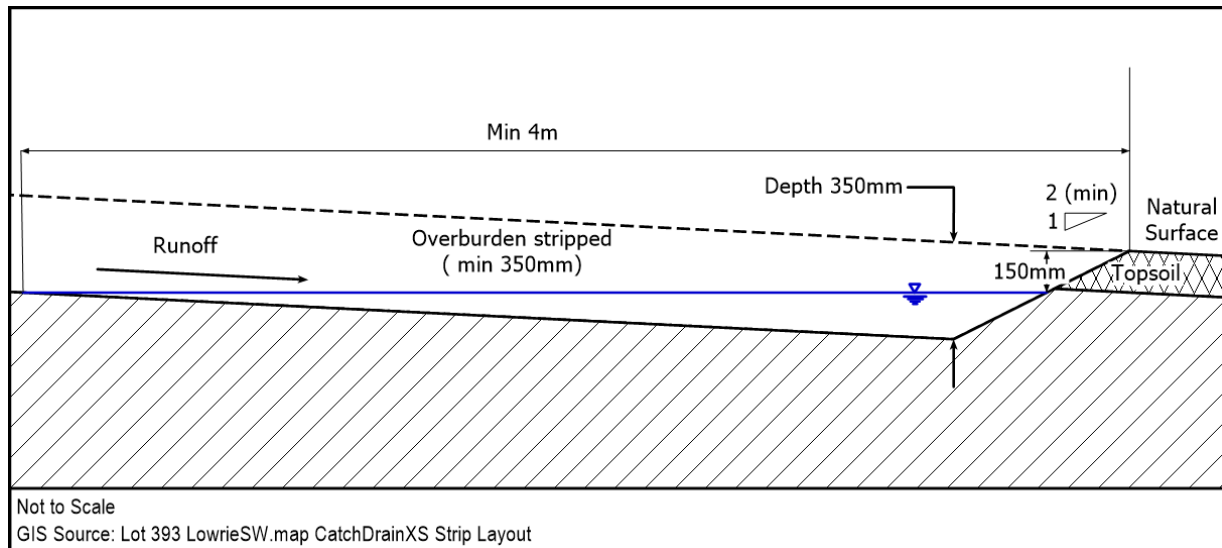


Figure 6: Catch Drain Design Cross-section — Additional Stripping

3.4 CONTOUR BANKS

To further manage runoff, increase infiltration, and reduce sediment movement post extraction, contour banks are to be constructed along the final landform contour at 100-m intervals. These are to be constructed during post mining rehabilitation works for each stage after completion of extraction.

Contour banks are to be constructed to the following specifications:

- Only clean material that is free of roots, stumps, or debris to be used.
- Minimum crest width – 0.5 m.
- Maximum bank grade – 2:1 (horizontal to vertical).
- Minimum height – 0.5 m.
- Aligned on the contour of the final landform.
- Joined to the final pit batters at each end.

Rehabilitation works for each stage will also include ripping along the contour to remove soil compaction and improve runoff infiltration and root penetration. Topsoil will be respread following ripping and vegetation established as described in the rehabilitation and decommissioning programs and the native vegetation rehabilitation plans for the properties.

4. MONITORING AND MAINTENANCE

All full inspection of stormwater management structures will be undertaken ahead of the commencement of seasonal autumn/winter rains and ahead of forecasted major out-of-season rainfall (e.g. summer rainfall due to cyclone activity). The purpose of these inspections is to check that everything is operational and to undertake maintenance as need be.

Catch drains and retention ponds will be inspected weekly during operations and within 24 hours after any runoff-producing rainfall events. Any slumps, bank damage, or loss of freeboard that would interfere with performance will be repaired to specification. Any fill material or sediment blocking the drain will be removed.

Following the occurrence of a rainfall event greater than the 10% AEP 2-hour duration (38.3 mm) or in the event of sediment laden runoff leaving the properties, a report will be made within 48 hours to the Shire of Capel detailing impacts and remediation actions (if any necessary).

5. ROLES AND RESPONSIBILITIES

Roles and responsibilities with respect to stormwater management are outline in Table 4.

Table 4: Roles and Responsibilities

Role	Responsibilities
EIL Licensee	• Responsible for overall implementation of this plan. • Will provide information for site personnel on stormwater management objectives and measures to be undertaken on site. • Responsible for reporting to Shire of Capel.
All personnel	• Will be familiar with stormwater management objectives. • Will implement stormwater management measures as outlined in this plan. • Responsible for reporting stormwater management issues to EIL Licensee.

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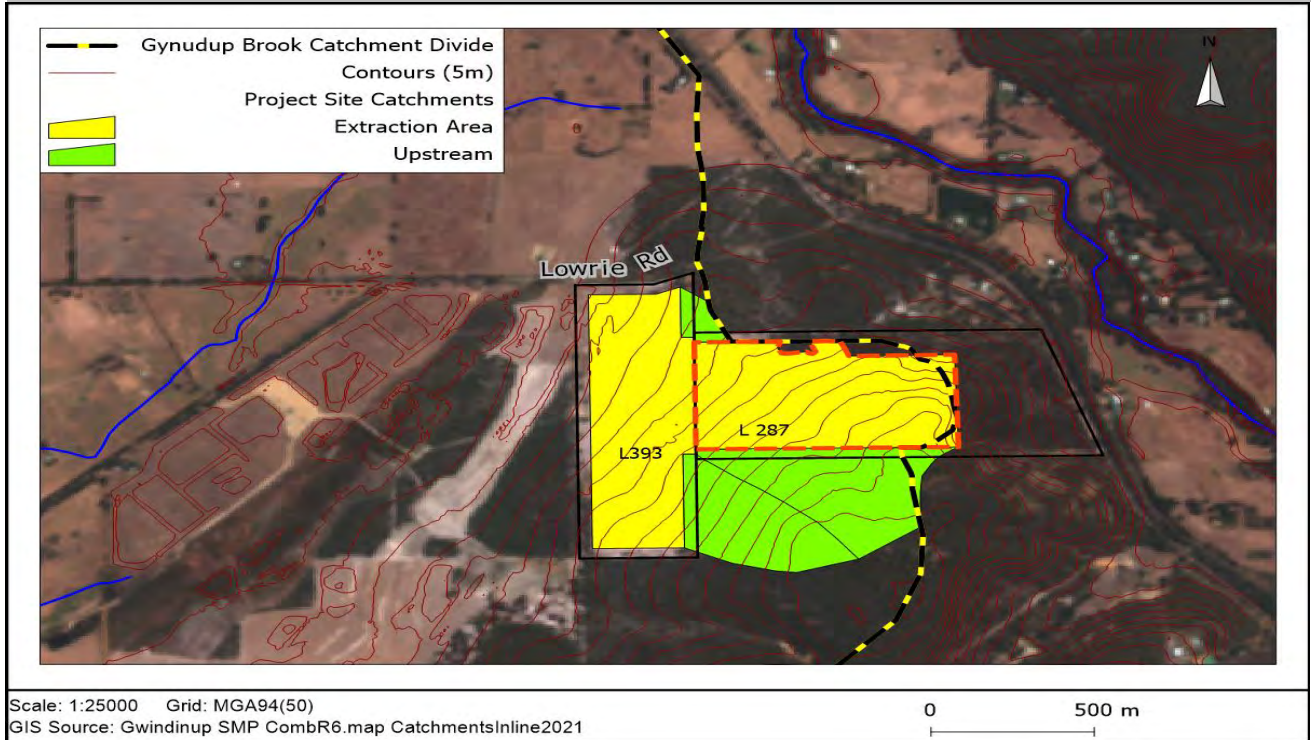
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APPENDICES

APPENDIX 1: HYDROLOGICAL CALCULATIONS — LOT 393 LOWRIE ROAD

A1.1 Project Site Location and Catchments



A1.2 Peak Flow Estimates for Vegetated Catchments (RFFE Method)

Peak Flow Estimate for Extraction Area (Stages 1 to 17) Lot 393 Lowrie Road

Results from ARR RFFE Model

<https://rffe.arr-software.org/>

Regional Flood Frequency Estimation Model for the 4th Edition of Australian Rainfall and Runoff

Input Data

Datetime: 2019-03-27 15:18

Region name: SW WA

Region code: 5

Site name: 393 Lowrie St 1-18

Latitude at catchment outlet (degree) = -33.5143

Longitude at catchment outlet (degree) = 115.731

Latitude at catchment centroid (degree) = -33.5193

Longitude at catchment centroid (degree) = 115.733

Distance of the nearest gauged catchment in the database (km) = 3.82

Catchment area (sq km) = 0.314

Design rainfall intensity, 1 in 2 AEP and 6 hr duration (mm/h): 6.248338

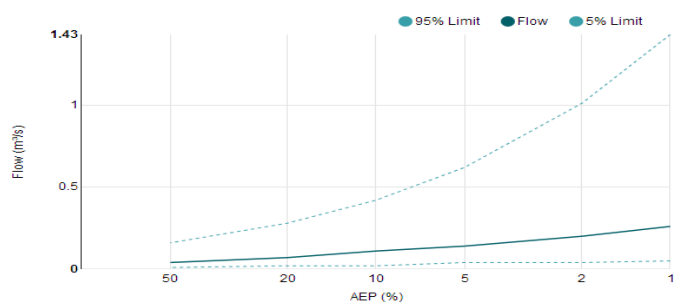
Design rainfall intensity, 1 in 50 AEP and 6 hr duration (mm/h): 13.147148

Shape factor of the ungauged catchment: 1.05

Catchment Location



Results



*The catchment is outside the recommended catchment size of 0.5 to 1,000 km². Results have lower accuracy and may not be directly applicable in practice.

AEP (%)	Discharge (m ³ /s)	Lower Confidence Limit (5%) (m ³ /s)	Upper Confidence Limit (95%) (m ³ /s)
50	0.04	0.01	0.16
20	0.07	0.02	0.28
10	0.11	0.02	0.42
5	0.14	0.04	0.62
2	0.2	0.04	1.01
1	0.26	0.05	1.43

Peak Flow Estimate for Upstream Catchment of Lot 393 Lowrie Road

Results from ARR RFFE Model

<https://rffe.arr-software.org/>

Regional Flood Frequency Estimation Model for the 4th Edition of Australian Rainfall and Runoff

Input Data

Datetime: 2021-02-11 18:55

Region name: SW WA

Region code: 5

Site name: Gwindinup Upstream Diversion

Latitude at catchment outlet (degree) = -33.5203

Longitude at catchment outlet (degree) = 115.7345

Latitude at catchment centroid (degree) = -33.5221

Longitude at catchment centroid (degree) = 115.7378

Distance of the nearest gauged catchment in the database (km) = 4.5

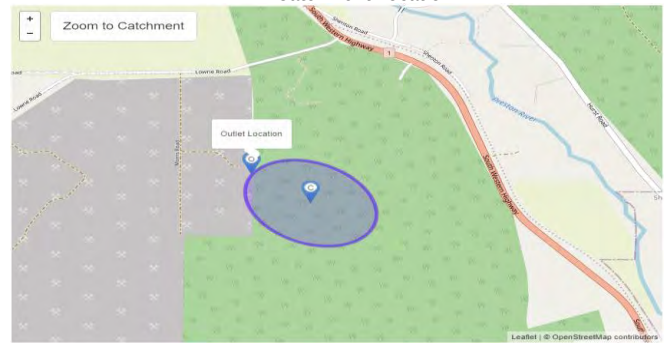
Catchment area (sq km) = 0.319

Design rainfall intensity, 1 in 2 AEP and 6 hr duration (mm/h): 6.248338

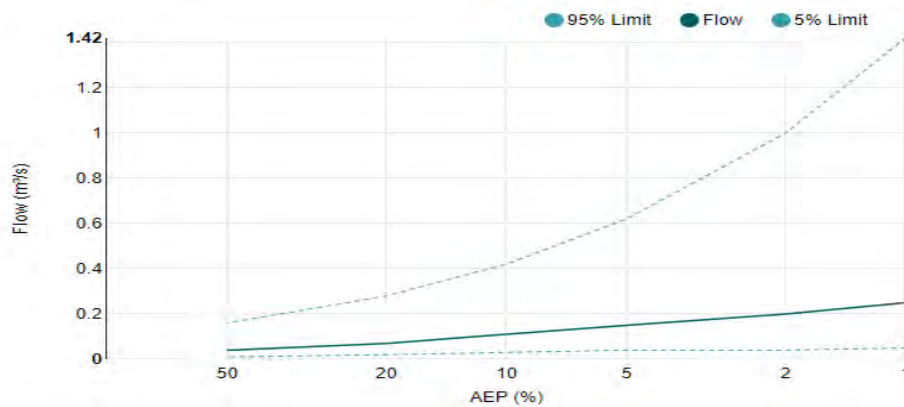
Design rainfall intensity, 1 in 50 AEP and 6 hr duration (mm/h): 13.147148

Shape factor of the ungauged catchment: 0.65

Catchment Location



Results



AEP (%)	Discharge (m³/s)	Lower Confidence Limit (5%) (m³/s)	Upper Confidence Limit (95%) (m³/s)
50	0.04	0.01	0.16
20	0.07	0.02	0.28
10	0.11	0.03	0.42
5	0.15	0.04	0.62
2	0.2	0.04	1
1	0.25	0.05	1.42

A1.2 Peak Flow Estimate for Bare Catchments (Empirical Rational Method)

Methods

Calculation methods from Soil Conservation Guidelines for Queensland, Ch4 Empirical Version of Rational Method

The Rational Method design equation is:

$$QY = 0.278 \cdot C_Y \cdot I_{tc,Y} \cdot A$$

C10 based on catchment characteristics

Slope	5.7%	(Rolling - 2 to 10%)
Permeability	High	
Condition	3	(Bare)
C ₁₀	0.3	

Rational Method Frequency Factors (C_Y / C₁₀):

ARI (years)	2	5	10	20	50	100
Frequency Factor	0.6	0.8	1	1.2	1.5	1.8

Calculations and Results

Complete Excavation Area (bare ground)

Horton n	0.0275	(bare surface)
Total Distance	1019	
Overland	390	
Drain	700	
t overland	15.1	minutes
t channel (1m/s)	11.7	minutes
t _c	26.8	minutes
t _c	0.45	hr
A	0.314	km ²
C ₁₀	0.300	

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)		100
Annual Exceedance Probability		1%
Coefficient	C _Y	0.54
Time of Conc rainfall intensity	I _{tc}	89.33
Peak Discharge (Rational)	Q _Y (m ³ /s)	4.2

Stage 9 Large Pond (as constructed)

Horton n	0.0275	(bare surface)
Total Distance	570	
Overland	570	
Drain	0	
t overland	17.2	minutes
t channel (1m/s)	0.0	minutes
t _c	17.2	minutes
t _c	0.29	hr
A	0.150	km ²
C ₁₀	0.300	

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)		100
Annual Exceedance Probability		1%
Coefficient	C _Y	0.54
Time of Conc rainfall intensity	I _{tc}	105.00
Peak Discharge (Rational)	Q _Y (m ³ /s)	2.4

Stage 1 & 2 and 3 (bare ground)

Horton n	0.0275	bare surface	
Total Distance	268		
Overland	268		
Drain	0		
t overland	13.3		
t channel (1m/s)	0.0		
t _c	13.3	minutes	
t _c	0.25	hr	(rounded to 15min)
A	0.032	km ²	
C ₁₀	0.300		

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)	10	100
Annual Exceedance Probability	10%	1%
Coefficient	C _y	0.30 0.54
Time of Conc rainfall intensity	Itc	72.00 110.80
Peak Discharge	Q _y (m ³ /s)	0.19 0.53

Individual Stages (4 to 18)

Horton n	0.0275	bare surface	
Total Distance	179		
Overland	179		
Drain	0		
t overland	11.7		
t channel (1m/s)	0.0		
t _c	11.7	minutes	
t _c	0.25	hr	(rounded to 15min)
A	0.020	km ²	
C ₁₀	0.300		

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)	10	100
Annual Exceedance Probability	10%	1%
Coefficient	C _y	0.30 0.54
Time of Conc rainfall intensity	Itc	90.00 138.00
Peak Discharge	Q _y (m ³ /s)	0.15 0.41

L287 Complete Excavation Area (bare ground)

Horton n	0.0275	(bare surface)	
Total Distance	500		
Overland	500		
Drain	0		
t overland	16.4	minutes	
t channel (1m/s)	0.0	minutes	
t _c	16.4	minutes	
t _c	0.27	hr	
A	0.184	km ²	
C ₁₀	0.300		

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)	100
Annual Exceedance Probability	1%
Coefficient	C _y 0.54
Time of Conc rainfall intensity	Itc 110.80
Peak Discharge (Rational)	Q _y (m ³ /s) 3.1

A1.3 Runoff Capacity Required for Retention Ponds

Runoff volume calculation for 10% AEP 2 hour duration event from bare ground for retention pond capacity.

Runoff based on WQPN 15 (DWER 2019) coefficient for gravel pits

P (mm)	38.3	10% AEP, 2 hour rainfall (mm)
Runoff Coefficient	0.80	
Runoff (mm)	30.6	

Runoff Volume for Catchments

Stage	Area (ha)	Runoff	Runoff Volume
		(mm)	(m ³)
1	1.5	30.6	459.6
2	1.7	30.6	520.9
3*	2.9	30.6	888.6
4	1.7	30.6	520.9
5	2.0	30.6	612.8
6	1.8	30.6	551.5
7	2.0	30.6	612.8
8	1.8	30.6	551.5
9	2.0	30.6	612.8
10	1.8	30.6	551.5
11	1.9	30.6	582.2
12	1.8	30.6	551.5
13	1.9	30.6	582.2
14	1.8	30.6	551.5
15	1.9	30.6	582.2
16	1.0	30.6	306.4
17	1.0	30.6	306.4
18	2.0	30.6	612.8
Total 1 to 18	32.5	30.6	9958.0
Stage 9 Large Pond**	15.0	30.6	4596.0

*3 includes some runoff from L287 Stage 8

** includes most of stages 1 to 9, excluding 3

A1.4 Hydraulic Flow Depth Calculations

Flood Levels for Peak Flows were estimated using Manning's Equation for an irregular channel.
Calculations were done with the HY-8 hydraulic analysis package version 7.6 (US Federal Highway Administration, 2019).

Diversion Banks

Channel bank 2:1 downstream, 20:1 upstream.
Slope 3.00% 0.03 m/m
Mannings n of 0.035 was used for the channel (natural channel, irregular, rough).

Channel Cross Section Definition

No.	Dist	Elevation	Mannings n
1	0	1	0.02
2	2	0	0.02
3	22	1	0.02

Hy-8 Output

AEP	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1%	0.25	0.16	0.16	0.948	49.881

Temporary Retention Pond Spillway

4m wide level spillway on natural terrain
Slope 5.00% 0.05 m/m
Mannings n of 0.02 was used (earth,uniform clean).

Channel Cross Section Definition

No.	Dist	Elevation	Mannings n
1	0	0.3	0.02
2	10	0	0.02
3	14	0	0.02
4	24	0.3	0.02

Hy-8 Output

AEP	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1%	0.53	0.06	0.06	1.431	30.037

Catch Drain (V drain)

Channel bank 2:1 downstream and upstream.

Slope 5.00% 0.05 m/m

Mannings n of 0.02 was used (earth,uniform clean).

Hy-8 Output

AEP	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1%	0.53	0.33	0.33	2.422	97.264

Catch Drain (Additional Excavation)

Channel bank 2:1 downstream, 20:1 upstream.

Slope 3.00% 0.03 m/m

Mannings n of 0.02 was used (earth,uniform clean).

Channel Cross Section Definition

No.	Dist	Elevation	Mannings n
1	0	1	0.02
2	2	0	0.02
3	20	1	0.02

Hy-8 Output

AEP	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1%	0.53	0.18	0.18	1.702	51.897

Final Excavation Spillway

45m wide level spillway on natural terrain

Slope 5.00% 0.05 m/m

Mannings n of 0.02 was used (earth,uniform clean).

Channel Cross Section Definition

No.	Dist	Elevation	Mannings n
1	0	49	0.02
2	8.5	48	0.02
3	53.5	48	0.02
4	78	49	0.02

Hy-8 Output

Flow	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1% AEP, Lot 393 only	4.20	48.06	0.06	1.622	27.63
1% AEP, Lot 393 and Lot 287	8.70	48.09	0.09	2.15	42.67

Stage 9 Large Pond Spillway

Trapezoidal drain on natural terrain

Slope 3.00% 0.03 m/m

Mannings n of 0.02 was used (earth,uniform clean).

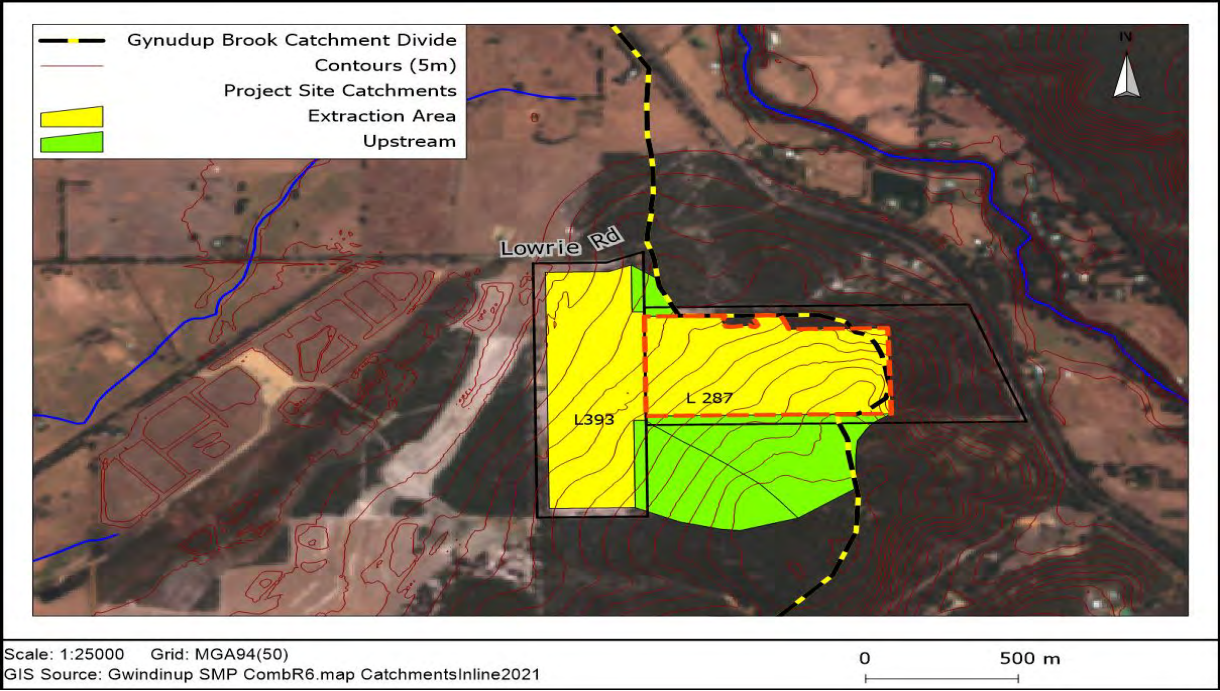
Channel Type:	Trapezoidal
Bottom Width:	2
Side Slope (H:V):	2.0:1

Hy-8 Output

Flow	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1% AEP, Stage 9 large pond	4.20	48.06	0.40	3.815	116

APPENDIX 2: HYDROLOGICAL CALCULATIONS — LOT 287 SOUTHWESTERN HIGHWAY

A2.1 Project Site Location and Catchments



A2.2 Peak Flow Estimate for Bare Catchments (Empirical Rational Method)

Methods

Calculation methods from Soil Conservation Guidelines for Queensland, Ch4 Empirical Version of Rational Method

The Rational Method design equation is:

$QY = 0.278 \cdot C_Y \cdot I_{tc} \cdot A$

C10 based on catchment characteristics

Slope	5.7%	(Rolling - 2 to 10%)
Permeability	High	
Condition	3	(Bare)
C ₁₀	0.3	

Rational Method Frequency Factors (C_Y / C₁₀):

ARI (years)	2	5	10	20	50	100
Frequency Factor	0.6	0.8	1	1.2	1.5	1.8

Calculations and Results

L287 Excavation Area (bare ground)

	Main Pit	Stage 21	Stage 22
Horton n	0.0275	0.0275	0.0275
Total Distance (m)	980	300	100
Overland (m)	980	300	100
Drain (m)	0	0	0
t overland (min)	20.6	13.9	9.6
t channel (min)	0.0	0.0	0.0
t _c (min)	20.6	13.9	9.6
t _c (hr)	0.34	0.23	0.16
A (km ²)	0.326	0.018	0.005
C ₁₀	0.300	0.300	0.300

(Rainfall intensity based on ARR 2016)

Average Recurrence Interval (years)		100	100	100
Annual Exceedance Probability		1%	1%	1%
Coefficient	C _v	0.54	0.54	0.54
Time of Conc rainfall intensity	t _{tc}	91.60	110.80	138.00
Peak Discharge (Rational)	Q _v (m ³ /s)	4.5	0.3	0.1

A2.3 Runoff Capacity Required for Retention Ponds in L287

Runoff volume calculation for 10% AEP 2 hour duration event from bare ground for retention pond capacity.

Runoff based on WQPN 15 (DWER 2019) coefficient for gravel pits

P (mm)	38.3	10% AEP, 2 hour rainfall (mm)
Runoff Coefficient	0.80	
Runoff (mm)	30.6	

Runoff Volume

Stage	Area (ha)	Runoff	Runoff Volume
		(mm)	(m ³)
Stages 1 to 19 (draining west to main pond)	32.5	30.6	9,970
Stage 20 (NE Pond)	0.8	30.6	257
Stage 21 (SE Pond)	0.5	30.6	139
Total	33.8	30.6	10,367

A2.4 Hydraulic Flow Depth Calculations

Flood Levels for Peak Flows were estimated using Manning's Equation for an irregular channel. Calculations were done with the HY-8 hydraulic analysis package version 7.6 (US Federal Highway Administration, 2019).

Permanent Retention Pond Spillway

Trapezoidal drain on natural terrain

Slope 3.00% 0.03 m/m

Mannings n of 0.02 was used (earth, uniform clean).

Channel Type:	Trapezoidal
Bottom Width:	2
Side Slope (H:V):	2.0:1

Hy-8 Output

Flow	Flow (m ³ /s)	Elevation (m)	depth(m)	velocity (m/s)	shear (pa)
1% AEP, Lot 287	4.50	69.51	0.51	3.44	150.35

APPENDIX 9: DUST MANAGEMENT PLAN

LOT 287 SOUTH WESTERN HWY, GWINDINUP

DUST MANAGEMENT PLAN

PREPARED FOR:

MARIO MICHELE GIACCI

MARCH 2024

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LOT 287 SOUTH WESTERN HIGHWAY, GWINDINUP DUST MANAGEMENT PLAN

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APPENDICES

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1. INTRODUCTION

1.1 PURPOSE

Mario Michele Giacci (the applicant) has an existing Development Approval (DA) and Extractive Industry Licence (EIL) for the extraction of sand and gravel on Lot 287 South Western Highway, Gwindinup (the property) within the Shire of Capel (Figure 1). The applicant is proposing to expand extraction operations on Lot 287 by an additional 15.31 ha in an easterly direction, which requires an updated Dust Management Plan (DMP).

This DMP was prepared in accordance with the Department of Environment and Conservation's (DEC — now Department of Water and Environmental Regulation) *"A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities"* (DEC 2011). This DMP should be read in conjunction with the DA and EIL report.

1.2 SCOPE

The scope of this DMP includes the following:

- Description of the existing environment and identification of sensitive receptors.
- Identification of potential sources of dust associated with the operations.
- Identification of roles and responsibilities.
- A site risk assessment for dust.
- Description of appropriate dust prevention, monitoring, and mitigation measures.
- A dust complaints process.

1.3 OBJECTIVE

The objective of this DMP is to minimise dust emissions generated by sand and gravel extraction operations on Lot 287.



Scale: 1:300000 Original Size: A4 Image: ESRI World Imagery Grid: GDA94 / MGA zone 50 0 5 10 km	Mario Michele Giacci Lot 287 South Western Highway, Gwindinup	Figure 1 Location	Martinick Bosch Sell Pty Ltd 4 Cook St West Perth WA 6005 Australia t: +61 8 9226 3166 info@mbsenvironmental.com.au www.mbsenvironmental.com.au MBS ENVIRONMENTAL
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2. EXISTING ENVIRONMENT

2.1 CLIMATE

The climate of the project area is Mediterranean, with cool wet winters and hot dry summers. Bureau of Meteorology (BoM) long-term average climate data for the closest meteorological station (Donnybrook, 9 km southeast of the property) is shown in Figure 3. The average annual rainfall is 970.4 mm, mean minimum temperatures between 5 and 15°C and mean maximum temperatures between 16 and 31°C (BoM 2023).

Long-term wind roses for Donnybrook (BoM 2023) indicate prevailing winds comprise morning easterlies and afternoon westerlies (Appendix 1).

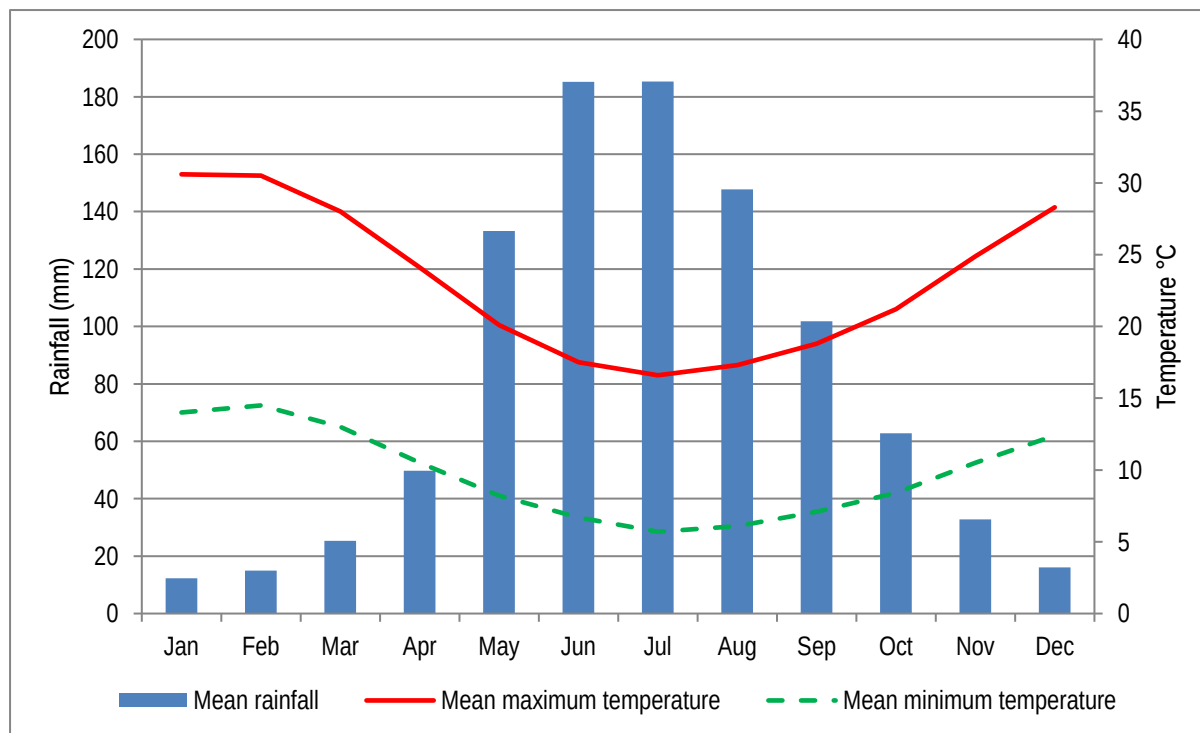


Figure 3: Climate Statistics (1900–2023) for BoM Station 9534

2.2 LAND USE

Lot 287 is located on South Western Highway within the Shire of Capel, approximately 3.5 km south of Boyanup and approximately 26 km southeast of Bunbury (Figure 1). The property covers a total area of 60.01 ha and is zoned Rural under the Shire of Capel Local Planning Scheme (LPS) No.8 and the Greater Bunbury Region Scheme (WA Gov 2014). LPS No.8 maps the property within three Special Control Areas (SCA): SCA4 — Transport Corridors, SCA6 — Strategic Minerals and Basic Raw Materials, and SCA8 — Regional Ecological Linkages (Shire of Capel 2023).

A 'Highway Protection Line' straddles the property along its eastern highway road frontage and delineates an area (100 m distance from either side of the centre line of the road), which is defined as the 'Highway Protection Area'. The purpose of the 'Highway Protection Area' is to protect the function, amenity, and visual character of the Highway. The proposed extraction area is well outside the 'Highway Protection Area'.

The property contains no buildings. In addition to the active extraction area on the western side of the property, Lot 287 contains a blue gum plantation with pockets of remnant native vegetation (Figure 2).

2.3 LANDFORM AND SOILS

The highest point on Lot 287 is situated approximately halfway along the southern property boundary and has an elevation of 111 m Australian Height Datum (mAHD) (Figure 2). From this point, the land to the west and north slopes and undulates downward at gradients between approximately 1:10 and 1:20. Near the northern boundary there are steep areas of approximately 1:6. To the east of the proposed extraction area lies the steepest gradients on the property, which slope towards the South Western Highway at gradients up to 1:6 within the proposed extraction area and 1:4 further east, beyond the proposed EIL boundary line. Within the proposed extraction area, the highest point is 109 mAHD in the south and the lowest point is 78 mAHD in the northeast (Figure 2).

Three soil and landform mapping systems are mapped within and surrounding the proposed extraction area (DPIRD-064):

- Whicher Scarp System: Low scarp and raised platform, on the northern edge of the Donnybrook Sunkland. Sandy gravel and pale deep sands, loamy gravel, and non-saline wet soils. Jarrah-marri forest and woodland.
- Goodwood Valleys System: Valleys, of the Donnybrook Sunkland. Sandy gravel, loamy gravel, and deep sand. Jarrah-marri forest and woodland.
- Blackwood Plateau System: Lateritic plateau in the Donnybrook Sunkland. Sandy gravel, loamy gravel, and deep sand. Jarrah-marri forest.

The proposed expansion to the extraction area is mostly located within the Goodwood Valleys System. Extraction on the property so far has shown that there is a layer of sand, of varying depth, that overlies the gravel.

Lot 287 is located away from wetlands and waterways on well-draining soils. The Australian Soil Resource Information System maps the property as 'Extremely Low Probability/Low Confidence' for the risk of acid sulfate soil (CSIRO 2014).

2.4 VEGETATION

Lot 287 contains a mosaic of remnant native vegetation, blue gum plantation, extraction operation, and some cleared land. There is approximately 19 ha of native vegetation, split into several patches. Reconnaissance flora and vegetation survey (Marsh 2019) identified three native vegetation types and an introduced vegetation type in the proposed extraction area:

- VT1: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low woodland of *Banksia grandis* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii*.
- VT2: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea gracilis*.
- VT3: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low sparse shrubland of *Xanthorrhoea preissii* and *Hibbertia hypericoides*.
- D: Disturbed: Blue gum plantations, tracks, and clearings.

The native vegetation communities vary in condition from Degraded to Very Good – Good (using condition scale by Keighery 1994) and show signs of multiple historical disturbances including selective logging, fire, weeds, and *Phytophthora cinnamomi* (dieback). Currently there is disturbance in the form of cleared tracks and small bare areas. The blue gum plantation areas have been completely cleared of native vegetation in the past.

No Threatened or Priority Ecological Communities or Threatened or Priority flora species have been recorded at Lot 287. Several weed species have been recorded but no Declared Pest species or weeds of national significance (Marsh 2019).

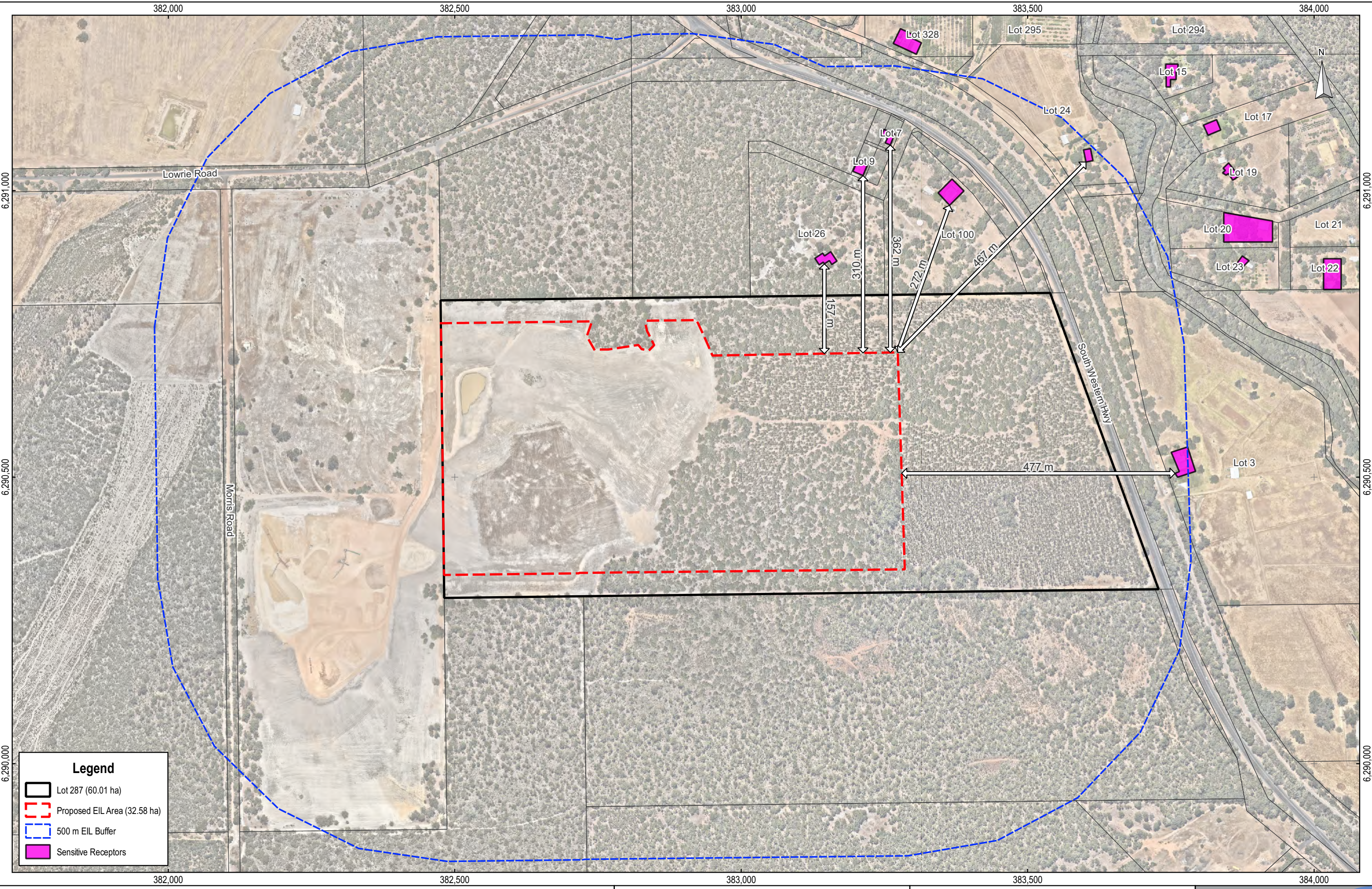
2.5 SENSITIVE RECEPTORS

The land surrounding Lot 287 is zoned either 'Rural', 'State Forest', 'Regional Open Space', or 'Primary Regional Road' (Shire of Capel 2023). They include land uses of sand and gravel extraction, remnant bushland, state forest, and residential dwellings (Figure 4).

The main sensitive receptors in the area are the residential dwellings on other rural properties. The closest receptor is a residential dwelling to the north on Lot 26, located 157 m from the proposed EIL area. Dwellings within 500 m of the extraction area are summarised in Table 1 and shown in Figure 4. It is noted that there is a sand and gravel extraction site on Lot 393 located immediately west of the property.

Table 1: Sensitive Receptors within 500 m of Extractive Operations

Property Details	Distance and Direction from Operations	Type of Receptor
Lot 26 (Plan 143766)	157 m north	Residential dwelling, outbuildings, and a dam
Lot 100 (Plan 44666)	272 m northeast	Residential dwelling and outbuildings
Lot 9 (Plan 130054)	310 m north	Residential dwelling and outbuildings
Lot 7 (Plan 130054)	362 m north	Residential dwelling and outbuildings
Lot 24 (Plan 143273)	467 m northeast	Residential dwelling and outbuildings
Lot 3 (Plan 5336)	477 m east	Residential dwelling and outbuildings



Legend

- Lot 287 (60.01 ha)
- Proposed EIL Area (32.58 ha)
- 500 m EIL Buffer
- Sensitive Receptors

Scale: 1: 6,000
Original Size: A3
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 100 200 m

Mario Michele Giacci
Lot 287 South Western Highway, Gwindinup

Figure 4

Sensitive Receptors

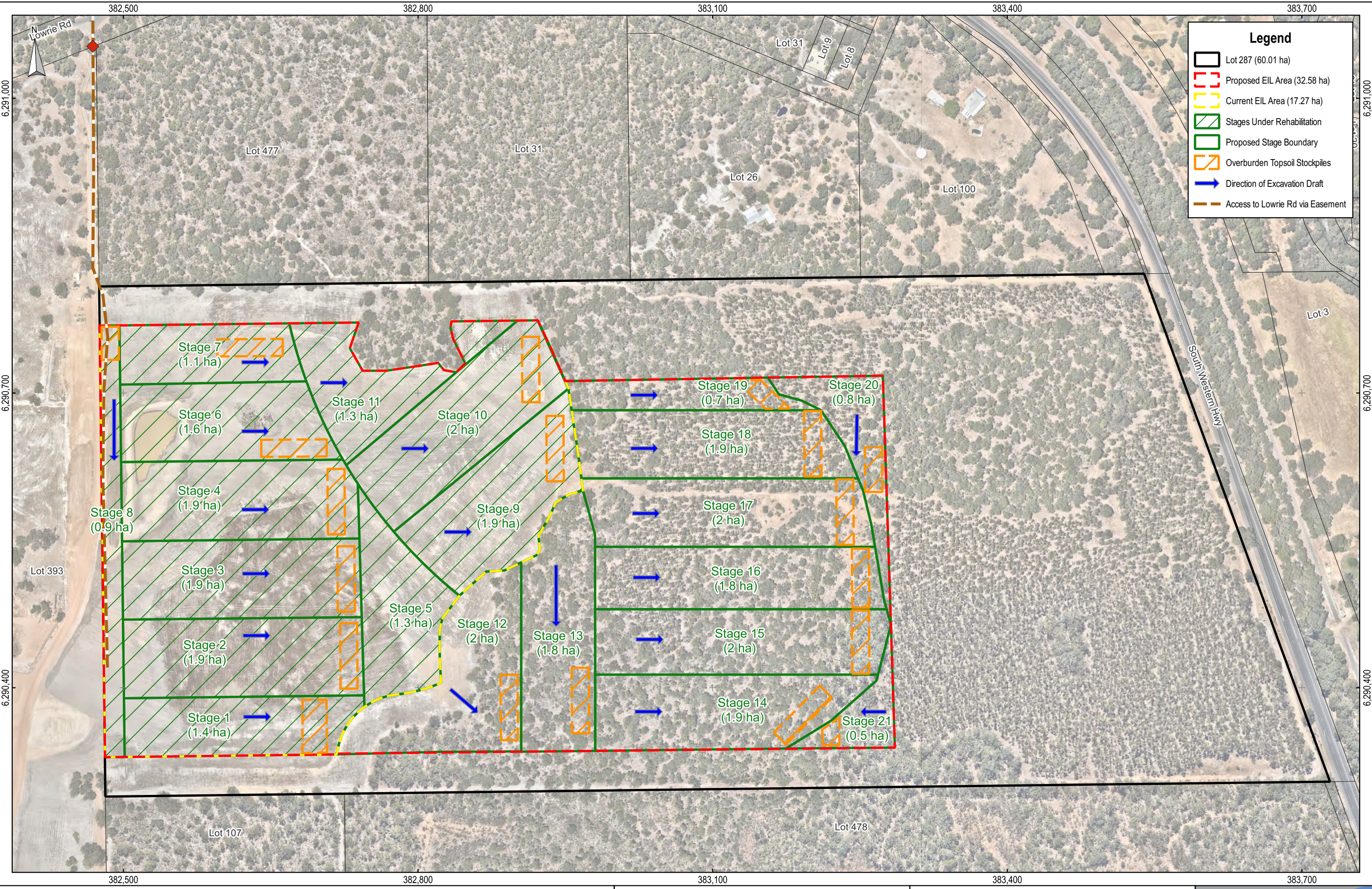
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3. POTENTIAL SOURCES OF DUST

The proposed project layout is shown in Figure 5. Potential sources of dust associated with the sand and gravel extraction operations include following:

- Vegetation clearing, topsoil stripping, and stockpiling.
- Sand and gravel extraction, crushing, stockpiling, and loading activities.
- Wind-borne dust from exposed surfaces, including cleared land, topsoil and resource stockpiles, and tracks.
- Vehicle movements on internal unpaved roads.
- Loading of haulage trucks.
- Poorly contained truck loads.
- Rehabilitation works, including final contouring, ripping, and spreading of topsoil and other materials.



Scale: 1: 3,500
Original Size: A3
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 100 200 m

W:\MGM\South West Hwy\GIS-Common\2024 Management Plans\MGM Lot 287 South West Hwy 2024.qgz 07/03/2024 F4 Works and Excavation Plan

Mario Michele Giacci
Lot 287 South Western Highway, Gwindinup

Figure 5

Works and Excavation Plan

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4. SITE RISK ASSESSMENT

Dust potentially generated as part of the extraction operations is expected to be free of contaminants and pollutants. The adverse effects of dust generation from the site would typically be 'nuisance dust'.

A risk assessment was prepared based on the DEC *"A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities"* (DEC 2011). The risk assessment for the proposed extractive operations is provided in Appendix 2.

It calculates the risk of dust impacts and the need for management controls based on the nature of the site and the proposed operations as well as the proximity of sensitive receptors and prevailing winds. The risk assessment assumes that vegetation clearing will be gradual and proceed in stages and that revegetation will follow gradually in stages as well. Prevailing summer winds are morning easterlies and afternoon westerlies, and these have been taken into consideration in the risk assessment.

A site classification score of 396 was calculated for the on-site works, placing this development in a Classification 2 (Low Risk) category (between 200 and 399 points). Based on the Low Risk classification, the following are required (DEC 2011):

- Contingency plan detailing activities to be undertaken should dust impacts occur.
- Monitoring requirements.

These are both addressed in Section 5.

The main sensitive receptor is the closest residential dwelling located 157 m to the north of the extraction area. The residence is well screened by vegetation and is not downwind of the site under prevailing summer winds. The other nearby residences are located further away (272 m, 310 m, 362 m, 467m, and 477 m) from the extractive operations and are also screened by vegetation. Therefore, dust impacts to these residences are not likely to be significant with dust management actions in place (see Section 5).

5. DUST MANAGEMENT ACTIONS

5.1 DUST PREVENTION

The Site operator will implement the following measures to prevent dust generation from site activities:

- Vegetation clearing and topsoil removal will only be undertaken on days of conducive wind strength and conditions to ensure windblown dust is minimised.
- Vegetation clearing and ground disturbance will be gradual in nature and proceed in stages (Figure 5).
- Rehabilitation will also be gradual in nature and proceed in stages, closely following the completion of sand extraction.
- Topsoil stockpiles will be no greater than 2 m in height and other stockpiles will not exceed 4 m in height.
- A vehicle speed limit of 20 km/h will be implemented across the site.
- A water cart with a capacity greater than 10,000 L will be available when required and will undertake preventative watering of access tracks, working areas, and stockpiles during dry periods.
- Trucks leaving the site will be required to have their load covered and tailgates and draw-bars clear of dust producing material prior to exiting the property. Appropriate signage will be erected at the site exit advising truck drivers to cover loads and clean their vehicle as required prior to entering public roads.

5.2 DUST MONITORING AND MITIGATION

The Site operator will implement the following measures to monitor and mitigate dust generation from site activities:

- Visual monitoring of dust generation from the operations will be undertaken on an ongoing basis.
- Should excessively dust generation be observed onsite and there is a risk of dust being blown off site, additional watering of dust sources with the water cart will be organised. Alternative dust controls, such as chemical dust suppressants or dust fencing, may also be considered for more persistent sources of dust.
- When weather conditions negate the effectiveness of dust prevention and mitigation measures and dust continues to be blown off site, the dust generating activities will cease until conditions improve and compliance with this DMP can be achieved.

5.3 DUST COMPLAINTS

The dust complaints process is as follows:

- A sign will be erected at the entrance to the extraction site advising the public on the appropriate contact in the event of a complaint.
- In the event of receiving a complaint, the EIL licensee will complete a Dust Complaint Form (Appendix 3), investigate, and resolve the complaint within 4 hours.
- A copy of the completed Dust Complaint Form will be forwarded to the Shire of Capel for their records.
- If required, a review of the DMP will be undertaken to refine dust prevention, monitoring, and mitigation measures.

6. ROLES AND RESPONSIBILITIES

Roles and responsibilities with respect to dust management are outlined in Table 2.

Table 2: Roles and Responsibilities

Role	Responsibilities
EIL Licensee	• Will have overall responsibility for the dust management of the operations. • Will provide information for site operators and truck drivers on dust management objectives, and dust management measures to be undertaken on site (prevention, monitoring, and mitigation). • Will be responsible for resolving any persistent dust management issues. • Will be responsible for administering the dust complaints process.
All personnel	• Will be familiar with potential sources of dust associated with own role and how to minimise dust generation. • Will implement the dust prevention, monitoring and mitigation measures as described in this plan and as advised by the EIL Licensee. • Will be responsible for reporting any persistent dust management issues to the EIL Licensee.

7. REFERENCES

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APPENDICES

APPENDIX 1: WIND ROSES

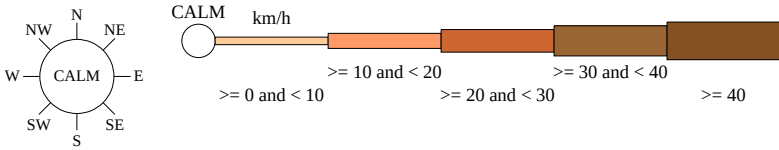
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 10 Aug 2023)

Custom times selected, refer to attached note for details

DONNYBROOK

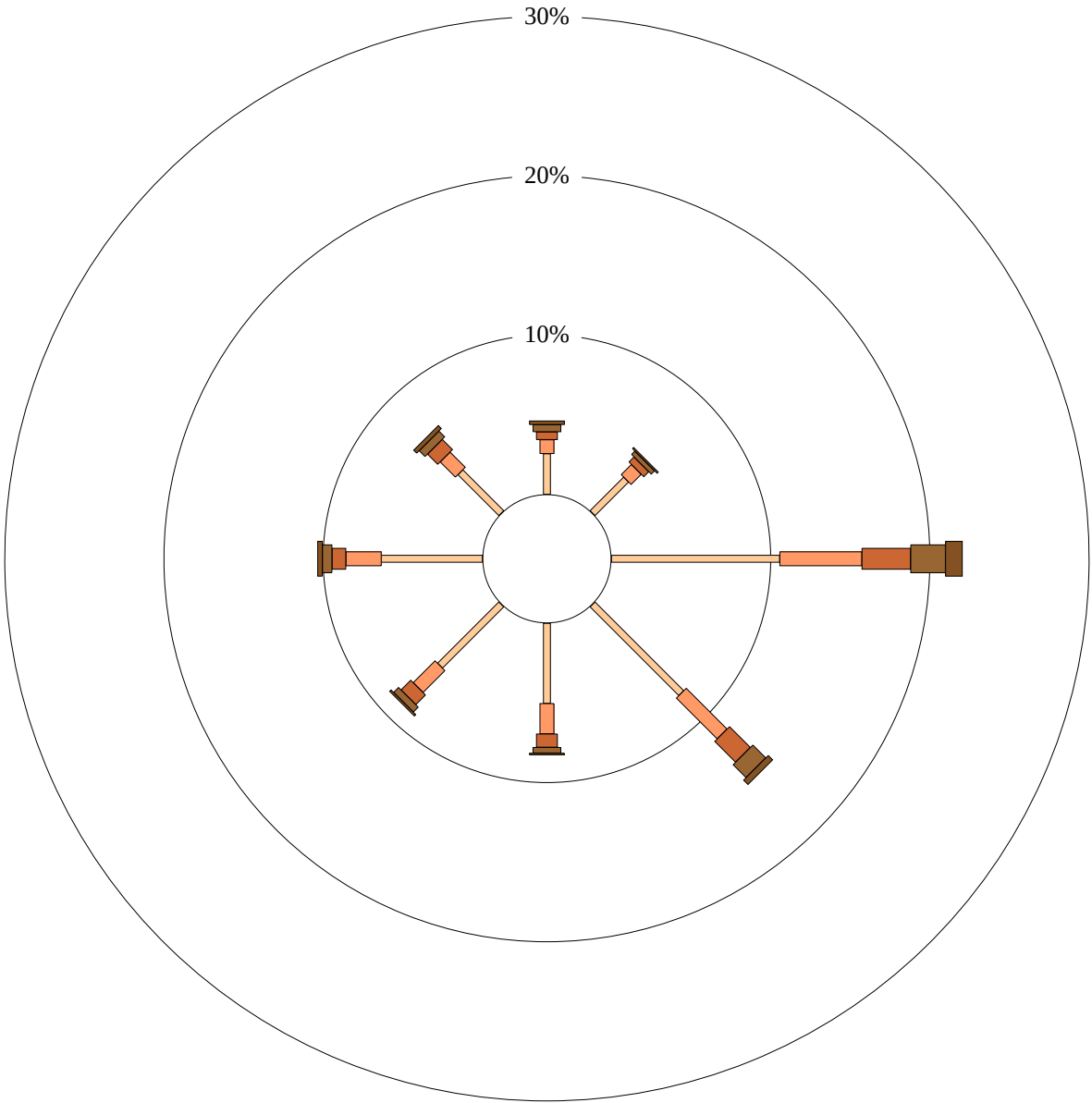
Site No: 009534 • Opened Jan 1900 • Still Open • Latitude: -33.5719° • Longitude: 115.8247° • Elevation 63m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
23300 Total Observations

Calm 20%



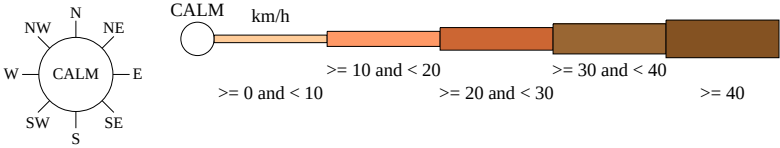
Rose of Wind direction versus Wind speed in km/h (01 Jan 1957 to 10 Aug 2023)

Custom times selected, refer to attached note for details

DONNYBROOK

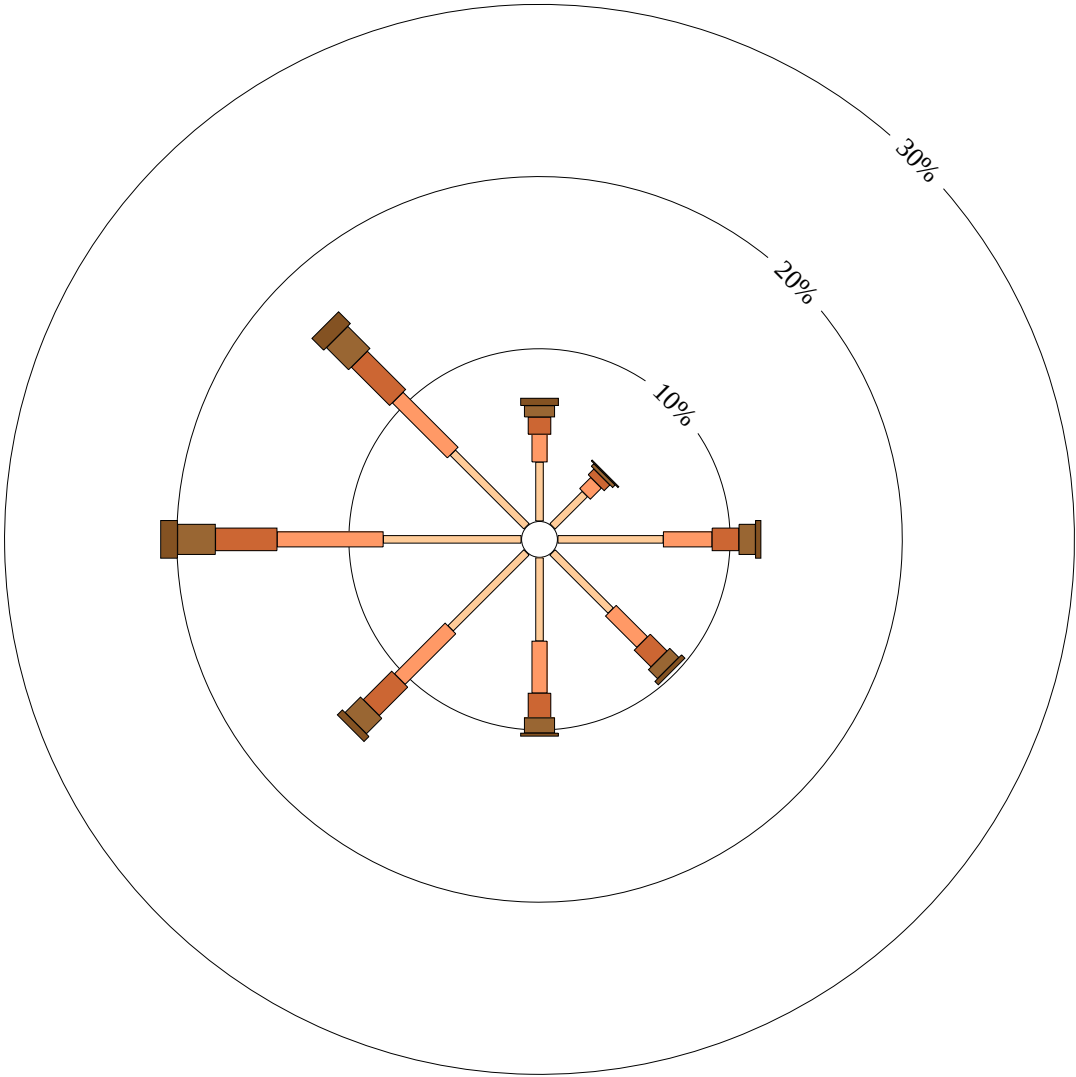
Site No: 009534 • Opened Jan 1900 • Still Open • Latitude: -33.5719° • Longitude: 115.8247° • Elevation 63m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm
20359 Total Observations

Calm 5%



APPENDIX 2: RISK ASSESSMENT

Site Risk Assessment/Classification for Activities Generating Uncontaminated Dust

Part A: Nature of site

Item	Score Options				Allocated Score
1. Nuisance potential of soil, when disturbed.	Very low.....1	Low.....2	Medium.....4	High.....6	4
2. Topography and protection provided by undisturbed vegetation.	Sheltered and screened.....1	Medium screening.....6	Little screening.....12	Exposed and wind prone.....18	6
3. Area of site disturbed by the works.	Less than 1 ha.....1	Between 1-5 ha.....3	Between 5-10 ha.....6	More than 10 ha.....9	3
4. Type of work being done.	Roads or shallow trenches.....1	Roads, drains, and medium depth sewers.....3	Roads, drains, sewers, and partial earthworks.....6	Bulk earthworks and deep trenches.....9	9
TOTAL score for Part A					22

Part B: Proximity of site to other land uses

Item	Score Options				Allocated Score
1. Distance of other land uses from site.	More than 1 km.....1	Between 1 km and 500 m.....6	Between 100 m and 500 m.....12	Less than 100 m.....18	12
2. Effect of prevailing wind direction (at time of construction) on other land uses.	Not affected.....1	Isolated land uses affected by one wind direction.....6	Dense land uses affected by one wind direction.....9	Dense/sensitive land uses highly affected by prevailing winds.....12	6
TOTAL score for Part B					18

Site Classification Score (A x B) = 396

APPENDIX 3: DUST COMPLAINT FORM

DUST COMPLAINT FORM

Property: Lot 287 South Western Hwy, Gwindinup

Complaint date: _____

Complaint time: _____

Received by: _____

Complainant's Details

Name: _____

Telephone: _____

Affected address: _____

Complaint Details (attach report if insufficient space)

Action Taken (attach report if insufficient space)

Actions recorded by: _____

Date: _____

Copy to Shire of Capel: ☐ (tick)

APPENDIX 10: WEED AND DIEBACK MANAGEMENT PLAN

WEED AND DIEBACK MANAGEMENT PLAN LOT 287 SOUTH WESTERN HWY, GWINDINUP

PREPARED FOR:

MARIO MICHELE GIACCI

MARCH 2024

PREPARED BY:

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LOT 287 SOUTH WESTERN HWY, GWINDINUP WEED AND DIEBACK MANAGEMENT PLAN

Distribution List:

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Final Report	Sharon Rose	Kirsi Kauhanen	8 March 2024

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APPENDICES

Appendix 1:	Phytophthora Dieback Assessment Report
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1. INTRODUCTION

1.1 PURPOSE

Mario Michele Giacci (the applicant) is proposing to expand existing sand and gravel extraction operations on Lot 287 (Plan 100056) South Western Hwy in Gwindinup (the property), Western Australia (Figure 1, Figure 2). This Weed and Dieback Management Plan (WDMP) has been prepared for the proposed operations as supporting documentation to accompany a Development Application (DA) and Extractive Industry Licence (EIL) application to the Shire of Capel (the Shire).

This WDMP is prepared in accordance with the *Biosecurity and Agriculture Management Act 2007* (BAM Act), the *Australian Weeds Strategy 2017–2027* developed by the Invasive Plants and Animals Committee (2017), and the Dieback Working Group's (DWG 2021) *Best Practice Guidelines for Management of Phytophthora Dieback in Raw Material Industries* (the Guidelines). Consideration has also been given to the *Phytophthora Dieback Management Manual* (the Manual) produced by the Department of Biodiversity, Conservation and Attractions (DBCA 2020) and the *Dieback Hygiene Guidelines* by South Coast Natural Resource Management (South Coast NRM 2013).

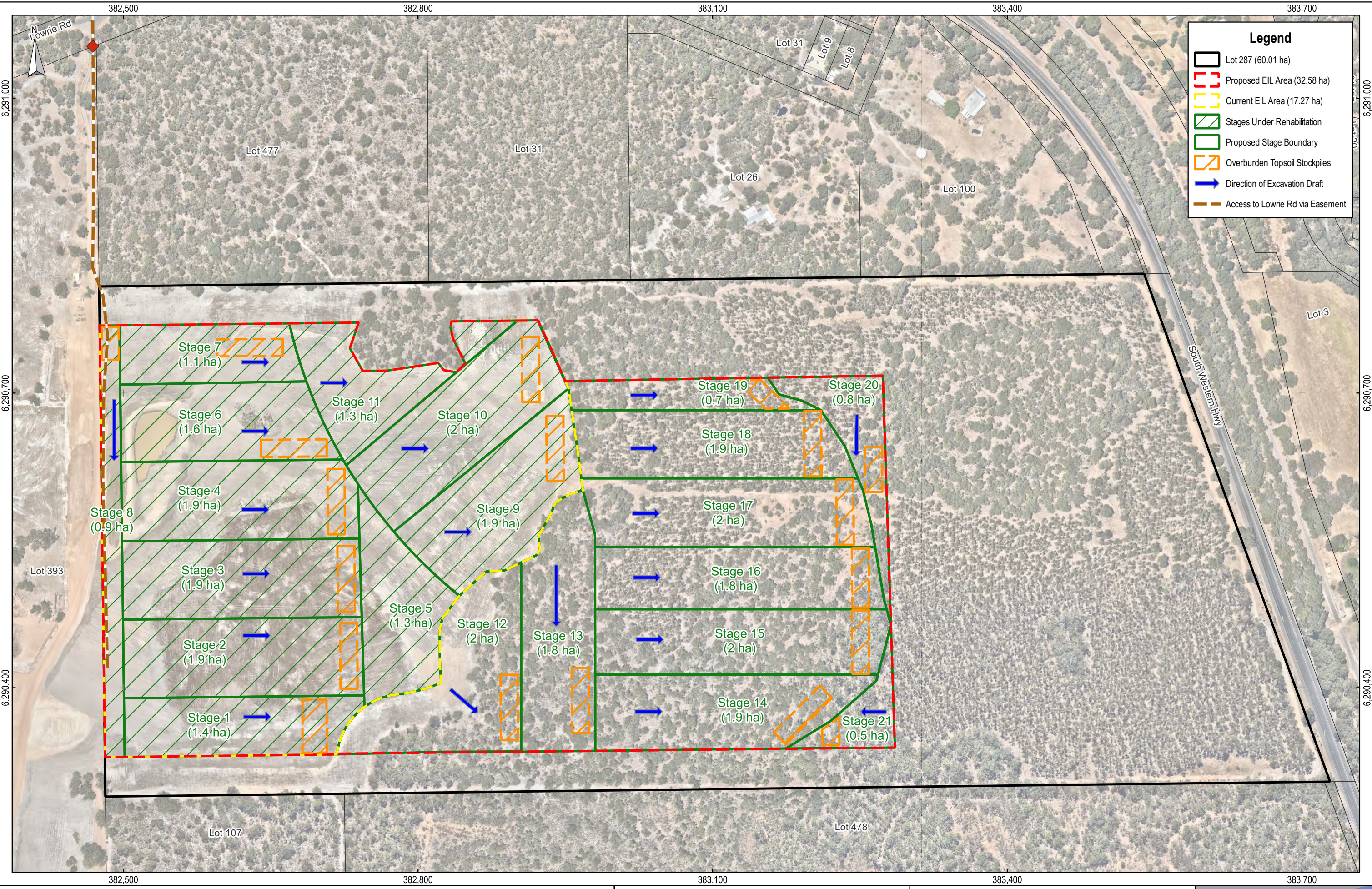
1.2 SCOPE AND OBJECTIVE

This WDMP has been developed to provide details of the existing environment and guidance around best management practices for weeds and *Phytophthora cinnamomi* (dieback) with the objective to minimise the risk of introduction and spread of weeds and dieback during the extraction operations.

The scope of this WDMP includes following:

- Describe the existing environment.
- Provide guidance to minimise spread of weeds and dieback within, to, and from Lot 287.





Scale: 1: 3,500
Original Size: A3
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 100 200 m

W:\MGM\South West Hwy\GIS-Common\2024 Management Plans\MGM Lot 287 South West Hwy 2024.qgz 07/03/2024 F4 Works and Excavation Plan

Mario Michele Giacci
Lot 287 South Western Highway, Gwindinup

Figure 2

Works and Excavation Plan

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2. EXISTING ENVIRONMENT

2.1 CLIMATE

The climate of the Project area is Mediterranean, with cool wet winters and hot dry summers. Bureau of Meteorology (BoM) long-term average climate data for the closest meteorological station (Donnybrook, 9 km southeast of the property) is shown in Figure 3. The average annual rainfall is 970.4 mm, mean minimum temperatures between 5 and 15°C and mean maximum temperatures between 16 and 31°C (BoM 2023).

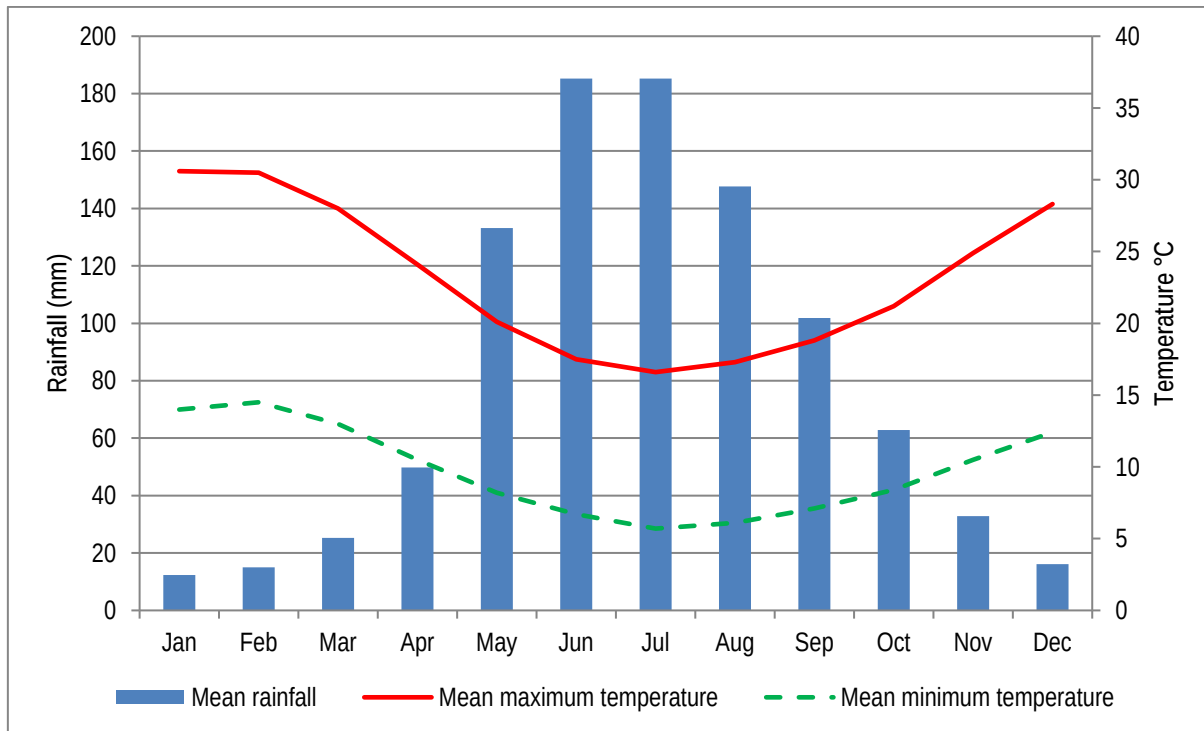


Figure 3: Climate Statistics (1900–2023) for BoM Station 9534

2.2 LANDFORM AND SOILS

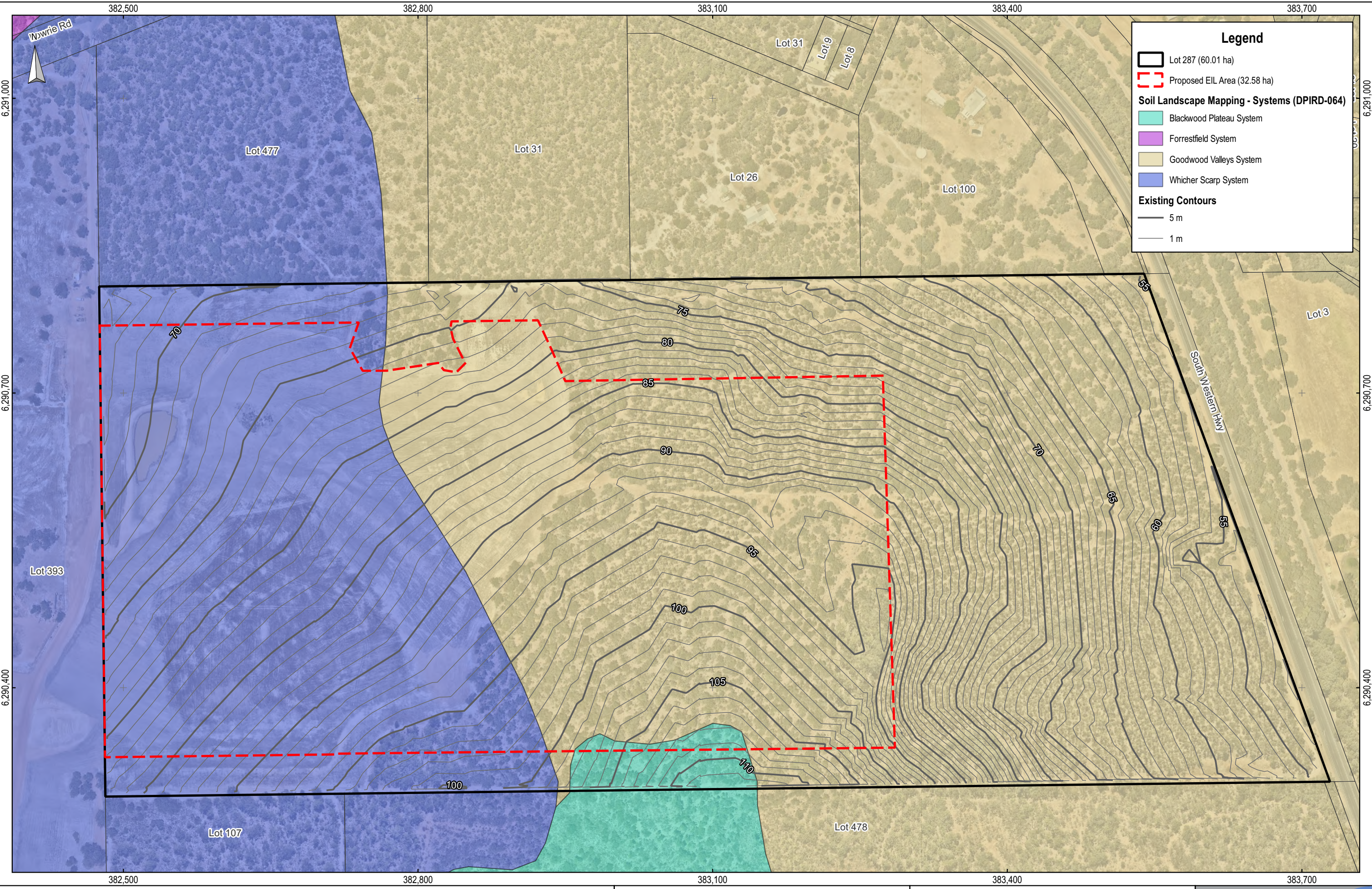
The highest point on Lot 287 is situated approximately halfway along the southern property boundary and has an elevation of 111 m Australian Height Datum (mAHD) (Figure 4). From this point, the land to the west and north slopes and undulates downward at gradients between approximately 1:10 and 1:20. Near the northern boundary there are steeper areas of approximately 1:6. To the east of the proposed extraction area lies the steepest gradients on the property, which slope towards the South Western Highway at gradients up to 1:6 within the proposed extraction area and up to 1:4 further east, beyond the proposed extraction area. Within the proposed extraction area, the highest point is 109 mAHD in the south and the lowest point is 78 mAHD in the northeast (Figure 4).

Three soil and landform mapping systems are mapped within and surrounding the proposed extraction area (DPIRD-064):

- **Whicher Scarp System:** Low scarp and raised platform, on the northern edge of the Donnybrook Sunkland. Sandy gravel and pale deep sands, loamy gravel, and non-saline wet soils. Jarrah-marri forest and woodland.
- **Goodwood Valleys System:** Valleys, of the Donnybrook Sunkland. Sandy gravel, loamy gravel, and deep sand. Jarrah-marri forest and woodland.
- **Blackwood Plateau System:** Lateritic plateau in the Donnybrook Sunkland. Sandy gravel, loamy gravel, and deep sand. Jarrah-marri forest.

The proposed expansion to the extraction area is mostly located within the Goodwood Valleys System. Extraction on the property so far has shown that there is a layer of sand, of varying depth, that overlies the gravel.

Lot 287 is located away from wetlands and waterways on well-draining soils. The Australian Soil Resource Information System maps the property as 'Extremely Low Probability/Low Confidence' for the risk of acid sulfate soil (CSIRO 2014).



2.3 VEGETATION

Lot 287 contains a mosaic of remnant native vegetation, blue gum (*Eucalyptus saligna*) plantation, extraction operation, and some cleared land. There is approximately 19 ha of native vegetation, split into several patches. Reconnaissance flora and vegetation survey (Marsh 2019) identified three native vegetation types and an introduced vegetation type in the proposed extraction area:

- VT1: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low woodland of *Banksia grandis* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii*.
- VT2: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea gracilis*.
- VT3: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low sparse shrubland of *Xanthorrhoea preissii* and *Hibbertia hypericoides*.
- D: Disturbed: Blue gum plantations, tracks, and clearings.

The native vegetation communities vary in condition from Degraded to Very Good – Good (using condition scale by Keighery 1994) and show signs of multiple historical disturbances including selective logging, fire, weeds, and dieback. Currently there is disturbance in the form of cleared tracks and small bare areas. The blue gum plantation areas have been completely cleared of native vegetation in the past.

No Threatened or Priority Ecological Communities or Threatened or Priority flora species have been recorded at Lot 287. Several common weed species have been recorded but no Declared Pest species or weeds of national significance (Marsh 2019).

2.4 LAND USE

Lot 287 is zoned 'Rural' under the Shire of Capel Local Planning Scheme No.8 (2023) and falls within three Special Control Areas (SCA): SCA4 - Transport Corridors, SCA6 - Strategic Minerals and Basic Raw Materials, and SCA8 - Regional Ecological Linkages.

The property contains no buildings. In addition to the active extraction area on the western side of the property, Lot 287 contains a blue gum plantation with pockets of remnant native vegetation (Figure 2). Blue gums within the previously approved extraction area have been harvested, with the remainder of the current application area to be harvested prior to extraction.

The eastern edge of Lot 287 is reserved for 'Primary Regional Road' (Shire of Capel 2023). A 'Highway Protection Line' straddles the property along its eastern highway road frontage and delineates an area (100 m distance from either side of the centre line of the road), which is defined as the 'Highway Protection Area'. The purpose of the 'Highway Protection Area' is to protect the function, amenity, and visual character of the Highway. The proposed extraction area is well outside the 'Highway Protection Area'.

2.5 CURRENT WEED STATUS

Seven introduced (weed) species were identified from the 62 plant taxa recorded on the property (Marsh 2019) and are listed below:

- | | |
|---|--|
| • Blowfly Grass (<i>Briza maxima</i>). | • Smooth Cats-ear (<i>Hypochaeris glabra</i>). |
| • Cape Bluebell (<i>Wahlenbergia capensis</i>). | • Ursinia (<i>Ursinia anthemoides</i>). |
| • Flinders Range Wattle (<i>Acacia iteaphylla</i>). | • Velvet Pink (<i>Petrorragia dubia</i>). |
| • Silvery Hairgrass (<i>Aira cupaniana</i>). | |

None of the identified weeds are listed as Weeds of National Significance or Declared Pests under the BAM Act.

Other weed species (e.g. ink weed *Phytolacca octandra*) have been opportunistically observed in the blue gum plantation and other disturbed areas of the property. Blue gums are an introduced species and will be harvested before extraction occurs. Any subsequent blue gum regrowth will be controlled as part of the site weed management program.

2.6 CURRENT DIEBACK STATUS

Dieback is present in locations around the globe that have a Mediterranean climate, including the southwest of Western Australia. There are over 140 species of *Phytophthora* worldwide, but the most commonly found and damaging species in the southwest is *Phytophthora cinnamomi*.

Dieback Public Map (Project Dieback 2024) indicates that all the native vegetation on Lot 287 and the adjacent properties is dieback infested with moderate confidence, based on an assessment in 2008. Bark Environmental conducted site-specific dieback surveys at Lot 287 in May and September of 2019 (Appendix 1). It was determined that the majority of the remaining native vegetation, 15 ha is dieback infested with only around 1 ha uninfested (Bark Environmental 2020). The remainder of the native vegetation, blue gum plantation areas, and cleared areas are mapped as excluded because the presence of dieback was undeterminable due to the lack of indicator species (Appendix 1). The presence of dieback in these areas cannot be ruled out and, because of this, they will be treated as potentially dieback infested for site management purposes.

Dieback is spread through infected soil. The infected soil can be spread by fauna movement, surface water runoff, soil movement on sloping surfaces, and spores; however, the biggest spreader of dieback is human activity and movement. Infected soil can contaminate vehicles, footwear, and equipment that then moves to an uninfected area, introducing the pathogen. Additionally, the transport of infected soil as import or export material from a site can contribute to dieback spread. Various rural activities in the local area and recreational use of the reserves carry a risk of introducing and spreading dieback.

3. WEED MANAGEMENT

Weeds can be spread or introduced to an area via a number of circumstances, such as wind-borne seed, vehicle movements, rain runoff, fauna activity, movement of soil, dust, and introduction of materials, such as soil and mulch, from external sources. The applicant recognises the importance of effective management of weeds during extractive operations and subsequent revegetation. As the site already contains a range of common weed species and part of the property will be rehabilitated to pasture, weed management during the extractive operations will mainly aim to prevent the introduction of declared weed species, minimise spread of the more common weeds, and instigate the monitoring and control of weeds during rehabilitation.

3.1 WEED PREVENTION

The site operator will implement the following measures as part of the extractive operations to reduce weed spread and prevent, as far as practicable, the introduction of new weed species at Lot 287 and the export of weeds from the property:

- All vehicles, plant, and equipment entering or exiting the property will be clean and free of weeds.
- Topsoil will be removed from the extraction area and stockpiled (gradually in stages).
- Following removal of topsoil, the movement of vehicles and machinery will be limited to the areas free of topsoil to limit the spread of weeds.
- Exported quarry products will be free of weeds.
- Materials imported to site will be free of weeds.
- Weed control will be conducted in operational areas (e.g. trafficable areas and material stockpiles) to ensure these areas remain weed free.
- Weed control of topsoil stockpiles will be undertaken to minimise seed set.
- During rehabilitation activities, weed control will be undertaken as necessary to minimise weed spread and to prevent weeds from compromising the end land use.
- Weed presence and control will be monitored (Section 3.2).

Weed control will be tailored to cater for the specific needs of the weed species being managed and may involve chemical and/or manual control. In addition to broad spectrum herbicides, weed specific herbicides will be used where appropriate to target broadleaf, grass, geophyte, and woody weeds.

The requirements for rehabilitation and associated weed control are detailed in a separate rehabilitation plan. At this stage, it is anticipated that both pasture and native vegetation will be returned as part of rehabilitation. It is expected that rehabilitation weed control will, as a minimum, include control prior to planting/seeding once topsoil has been re-spread. This is typically undertaken in late autumn/early winter depending on commencement of seasonal rains. This will enable any weeds germinating from the soil seed bank to be targeted. Ongoing weed control following planting/seeding will also occur as need be to allow for the pasture and native species to become established.

3.2 MONITORING

3.2.1 Weed Status Monitoring

The weed status of Lot 287 will be monitored biannually to determine whether introduction or spread of weeds is occurring and to identify required weed control. Monitoring should occur four to six weeks after the first significant autumn/early winter rains and in mid to late spring; however, opportunistic passive monitoring will also occur as a part of general operations and weed control will be organised if the need is identified.

3.2.2 Weed Control Monitoring

Areas requiring weed control will be checked within two weeks before the commencement of weed control (either as part of biannual monitoring or separately) and then six to eight weeks after weed control has been conducted to gauge effectiveness and determine if follow up control is required.

4. DIEBACK MANAGEMENT

Based on Section 2.6, the occurrence of dieback on Lot 287 is confirmed (Bark Environmental 2020). For the purposes of dieback management, the proposed extraction area and blue gum harvest areas will be considered as dieback infested. Vegetation outside the proposed extraction area mapped as dieback-free (Bark Environmental 2020) will become a no-access zone.

Dieback will be managed in accordance with the best practice guidelines and manuals (Section 1.1), and will include the following measures:

- All earth-moving machinery will be cleaned of soil and vegetation prior to entering and leaving site.
- Soil will only be moved in dry conditions.
- No dieback-affected material will be brought to site.
- Machinery and other vehicles will remain within the extraction area to minimise the risk of spreading disease.
- Drainage will be contained within the extraction area, with designated overflow pathways that minimise potential for disease spread. Direct surface water runoff from the extraction area to the surrounds will be avoided.
- Personnel will be informed that the site may be infested with dieback and that dieback can spread on vehicles, machinery, equipment, footwear, and tools, and instructed on clean down requirements.
- Topsoil will be stockpiled and respread as close to its source area as possible.
- Potential customers will be advised that the material exported from site cannot be considered dieback free.
- Entry to and exit from the site will be limited to designated locations.
- Trucks exporting sand from the site will be required to have their load properly covered.
- Ensure that, as far as can be known, any soil, mulch, fill, or other material brought on site is sourced responsibly and free of dieback.
- Topsoil will be removed and stockpiled from the extraction area (gradually in stages), and the subsequent movement of vehicles and machinery will be limited to the areas free of topsoil.
- Vegetation clearing and topsoil removal and stockpiling will only be undertaken in dry conditions.
- Existing and new personnel will be informed of dieback prevention measures and be required to meet them.
- Unauthorised access to the extraction site will be managed through fencing and lockable gates.
- Signage regarding unauthorised entry and 'clean on entry' requirements will be placed at the gates.
- Trafficable areas and material stockpiles areas will be maintained well drained.

5. ROLES AND RESPONSIBILITIES

Roles and responsibilities with respect to weed and dieback management are outline in Table 1.

Table 1: Roles and Responsibilities

Role	Responsibilities
EIL Licensee	• Responsible for overall implementation of this plan. • Will provide information for site personnel and truck drivers on weed and dieback management objectives and measures to be undertaken on site. • Responsible for organising monitoring and control of weeds. • Responsible for site access security and appropriate signage.
All personnel	• Will be familiar with weed and dieback management objectives. • Will implement measures to prevent spread and introduction of weeds and dieback as outlined in this plan. • Responsible for reporting any weed or dieback management issues to EIL Licensee.

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APPENDICES

APPENDIX 1: PHYTOPHTHORA DIEBACK ASSESSMENT REPORT

Phytophthora Dieback Assessment Report

Lot 287 Gwindinup

Method of assessment	Comprehensive / Basic raw materials (BRM) pit assessment
Dates of field work	May and September 2019
Interpretation	BARK Environmental
Map Expiry	September 2020 – It can be rechecked up to 3 years after initial assessment (up to 2022), then a Comprehensive Assessment is required.
Map Validity for disturbance activities	This Dieback Occurrence Map (Figure 1) is valid for 12 months (September 2020). It can be rechecked annually for up to 3 years (September 2022), before any further soil disturbance activities occur. After September 2022, a complete <i>Phytophthora</i> assessment should be undertaken to ensure accurate mapping of disease.
Report Version	2.2020

BARK ENVIRONMENTAL

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Figure 1. Phytophthora Dieback Occurrence: Lot 287 Gwindinup

Appendices

A: Site Photographs Lot 287 – October 2019

B: Sample Data Sheet

1 INTRODUCTION

1.1 Background

A *Phytophthora* Dieback Assessment is required as part of the environmental approvals process for the proposed expansion of a basic raw materials area within Lot 287 (Plan 100056) situated approximately 5km south of Boyanup.

Phytophthora Dieback is a devastating plant disease caused by a soil-borne water mould that threatens biodiversity in the south west region where up to approximately 40% of the known native plant species are susceptible. The pathogen is now widespread.

Phytophthora spread is accelerated by physically moving infested soil and plant material across landscapes, particularly under warm, moist conditions. It also spreads autonomously through infected root to root contact and in water. Therefore, human activities that can transport *Phytophthora* infected material present the most significant risk to vectoring the disease such as on uncleaned vehicles, tools and footwear, when clearing vegetation and vehicle movements.

Mitigating the spread and impact of *Phytophthora* Dieback in natural areas is difficult. Raising awareness of the issue among stakeholders and mapping its spatial distribution are the first steps to developing an effective Dieback Management Plan. This report describes the results with recommendations from undertaking a *Phytophthora* Dieback Occurrence Assessment over Lot 287 over 2 days in May and September 2019. It includes a *Phytophthora* Dieback Occurrence Map (Figure 1) with management recommendations. Figure 1 is valid for 1 year and can be rechecked in the field annually for up to 3 years to ensure the boundaries are accurate as the disease can spread over time. A comprehensive assessment is recommended as standard practice by the Department of Biodiversity Conservation and Attractions (DBCA) when occurrence maps are over 3 years old.

1.1 Site description and historical disturbance

Lot 287 is a rectangular fenced area bounded by the South Western Highway to the east, remnant vegetation to the north and south and cleared land with sand extraction occurring in the west. The total assessment area size is 46.1 ha and the majority has been planted with blue-gums. Approximately 19ha comprises fragmented native vegetation in clumps separated by blue-gum plantations. Exploration pits are scattered throughout and some previous gravel exploration and extraction has occurred in the eastern parts (see Plate 1). The entire area has been subjected to historic clearing (see Plate 2), firewood collection (Plate 3) and various degrees of human disturbance over decades.

The average annual rainfall in this locality exceeds 900mm, that confirms the study area falls within the vulnerable zone where *Phytophthora* disease can develop and cause impacts to native vegetation (Bureau of Meteorology, 2019).

Site vegetation is comprised of three vegetation complexes, namely the Rosa, Whicher Scarp and Kingia vegetation complexes as described in the 'Vegetation Complexes of South West Forest Region of WA (DBCA-047)' dataset. Each of these complexes contain some plants susceptible to *Phytophthora* disease. Deep sandy soils were observed during assessment enabling good drainage, however surface laterite is also present particularly on the eastern slopes that appears to form micro collection of surface water run-off that may support

Phytophthora development, if it is introduced. There was no significant recent fire damage observed to existing vegetation in the area that could limit *Phytophthora* interpretation.

Plate 1. Old gravel exploration pits are scattered throughout Lot 287.



Plate 2. Much of the assessment area has been subjected to historic clearing and disturbance, that has reduced the understorey density and abundance of expected plant species.



Plate 3. Firewood collection.



2 METHODS

2.1 Interpretation

Field interpretation was based on the Comprehensive and Basic Raw Materials (BRM) pit assessment methodology used by the DBCA and described in their manual “Forest and Ecosystem Management Division 2015, *Phytophthora* Dieback Interpreter’s manual for lands managed by the department, DPaW, Perth, Western Australia.”

2.2 Demarcation

BARK was advised that no taping was necessary at this stage and given the remnant blocks can be clearly identified by plantation boundaries, no taping was done. Instead, boundaries were recorded and mapped using GPS data obtained in the field. The standards for taping are given below for general information only.

Infested areas are demarcated using 25 mm fluoro pink tape tied to trees at chest height with the knots facing into the infestation. Excluded and Uninterpretable areas are demarcated using 25 mm striped black/pink tape tied to trees with the knots facing towards the respective category. When vegetated boundaries adjoin cleared completely degraded areas, taping may not be applied as they can easily be observed in the field, on aerial imagery and established with captured GPS data.

2.3 Soil and tissue sampling

Soil and tissue samples associated with dead or dying plants are collected per DPaW 2015 methodology to confirm the presence or absence of *Phytophthoras*. Sample locations are tagged in the field and point data is recorded with GPS receivers before despatching samples to a laboratory for testing. Sample results are only used as supporting evidence. **Please note:** It cannot be concluded that an entire site or an entire stockpile of basic raw material is dieback-free from a single or a small number of samples where *Phytophthora* was not detected. On occasions sample results may give false negative results, so field observations are critical to making effective interpretation decisions.

2.4 Mapping

Field observations, boundaries, waypoints and survey data are recorded on hand-held GPS and downloaded into a Geographic Information System (GIS) to produce *Phytophthora* maps.

2.5 Vegetation Condition Rating

Site vegetation was rated using the scale described below.

Table 1. Vegetation Condition Rating Scale (Keighery, 1996).

Rating	Description
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback , logging and grazing.
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

3 RESULTS

3.1 Assessment category distribution

Three Dieback categories have been applied to within Lot 287 (Table 2) as follows:

- **Uninfested** – Free from plant disease symptoms caused by *Phytophthora spp.*
This includes 2 separate areas of remnant vegetation located towards the northwest and southwest boundaries of Lot 287.
- **Infested** – Areas where disease symptoms are consistent with the presence of *Phytophthora spp.*
There are 3 separate infested remnant vegetation areas within Lot 287.
- **Excluded** – Areas of high disturbance unlikely to recover to enable interpretation.
This category was applied to all blue-gum plantation and previously disturbed completely degraded cleared areas and tracks. It includes Degraded and Completely Degraded areas.

Table 2: Dieback Occurrence Categories, Lot 287

Category	Area (ha)
Infested	17
Uninfested	1
Excluded	28.1
Total Area Assessed	46.1

3.2 Disease expression

Phytophthora disease expression within Lot 287 was “average” at the time of assessment. Within the infested areas, there is a marked reduction in biomass with species such as *Banksia grandis* expected to be present and abundant but that was not the case. *Xanthorrhoea gracilis* and *X. preissii* were observed to be the most reliable dead and dying indicator species. This was supported by sample results. There is some chronology of susceptible plant deaths present, particularly between upslope infestations and downslope areas where the disease has been present for longer. However, with reduced biomass and the presence of lateritic outcrops may be limiting root-root contact and even distribution of surface water, so the disease appears as scattered deaths, namely among *Xanthorrhoea spp.*

3.3 Disease impact

Site observations identified that *Phytophthora* disease is present and has caused a moderate to high impact to the native vegetation community structure and species composition within Lot 287 over time. However, the adverse effects from previous human disturbance activities such as clearing to establish plantations, track development, gravel extraction and timber harvesting have all contributed to this. There is no evidence in the public domain of any previous biosecurity-hygiene being applied for the aforementioned historic activities within Lot 287.

The predicted impact of *Phytophthora cinnamomi* at this site is moderate to high given the site contains a vulnerable plant community. In high rainfall years with warm-moist conditions, the disease in this area is likely to become more active and obvious with an increasing number of fresh plant deaths present resulting from *Phytophthora* infection. This observation has been made by the author within proximate vegetated areas in greater Bunbury.

3.4 Sample results

Four soil and plant tissue samples were collected on 12.05.2019 within Lot 287 and the laboratory results are summarised in table 3 with full details in appendix B. The sampling strategy applied was to target a range of indicator plants at different points along the contour across the site. Samples 1 and 2 were collected in upslope areas from not recent deaths. Sample 2 was collected from a potentially drought and insect affected dead *Banksia*. Samples 3 and 4 were collected from fresher plant deaths showing typical chlorosis symptoms on leaf structures.

Table 3. Sample Results Summary

Sample Name (date)	Plant Sampled	Result (POSITIVE, NEGATIVE)
S1	<i>Xanthorrhoea preissii</i>	NEGATIVE
S2	<i>Banksia grandis</i>	NEGATIVE
S3	<i>X. gracilis</i>	POSITIVE
S4	<i>X. preissii</i>	POSITIVE

3.5 Vegetation Condition

Industry Dieback assessment methodology and Keighery 1996 Vegetation Condition Scale Ratings were considered. Degraded areas and Completely Degraded areas were allocated the Excluded category. A good example of what Good-Very Good remnant vegetation condition would look like, if present within Lot 287 is situated outside of the Lot to the immediate north (see Appendix 1). In this area the density and diversity of plants vulnerable to *Phytophthora* is greater than within Lot 287.

This assessment included walking transects 25m wide throughout the entire study area that revealed a relatively consistent pattern of scattered *Xanthorrhoea spp.* deaths that were associated with long-term *Phytophthora* disease and two samples (3 and 4) results support this conclusion.

In the authors opinion, currently the majority of the remnant vegetation remaining at this site is made up of a mosaic of Degraded-Good condition areas and all remaining disturbed areas and plantations are Degraded and Completely Degraded.

4 CONCLUSION

Lot 287 has been exposed to a history of disturbance activities. Two small isolated blocks of remnant vegetation are Uninfested and in Very Good condition in the western part. However, their combined small area (1ha) will be difficult to manage in respect to *Phytophthora* Dieback given the surrounding site conditions. In the authors opinion if either of the aforementioned areas is to be retained as “Protectable Area”, the Uninfested area on the vegetated south west corner of Lot 287 is in the best condition and landscape position to be retained. By Department of Biodiversity Conservation and Attractions (DBCA) protocols for determining protectable areas, and based on information available to BARK at the time of assessment – none of the Uninfested areas warrant protection. The landholder may choose to retain these areas for example if Rare flora is present or as part of any vegetation clearing offset proposal.

Dieback infested areas are present and extensive within Lot 287 (17 ha). All remaining areas including the plantations within Lot 287 have been Excluded due to their Completely Degraded Vegetation condition ratings and no Dieback controls are necessary within them (28.1 ha).

The attached Figure 1 shows the spatial distribution of *Phytophthora* assessment categories and sample point locations. It is valid for 1 year and should be rechecked in the field annually for up to 3 years prior to undertaking soil disturbance activities. After 3 years (2022) a comprehensive *Phytophthora* assessment will be required to inform the Dieback Management Plan to guide activities at this site.

Overall, Dieback Management within Lot 287 should aim to not spread the disease outside of the operational footprint into any adjacent “protectable” vegetation or into offsite areas.

Standard *Phytophthora* management tactics are recommended below to assist with developing a Dieback Management Plan.

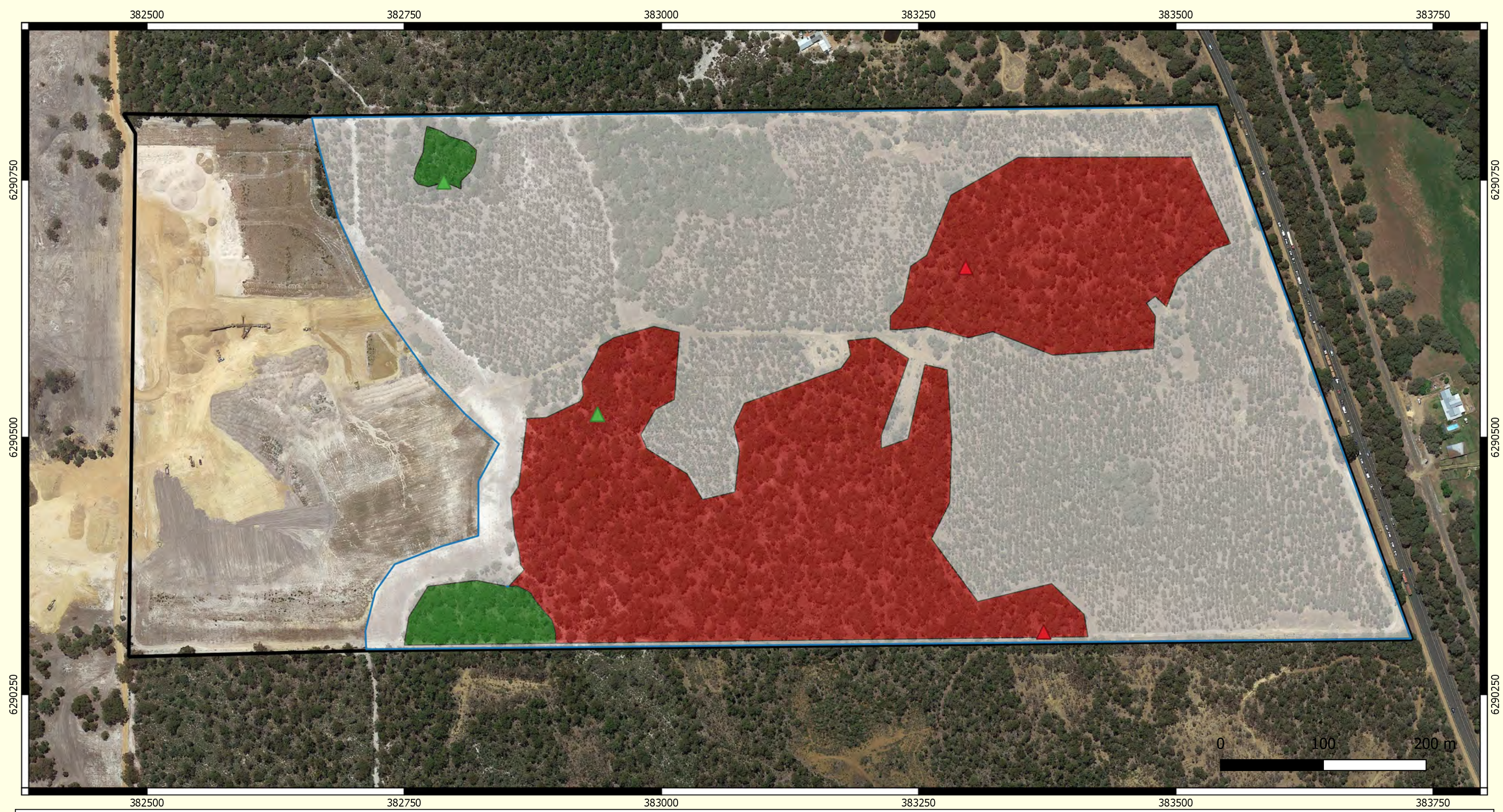
5 RECOMMENDATIONS

Dieback Management within Lot 287 should aim to not spread the disease outside of the operational footprint into any adjacent “protectable” vegetation retained or into offsite areas.

1. **Train the workforce** – about *Phytophthora* Dieback, its impact and management. Green Card training is recommended.
2. **Inform personnel** – within contracts and inductions that they are entering a site largely Infested with *Phytophthora* Dieback and that precautions need to be taken to ensure that it is not spread from the site or into any retained “Protectable” native vegetation.
3. **Clearly demarcate any Uninfested area/s** – to be retained to ensure there are no quarantine breaches.
4. **Schedule disturbance activities** – ideally in dry-soil conditions to minimise the effort needed to clean-down effectively.
5. **Surface water management** – Runoff is an efficient means for the spread of *Phytophthora* Dieback and increases in soil moisture can increase the impact of the pathogen on surrounding native vegetation. Thus, contain runoff from stockpiles so it does not enter sensitive areas.
6. **Clean-on-exit** – to avoid depositing *Phytophthora* infected material along carting routes, vehicles should be cleaned-down free of clods of dirt on the undercarriage and wheel arches prior to exiting the site. Scheduling work to cart materials in dry-soil conditions and informing operators to avoid driving through wet soil areas will reduce the clean-down effort.
7. **Separate Uninfested topsoil from Infested topsoil** - for insitu use on the area it was sourced from.
8. **Rehabilitation** – if planting, use resistant plant species from accredited nurseries to increase success of revegetation.
9. **Customer notification** – advise potential customers that the material is likely to be infested with *Phytophthora* Dieback.
10. **Maintain secure access** – to prevent uncontrolled access.
11. **Consider having a split phase operation** – to isolate loading from excavation, thus reducing the need to clean-down/washdown loading trucks.
12. **Signage** – ensure Dieback signage is installed at any Clean-Down access points.

6 REFERENCES

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Legend

Assessment Area

Lot 287

Sample Locations

▲ Negative

▲ Positive (*P. cinnamomi*)

Dieback Occurrence

Excluded

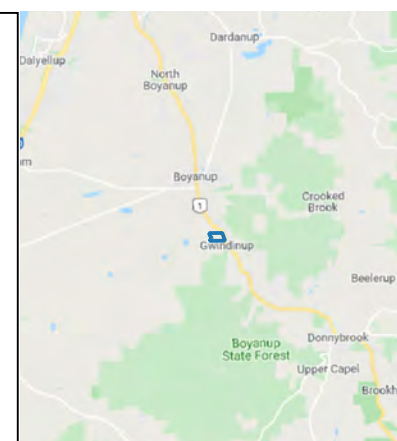
Infested

Uninfested

Occurrence Category	Area (ha)
Uninfested	0.986
Infested	15.0038
Excluded	30.0943
Total	46.0841

Interpretation Completed: September 2019

Map Expiry: September 2020



Project Location

Phytophthora Dieback Occurrence

Lot 287 Gwindinup



Datum: GDA 1994
Projection: MGA Zone 50

Scale: 1:3,500

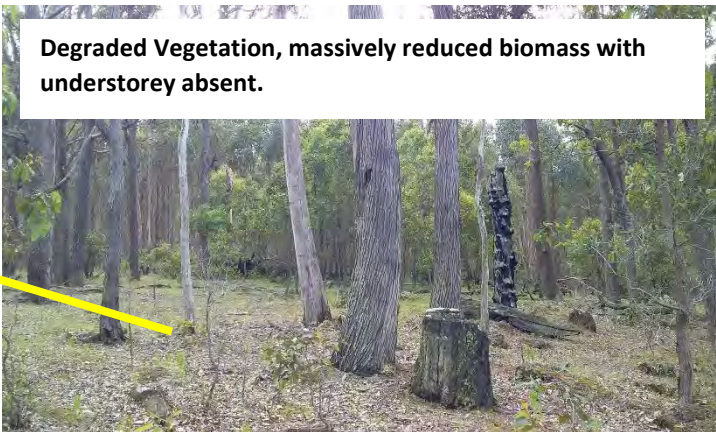
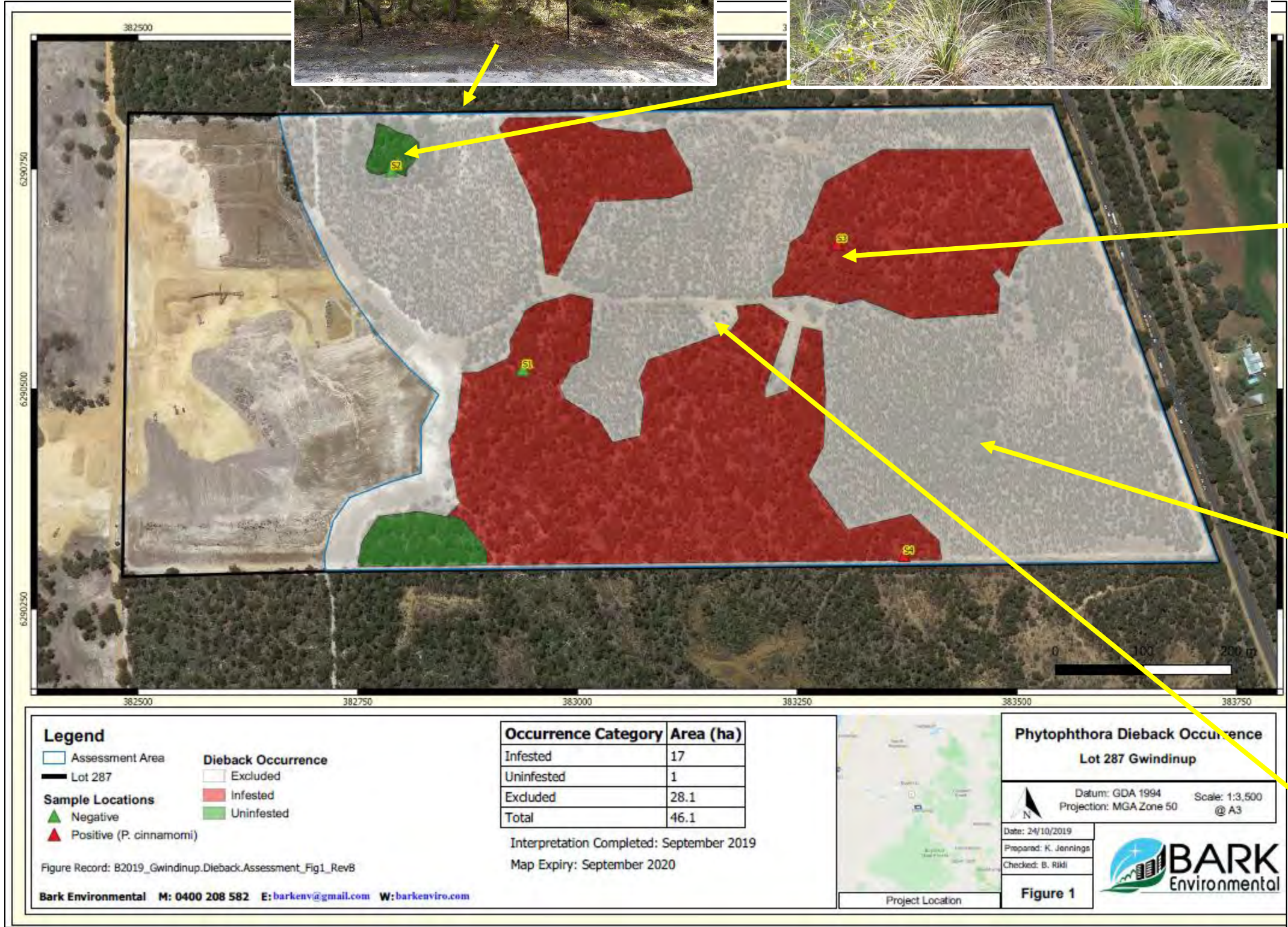
Date: 23/10/2019

Prepared: K. Jennings

Figure 1



Appendix A



Site Photographs Lot 287 (November 2019)

Appendix B

SEND TO: Vegetation Health Service, Ecosystem Health Branch – Dept. Parks & Wildlife, 17 Dick Perry Ave, KENSINGTON 6151
Phone: (08) 9334 0317 **Fax:** (08) 9334 0114

CONTACT DETAILS of sender
 Name BARK Environmental
 Phone No. 0400 208 582

GDA
 (1)
 GDA 94

Job Type (Please indicate)
 D.E.C. (C) — Alcoa (A)
 Recoup (R) — FPC
 Private (P) — Other

VHS USE ONLY
 Date received 17-5-19
 Date faxed 22-5-19, 30-5-19

VHS Identification Number (VHS USE ONLY)	Sample Date	Sample label (Give location, eg. Forest Block or Shire, etc. and sample number)	Plant species sampled	Site Impact (2)	Zone 50 or 51	Map Reference (3)	Land Tenure (4)	RESULT s/s root (5)	RESULT bait (5)
VHS 39496 (1111 11111111 11111111 11111111)	12.5.19	S1 - Lot 287 SW Hwy	X. preissii	L	50	E 382937 N 6290522	P		NEG
VHS 39497 (1111 11111111 11111111 11111111)	12.5.19	S2 - Lot 287 SW Hwy	B. grandis	M	50	E 382789 N 6290748	P		NEG
VHS 39498 (1111 11111111 11111111 11111111)	12.5.19	S3 - Lot 287 SW Hwy	X. gracilis	L	50	E 383296 N 6290665	P		CIN
VHS 39499 (1111 11111111 11111111 11111111)	12.5.19	S4 - Lot 287 SW Hwy	X. preissii	L	50	E 383371 N 6290311	P		CIN

NOTES:
 1. Please tick this box if your map references are supplied in the GDA 94 standard. If not, please specify the datum used.
 2. Site impact - Low, Moderate, or High (as in the Dieback Interpreter's Manual).
 3. An MGA map reference with prefixes **must** be supplied for all samples.
 4. Land Tenure - State Forest (SF), National Park (NP), Reserve (R), Westrail (W), Private (P), Gravel Pit (GP), or other. (Other - describe in comments below).
 5. Result codes used – CIN = *Phytophthora cinnamomi*, MUL = *P. multivora*, CRY = *P. cryptogea*, PI = *P. inundata*, ARE = *P. arenaria*, ELO = *P. elongata*, THE = *P. thermophila*, PM = *P. megasperma*, PN = *P. nicotianae*, CON = *P. constricta*, NEG = negative, SUB = subcultured for further tests
Please Note: a). NEG results cannot be used to represent a total absence of *Phytophthora* in the sampled area. b). Information from your samples will be incorporated into the VHS database.

COMMENTS: Please email results & invoice to barkenv@gmail.com – Thank you

Sample Data Sheet

APPENDIX 11: REHABILITATION AND DECOMMISSIONING PROGRAMME

LOT 287 SOUTH WESTERN HIGHWAY, GWINDINUP

REHABILITATION AND DECOMMISSIONING
PROGRAMME

PREPARED FOR:

MARIO MICHELE GIACCI

MARCH 2024

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ENVIRONMENTAL

LOT 287 SOUTH WESTERN HIGHWAY, GWINDINUP REHABILITATION AND DECOMMISSIONING PROGRAMME

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APPENDICES

- Appendix 1: Risk Assessment and Management
Appendix 2: Indicative Species List

1. INTRODUCTION

Mario Michele Giacci, the owner of Lot 287 (Plan 100056), is proposing to expand the existing sand and gravel extraction operations on the property, located in Gwindinup within the Shire of Capel (Figure 1). This Rehabilitation and Decommissioning Programme has been prepared to address requirements of the Shire of Capel and is submitted as an appendix of the application for a Development Approval (DA) and an Extractive Industry Licence (EIL).

The proposed extraction area (Figure 2, Figure 3) includes a previously approved western part of the pit covering 17.27 ha that is in the process of being rehabilitated, and an extension area of 15.31 ha. The proposed extraction area totals 32.58 ha. The proposed extension area involves clearing of 9.70 ha of native vegetation whereas the rest of the extraction area was historically cleared for rural purposes, most recently containing blue gums. Gradual post-extraction rehabilitation is proposed to establish 3.14 ha of native vegetation within the extraction area and convert further 15.57 ha of blue gums on the property to native vegetation. Also, 9.31 ha of existing remnant native vegetation on Lot 287 is proposed to be retained and improved. It is noted that the proposed vegetation clearing and rehabilitation areas may change as part of the Department of Water and Environmental Regulation (DWER) Clearing Permit application process.

This Rehabilitation and Decommissioning Programme has been prepared to address requirements of the Shire of Capel Extractive Industry Local Law 2016 and Local Planning Policy 6.2, and it should be read in conjunction with the DA/EIL application report and related plans. This 2024 Rehabilitation and Decommissioning Programme replaces all previous versions submitted to Shire of Capel. This document covers both pasture rehabilitation and native revegetation, however the details on native revegetation are indicative at this stage - these details will be further refined as part of the DWER Clearing Permit application process.

2. OBJECTIVES

The objectives of rehabilitation and decommissioning on Lot 287 are following:

- Establish stable and safe landform post-extraction.
- Remove temporary infrastructure, rubbish and debris.
- Establish a mixture of pasture and native vegetation (Figure 4) that will maintain the rural character of the property but also mitigate for the impacts of native vegetation clearing.



Scale: 1:300000
 Original Size: A4
 Image: ESRI World Imagery
 Grid: GDA94 / MGA zone 50

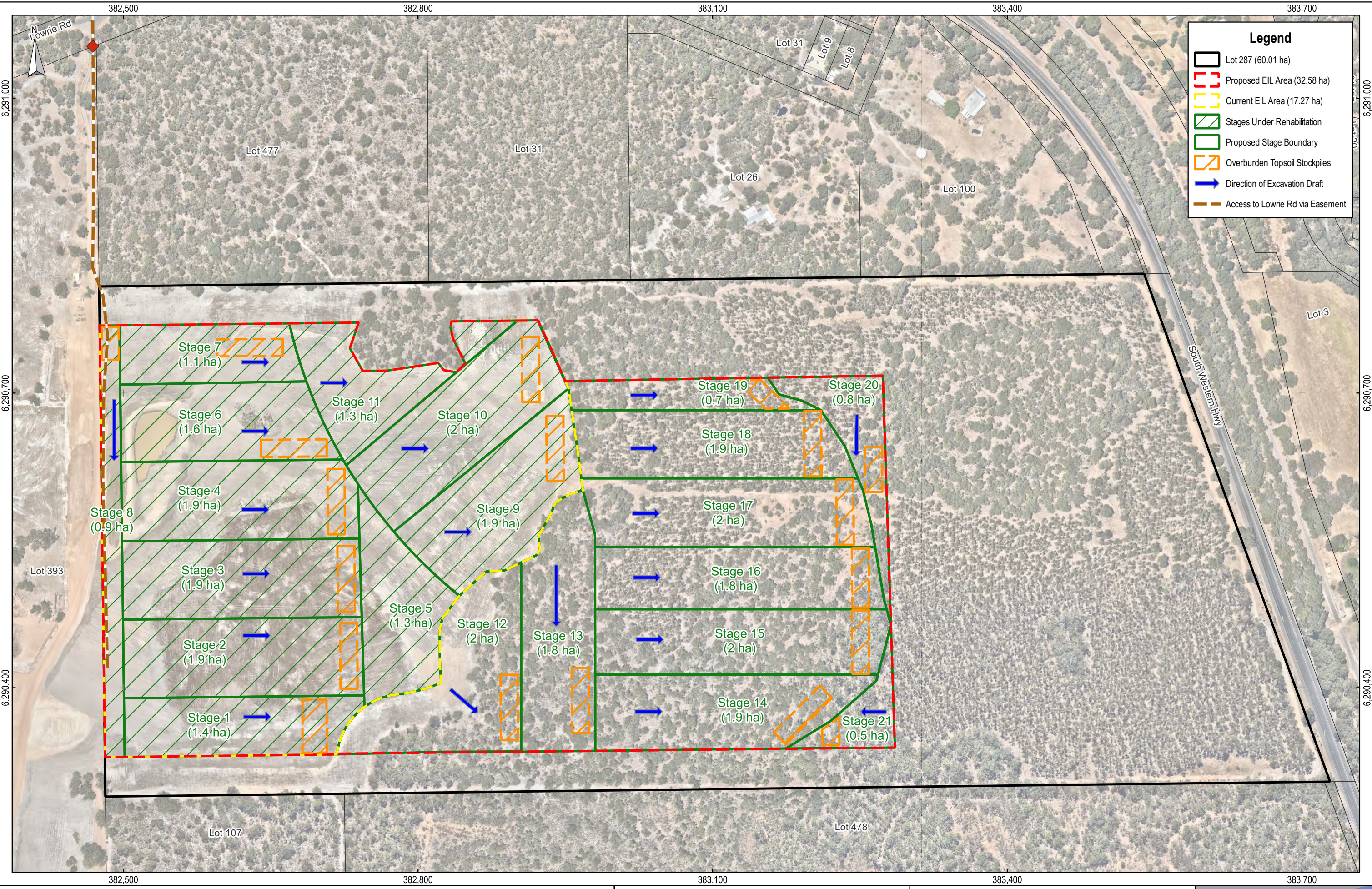
Mario Michele Giacci
 Lot 287 South Western Highway,
 Gwindinup

Figure 1

Location

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Scale: 1: 3,500
Original Size: A3
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 100 200 m

W:\MGM\South West Hwy\GIS-Common\2024 Management Plans\MGM Lot 287 South West Hwy 2024.qgz 09/03/2024 F3 Works and Excavation Plan

Mario Michele Giacci
Lot 287 South Western Highway, Gwindinup

Figure 3

Works and Excavation Plan

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Legend

Lot 287 (60.01 ha)

Proposed EIL Area (32.58 ha)

Proposed Final Contours

5 m

1 m

Remnant Native Vegetation (retained)

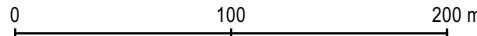
Revegetation to Native Vegetation

Revegetation to Pasture

Proposed Attenuation Basin

Gate Location

Scale: 1: 3,500
Original Size: A3
Air Photo Date: Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)



Mario Michele Giacci
Lot 287 South Western Highway, Gwindinup

Figure 4
Finished Development Plan

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3. BACKGROUND

3.1 SITE LOCATION

Lot 287 (Plan 100056) South Western Highway, Gwindinup (the property) is located within the Shire of Capel, approximately 4.5 km south of Boyanup (Figure 1). The property covers total area of 60.01 ha. Access to the site is gained off Lowrie Road via an easement on adjacent Lot 393, which is also owned by the applicant.

3.2 ZONING AND LAND USE

Lot 287 is zoned 'Rural' under the Shire of Capel Local Planning Scheme (LPS) No.8 and intercepts three Special Control Areas (SCA):

- SCA4 - Transport Corridors.
- SCA6 - Strategic Minerals and Basic Raw Materials.
- SCA8 - Regional Ecological Linkages.

SCA4 is associated with the South Western Highway and covers approximately 40 m wide strip along the eastern property boundary. SCA4 is well outside the extraction area. SCA6 is associated with mineral sand deposit further to the west and Lot 287 intersects the buffer zone to the deposit. SCA8 is associated with ecological linkages running along the Preston River and the Whicher Scarp (see Molloy *et al.* 2009). Lot 287 is not on the axis line but in close vicinity to it and contributes to the local connectivity.

The property has been historically largely cleared of native vegetation (Landgate 2024). Blue gums were planted across most of the property and these have been gradually harvested ahead of the extractive operations. Some patches and isolated individuals of native vegetation remain, as described in Section 4.4.4.

The land surrounding Lot 287 is zoned either 'Rural', 'State Forest', 'Regional Open Space', or 'Primary Regional Road' (Shire of Capel 2023). They include land uses of basic raw material extraction, livestock grazing, remnant bushland, state forest, and residential dwellings. The adjacent private properties contain a mixture of pastures and native vegetation. There is an extractive site on adjacent Lot 393 to the west of Lot 287 and a finished mineral sands mine further west of this. There are three reserves adjacent to the property (Figure 5):

- Reserve 2307 (Lot 477) – “Landscape Protection” (to the north).
- Reserve 25500 (Lot 31) – “Landscape Protection” (to the north).
- Reserve 18237 (Lot 478) – “Landscape Protection” (to the south).

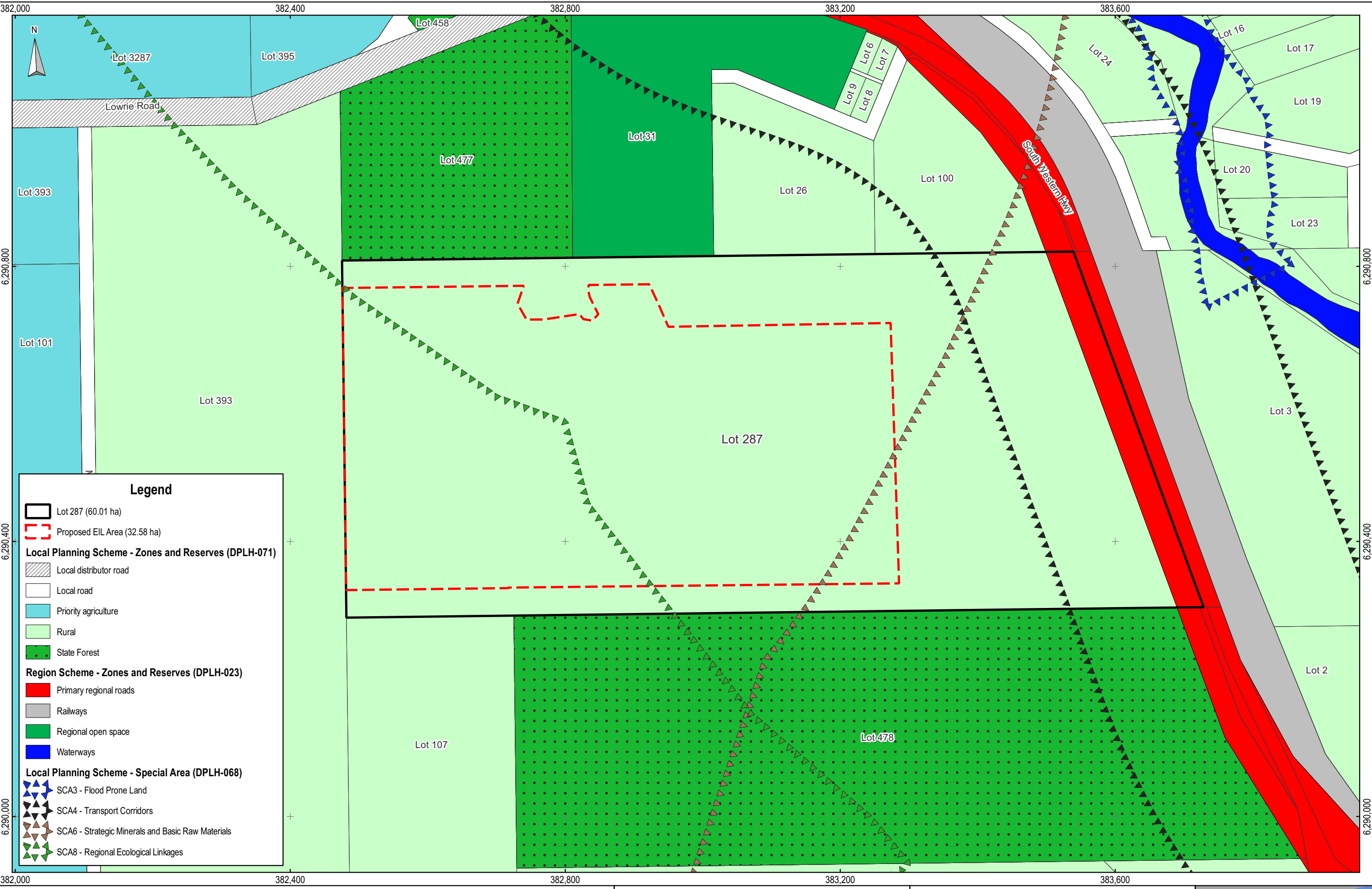
3.3 EXTRACTION WORKS

The proposed extraction area (also referred to as the site) covers 32.58 ha, including the previously approved pit (17.27 ha) and an extension of the pit to the east (15.31 ha) (Figure 2). The proposed extraction operations are summarised as follows:

- Remove vegetation, including remaining native vegetation.
- Remove topsoil, litter, and any present overburden, and stockpile these.
- Extract sand and gravel material in stages in accordance with the Works and Excavation Plan (Figure 3).
- Crush and screen gravel with a mobile crusher.
- Transport sand and gravel off site.
- Form final batters to maximum 1:6 (vertical:horizontal) (pit floor approximately 1:10) in accordance with the Final Development Plan (Figure 4).

- Rip pit floor, replace topsoil and any other overburden, and revegetate with mixture of pasture and native vegetation (Figure 4).

Once excavation of sand and gravel has been completed, the stage will be rehabilitated to pasture or native vegetation as excavation moves forward. Native revegetation works outside the extraction area will also progress gradually in stages to be defined later. At this stage total revegetation to pasture within the extraction area will be 29.46 ha, with 18.71 ha of native revegetation on the property, and 9.31 ha of native vegetation retained and improved.



4. ENVIRONMENTAL CONTEXT

4.1 LANDFORM AND SOIL

Three soil and landform mapping systems are present within and surrounding the proposed extraction area (Department of Primary Industries and Regional Development (DPIRD) 2022; DPIRD-064) (Figure 6):

- Whicher Scarp System: Low scarp and raised platform, on the northern edge of the Donnybrook Sunkland. Sandy gravel and pale deep sands, loamy gravel, and non-saline wet soils. Jarrah-marri forest and woodland.
- Goodwood Valleys System: Valleys, of the Donnybrook Sunkland. Sandy gravel, loamy gravel, and deep sand. Jarrah-marri forest and woodland.
- Blackwood Plateau System: Lateritic plateau in the Donnybrook Sunkland. Sandy gravel, loamy gravel, and deep sand. Jarrah-marri forest.

The majority of the proposed expansion to the extraction area and all of the proposed native revegetation area are located within the Goodwood Valleys System. Extraction on the property so far has shown that there is a layer of sand, of varying depth (mostly 0.3 m to 1.5 m thick), that overlies the gravel. The gravel layer is typically 1 m to 1.5 m thick but extends deeper in some areas. Material with increasing clay content is present under the gravel.

Lot 287 is located away from wetlands and waterways on well-draining soils, making the risk of acid sulfate soils (ASS) low.

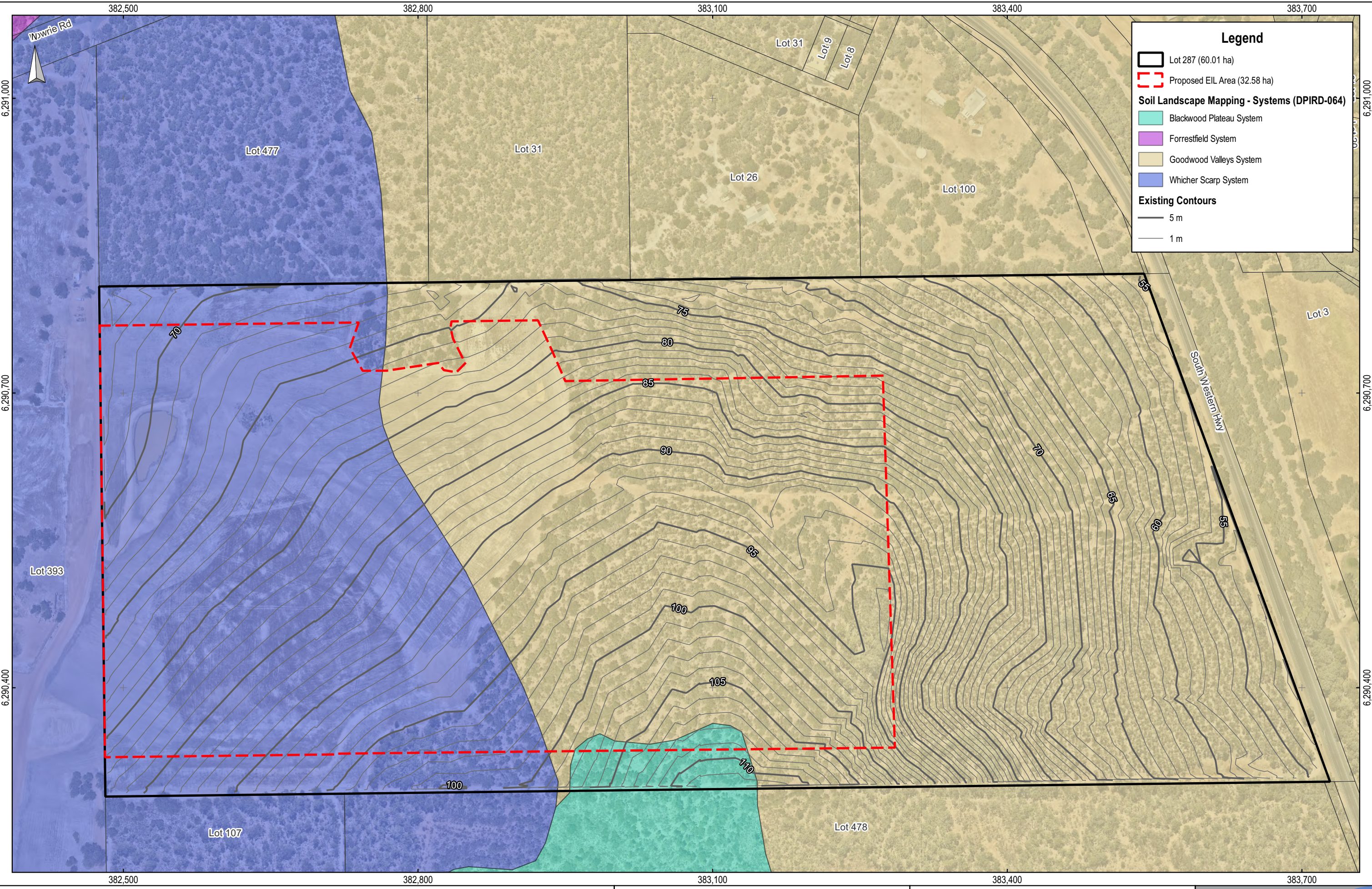
4.2 CONTOURS AND SITE STABILITY

The highest point on Lot 287 is situated approximately halfway along the southern property boundary and has an elevation of 111 m Australian Height Datum (AHD) (Figure 6). From this point, the land to the west and north slopes and undulates downward at gradients between approximately 1:10 and 1:20 slopes. Near the northern boundary there are steep areas of approximately a 1:6 slope. To the east of the proposed extraction area lies the steepest gradients on the property, which slope towards the South Western Highway at gradients up to 1:6 within the proposed extraction area and up to 1:4 further east, beyond the proposed EIL area. Natural landform within the proposed extraction area on Lot 287 ranges from 109 mAH in the south to 67 mAH in the northwest. The eastern part of the property down to approximately 52 to 55 mAH along the South Western Highway.

Batters within the extraction area will be formed to a maximum slope of 1:6 (vertical to horizontal). As shown in Figure 4, the maximum 1:6 batters are expected to be present along parts of the southern and eastern boundaries of the extraction area. Post-extraction gradients in the majority of the pit will be gently sloping (1:10), which is similar to pre-extraction landform. The establishment of pasture and native vegetation will stabilise these slopes for the long term.

Landform and soil profile outside the extraction area will remain as it. As the existing blue gum plantation has achieved stabilisation of the slopes, including the steepest natural 1:4 slopes, it is expected that native revegetation following removal of the blue gums will also stabilise the slopes over time.

Measures to minimise the risk of erosion and reduced soil stability are incorporated into the extraction and rehabilitation works. These are described in Section 7 and Section 8.



4.3 HYDROLOGY

4.3.1 Groundwater

Two piezometers were installed on Lot 287 in September 2012, and their locations are shown in Figure 2. Readings taken on 20 September 2012 are shown in Table 1. The results show that groundwater is approximately 7.8 m from the surface. Groundwater level data is also available from two piezometers on adjacent Lot 393 from October to December 2016 (Table 2). This data supports the results from Lot 287 and further also indicates that depth to groundwater increases as moving up the hill. The extractive operations on the site since 2013 have not intersected the groundwater table.

The lowest point of excavation on Lot 287 is the stormwater retention pond (at 65 mAHD) in the northwestern part of the property (Figure 4). This pond will remain approximately 2 m above maximum groundwater levels. Landform in the rest of the extraction area will be higher than the pond and depth to maximum groundwater will be more than 2 m.

Table 1: Groundwater Levels on Lot 287

Piezometer	Ground Level (AHD)	Groundwater Depth From Natural Ground Level	Groundwater Level (AHD)
A	68.20m	7.85m	60.35m
B	70.90m	7.84m	63.06m

Table 2: Groundwater Levels on Lot 393

Piezometer	Ground Level (AHD)	Groundwater Depth from Natural Ground Level	Groundwater Level (AHD)	Sampling Date
1 (southeast)	94.30 m	More than 8.8 m as bore dry	Bore dry at 85.50 m	18 Oct 2016
		More than 8.8 m as bore dry	Bore dry at 85.50 m	2 Nov 2016
		More than 8.8 m as bore dry	Bore dry at 85.50 m	14 Dec 2016
2 (northwest)	45.80 m	5.25 m	40.55 m	18 Oct 2016
		5.35 m	40.45 m	2 Nov 2016
		5.74 m	40.06 m	14 Dec 2016

4.3.2 Surface Water

The extraction area is mostly situated at the eastern edge of the catchment of Gynudup Brook, a tributary of the Capel River, which discharges into the Indian Ocean at Geographe Bay. A small area (approximately 2.3 ha) at the eastern limit of the extraction area is within the Preston River catchment and drains east toward the Preston River, approximately 800 m away. The eastern parts of the property outside the extraction area also drain east towards Preston River.

There are no watercourses on Lot 287 due to the well-draining soil and lack of upstream catchment area. Surface flow is only likely to occur during intense or prolonged rainfall events. Any surface flow leaving the extraction areas

of Lot 287 does so across the western boundary into Lot 393 Lowrie Road, with the exception of the 2.3 ha in the Preston River catchment. Lot 393 is also owned by the applicant and is being used for extraction of gravel and sand in conjunction with operations on Lot 287 under a separate EIL. Management of stormwater runoff for these two sites has been combined and is described further in a separate Stormwater Management Plan (MBS Environmental 2024b).

4.4 VEGETATION

4.4.1 Bioregional Context

The project area is located within the Jarrah Forest Bioregion classified by the Interim Biogeographic Regionalisation for Australia (IBRA) and described as a duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-wandoo woodlands on clayey soils (Thackway and Cresswell 1995).

The Jarrah Forest Bioregion is divided into two subregions, Jarrah Forest 1 (JF1 – Northern Jarrah Forest) and Jarrah Forest 2 (JF2 – Southern Jarrah Forest), of which the proposed extraction area is located within JF2 subregion. This subregion is comprised of eluvial and alluvial deposits that support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands (CALM 2003). The primary land use associated with this subregion includes grazing (improved pastures) and dry land agriculture, forestry, (both native and plantations), irrigated horticulture, mining, rural residential, easements, and conservation (CALM 2003).

4.4.2 Vegetation Complexes

Three broadscale vegetation complexes have been mapped across Lot 287 (Table 3, Figure 7) (DBCA 2018; DBCA-047).

Table 3: Vegetation Complexes

Complex	Subregion of the South West Forests	Broad landform	Description
Kingia	Blackwood Plateau and Plain	Uplands	Open forest of <i>Eucalyptus marginata</i> subsp. <i>Marginata</i> - <i>Corymbia calophylla</i> - <i>Allocasuarina fraseriana</i> - <i>Banksia grandis</i> - <i>Xylomelum occidentale</i> on lateritic uplands in perhumid and humid zones.
Rosa	Blackwood Plateau and Plain	Valleys	Woodland to open forest of <i>Corymbia calophylla</i> - <i>Eucalyptus marginata</i> subsp. <i>Marginata</i> - <i>Xylomelum occidentale</i> on slopes and tall shrubland of <i>Agonis linearifolia</i> in valley floors in the humid zone.
Whicher Scarp (290)	Whicher Scarp	Uplands	Open forest of <i>Eucalyptus marginata</i> subsp. <i>Marginata</i> - <i>Corymbia calophylla</i> on escarpment with some <i>Corymbia haematoxylon</i> , <i>Banksia attenuata</i> , and <i>Xylomelum occidentale</i> in the humid zone.

4.4.3 Vegetation Associations

Three native vegetation associations have been mapped across Lot 287 including associations 1017, 1181, and 1182 (Figure 7) (DPIRD 2019; DPIRD-006). Vegetation association 1017 is broadly described as 'Medium open

woodland; jarrah and marri, with low woodland; banksia', association 1181 as Medium woodland, jarrah, and *Eucalyptus haematoxylon* (Whicher Range), and association 1182 is described as Jarrah, marri, and wandoo.

4.4.4 Site Specific

Lot 287 contains a mosaic of remnant native vegetation, blue gum plantation, extraction operation, and some cleared land. There is approximately 19 ha of native vegetation remaining within Lot 287. A Reconnaissance Survey was undertaken of Lot 287 in November 2018 by Daniel Marsh Botanical Consulting (2019).

4.4.4.1 Flora Assemblage

A total of 55 native vascular plant taxa representative of 47 plant genera and 29 plant families were recorded within Lot 287 (Daniel Marsh Botanical Consulting 2019). The majority of the taxa recorded were representative of the Myrtaceae (7 taxa), Proteaceae (5 taxa) and Hemerocallidaceae (4 taxa) families.

An additional seven species recorded within Lot 287 were introduced species. None of these introduced taxa are listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act; WA Gov 2023).

4.4.4.2 Vegetation Types

The vegetation survey (Daniel Marsh Botanical Consulting 2019) identified three native vegetation types and an introduced vegetation type in the proposed extraction area (Figure 8):

- VT1: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low woodland of *Banksia grandis* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii*.
- VT2: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea gracilis*.
- VT3: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low sparse shrubland of *Xanthorrhoea preissii* and *Hibbertia hypericoides*.
- D: Disturbed: Blue gum plantations, tracks, and clearings.

No Threatened or Priority Ecological Communities or Threatened or Priority flora species have been recorded at Lot 287.

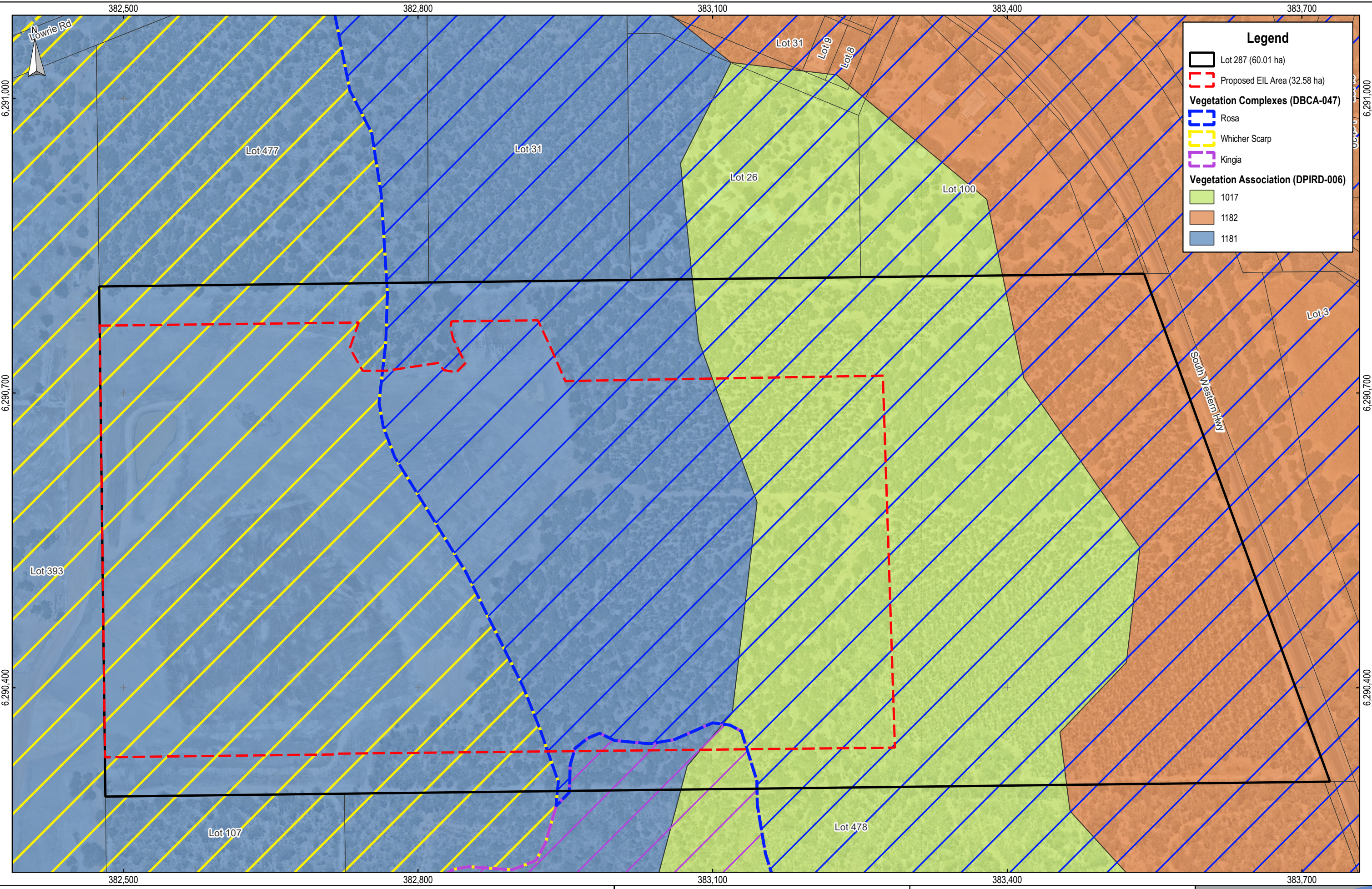
4.4.4.3 Vegetation Condition

The native vegetation communities vary in condition from Degraded to Very Good – Good (using condition scale by Keighery 1994) (Figure 9) and show signs of multiple historical disturbances including selective logging, fire, weeds, and *Phytophthora cinnamomi* (dieback) (Daniel Marsh Botanical Consulting 2019). Currently there is disturbance in the form of cleared tracks and small bare areas among native vegetation. The blue gum plantation and previously approved extraction areas have been completely cleared of native vegetation in the past.

4.5 DIEBACK AND OTHER PATHOGENS

The majority of the native vegetation on Lot 287 is dieback infested (15 ha) with just under 1 ha uninfested (Bark Environmental 2020). The remainder of the native vegetation, the blue gum plantation areas and cleared areas are mapped as 'excluded' due to the lack of indicator species to determine the occurrence of dieback; however, the presence of dieback in these areas cannot be ruled out. Mapping of the dieback status of Site 287 is presented in Figure 10. The areas of bushland surrounding Lot 287 are considered dieback infested with moderate confidence based on publicly available dieback mapping (Project Dieback 2024).

A Weed and Dieback Management Plan (MBS 2024c) has been prepared for the proposed extractive operations and these measures will apply to rehabilitation and decommissioning as well.





Legend

Lot 287 Boundary

Vegetation survey area

Vegetation type

VT1: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low woodland of *Banksia grandis* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii*.

VT2: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over tall sparse shrubland of *Kunzea glabrescens* over low sparse shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea gracilis*.

VT3: Tall woodland of *Eucalyptus marginata* and *Corymbia calophylla* over low sparse shrubland of *Xanthorrhoea preissii* and *Hibbertia hypericoides*

Disturbed: Bluegum plantations, tracks and clearings.

Scale: 1:6500
Original Size: A4
Air Photo Date: February 2017
Grid: MGA94(50)

0

200 m

Mario Michele Giacci
Lot 287 South Western Hwy, Gwindinup

Figure 8
Vegetation Types

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Legend

Lot 287 Boundary

Vegetation survey area

Vegetation condition

Very Good/Good

Good

Degraded

Completely Degraded

Scale: 1:6500
Original Size: A4
Air Photo Date: February 2017
Grid: MGA94(50)

0

200 m

Mario Michele Giacci
Lot 287 South Western Hwy, Gwindinup

Figure 9
Vegetation Condition

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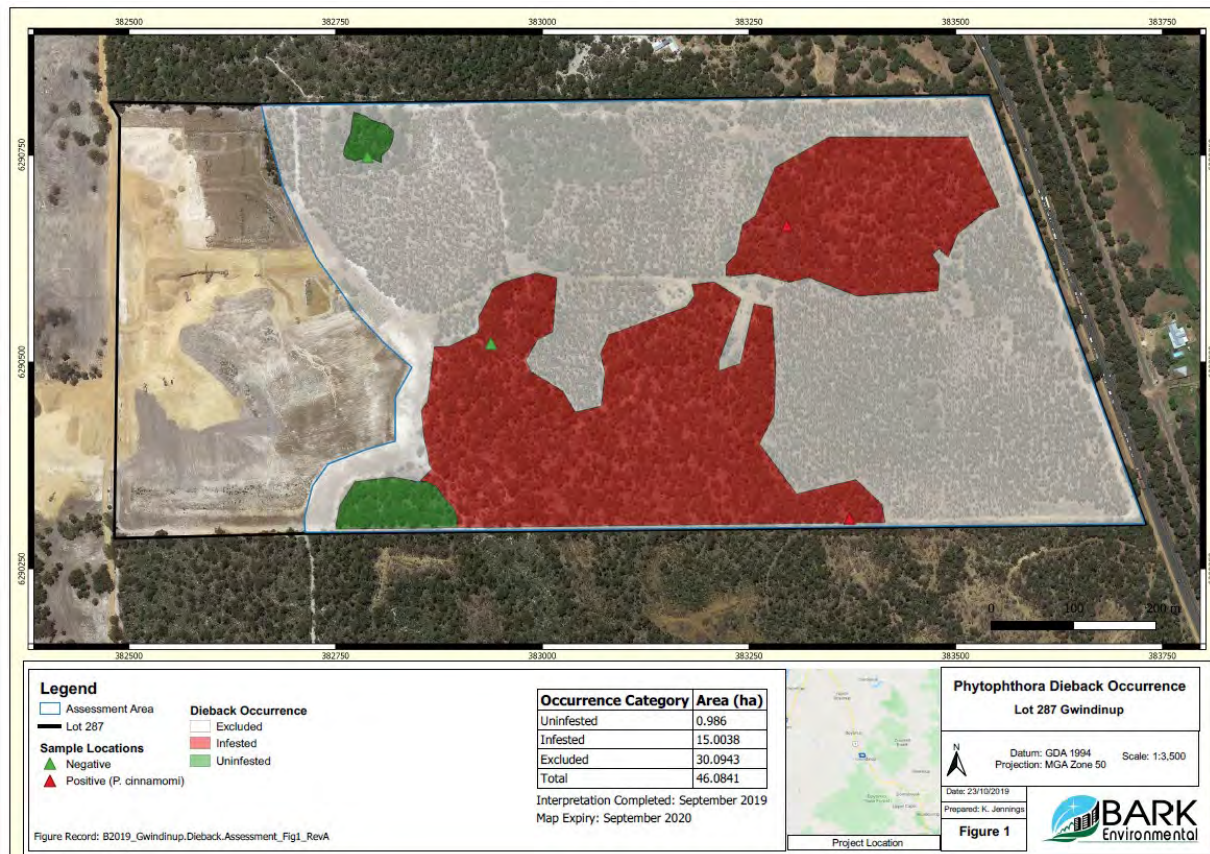


Figure 10: Dieback Status

4.6 FAUNA

4.6.1 Fauna Habitats

Zoologist Greg Harewood was engaged to conduct a fauna assessment for Lot 287 (Harewood 2019). This assessment identified four fauna habitat types that are summarised in Table 4.

Table 4: Fauna Habitat Types on Lot 287

Unit	Fauna Habitat Description	Total Area
VT1	Tall woodland of jarrah (<i>Eucalyptus marginata</i>) and marri (<i>Corymbia calophylla</i>) over low woodlands of <i>Banksia grandis</i> over tall sparse shrubland of <i>Kunzea glabrescens</i> over low sparse shrubland of <i>Xanthorrhoea preissii</i> .	0.79 ha (1.7%)
VT2	Tall woodland of jarrah (<i>E. marginata</i>) and marri (<i>C. calophylla</i>) over tall sparse shrubland of <i>Kunzea glabrescens</i> over low sparse shrubland of <i>Xanthorrhoea preissii</i> and <i>Xanthorrhoea gracilis</i> .	0.84 ha (1.4%)
VT3	Tall woodland of jarrah (<i>E. marginata</i>) and marri (<i>C. calophylla</i>) over tall sparse shrubland of <i>Kunzea glabrescens</i> over low sparse shrubland of <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> .	17.39 ha (28.6%)
D	Disturbed: Blue gum plantations, tracks and clearings	40.98 ha (68.3%)

4.6.2 Significant Fauna

During the fauna assessment (Harewood 2019), the following conservation significant fauna species were recorded within the proposed clearing area:

- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) - Vulnerable under the *Biodiversity Conservation Act 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) - Endangered under the BC Act and EPBC Act.
- Western Ringtail Possum (*Pseudocheirus occidentalis*) - Critically Endangered under the BC Act and EPBC Act.

Other significant fauna species may utilise Lot 287 based on habitat available although no evidence of them was recorded during the assessment. For further information, please see Harewood (2019).

4.6.3 Herbivores

Herbivores, including both native species (e.g. kangaroos) and introduced species, particularly rabbits, have the potential to severely compromise rehabilitation success by grazing on native seedlings and germinants. Both kangaroos and rabbits are known to occur on Lot 287 and the surrounding areas. Being a 'Rural' zoned area, there is also potential for the presence of cows, sheep, and other grazing livestock on surrounding properties. To limit grazing impacts on rehabilitation, fencing and other grazing controls will be utilised where appropriate.

4.7 CLIMATE

4.7.1 Existing Climate

The climate of the project area is Mediterranean, with cool wet winters and hot dry summers. Bureau of Meteorology (BoM) Long-term average climate data for the closest meteorological station (Donnybrook, 9 km southeast of the

property) is shown below in Figure 11. The average annual rainfall is 970.4 mm, mean minimum temperatures between 5 and 15°C and mean maximum temperatures between 16 and 31°C (BoM 2024).

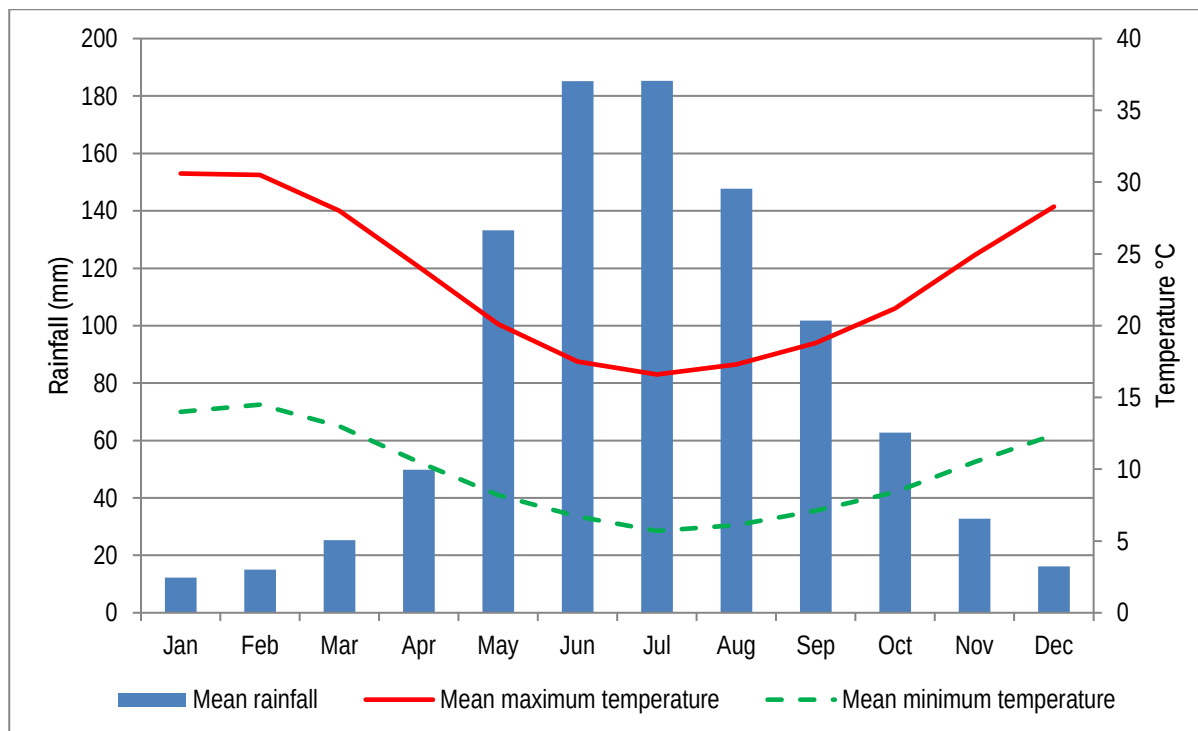


Figure 11: Climate Statistics (1900–2023) for Donnybrook (BoM Station 9534)

4.7.2 Regional Climate Change

Climate change modelling undertaken by Commonwealth Scientific and Industrial Research Organisation (CSIRO) and BoM, places Lot 287 within the South-Western Flatlands West (SWFW) cluster (WA Gov 2021). Key findings for this cluster regarding climate change to date and predictions for future change (high confidence) included following:

- Mean temperatures have increased by about 1.1 °C since 1910, with the rate of warming higher since 1960.
- Mean, maximum and minimum temperatures are projected to continue to rise.
- The temperature and frequency of very hot days is expected to increase, and heatwaves will get longer and more intense.
- The number of days with frost risk will decrease.
- The South West has experienced a marked drying trend since 1970, particularly in autumn and early winter.
- Further decreases in annual, winter and spring rainfall are projected with high confidence. By 2030 under all emission scenarios, winter rainfall is projected to decrease by up to 15 per cent. However, the intensity of heavy rainfall events will likely increase.
- Under all emission scenarios, the time spent in drought is projected to increase.
- Drier and hotter conditions will lead to decreases in soil moisture and runoff because of increased water loss from plants and soils (evapotranspiration).
- There is high confidence that climate change will result in a harsher fire weather climate in the future.
- Mean sea level will continue to rise, as will height of extreme sea level events. The oceans are also becoming warmer and more acidic in the future.

5. REHABILITATION RISK ASSESSMENT

A risk assessment has been undertaken for factors that may adversely impact upon rehabilitation success, particularly native revegetation. The risk assessment can be found in Appendix 1. The determination of risks is based on the risk rating system outlined in the Environmental Management Plan Guidelines (DoE 2014).

A number of activities were assessed as having 'high' risk prior to mitigation, which indicated an undesirable level of risk to achieving rehabilitation objectives. Following mitigation and management measures proposed within this programme, all risks were downgraded to either 'Medium' or 'Low'.

The rehabilitation risks that were considered are listed below:

- Weeds.
- Dieback.
- Erosion.
- Fire.
- Grazing.
- Poor soil moisture.
- Insufficient mulch.
- Availability of local seeds/cuttings.
- Seed/Seedling quality.
- Unauthorised access.
- Climate change.

The management of these risks has been incorporated into the proposed rehabilitation methodology (see Section 7 and Section 8).

6. IMPLEMENTATION STRATEGY

6.1 REHABILITATION ZONES

Four main rehabilitation zones are proposed for Lot 287:

- Zone 1: Extraction area to pasture, total of 29.46 ha.
- Zone 2: Extraction area to native vegetation, total of 3.14 ha.
- Zone 3: Plantation to native vegetation (outside extraction area), total of 15.57 ha.
- Zone 4: Native vegetation improvement (outside extraction area), total of 9.31 ha.

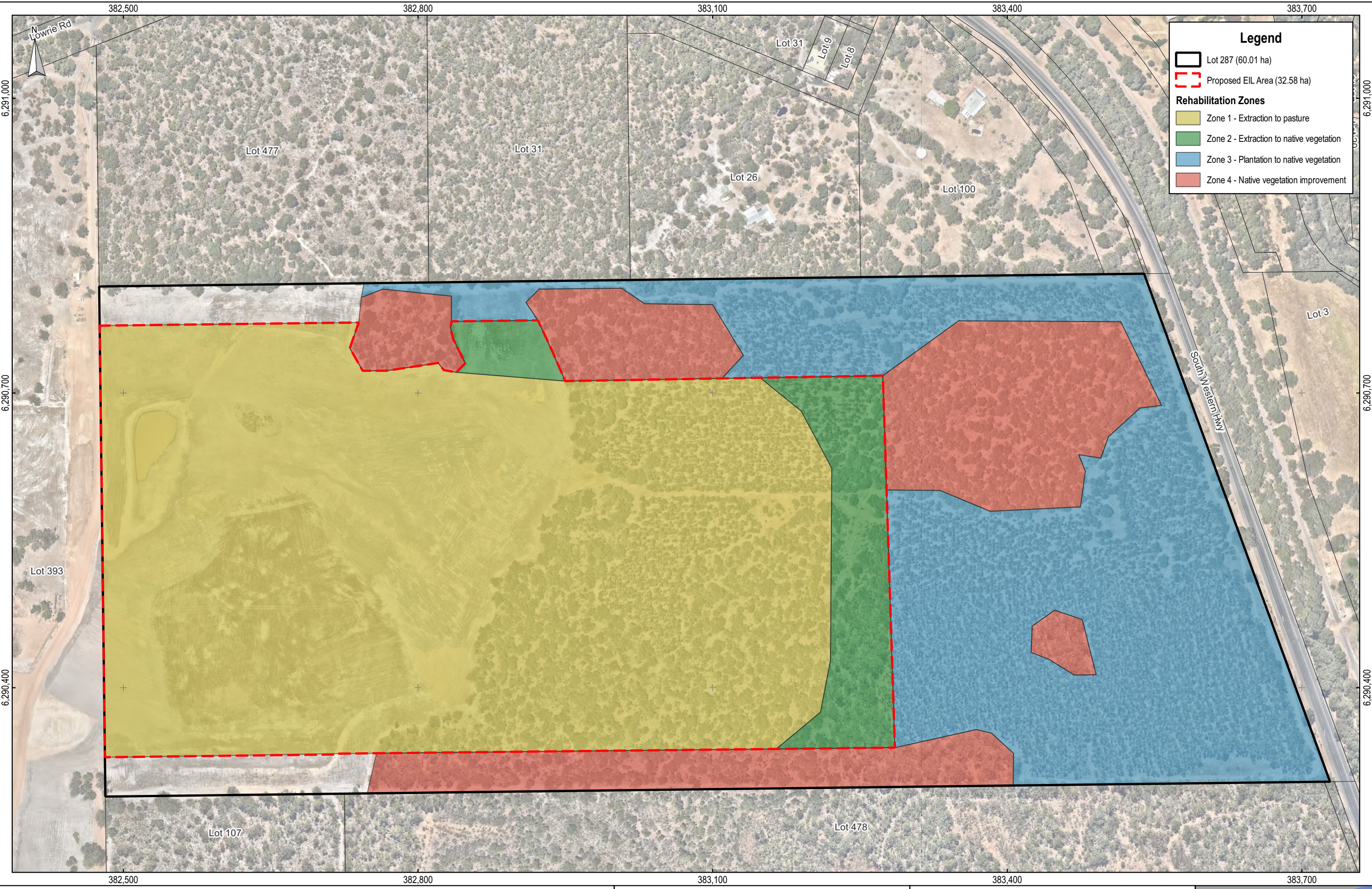
6.2 APPROACH AND STAGING

6.2.1 Within Extraction Area

Rehabilitation works within the extraction area (Zone 1 and Zone 2) will be gradual and follow the extraction stages (Figure 3). The timing of completion of each stage will depend on market demand for the resource and therefore cannot be predicted accurately in advance. Extraction of Stages 1 to 11 (previously approved area) has now been completed and rehabilitation of these areas is underway. In the extension area, extraction will commence in Stage 12 and continue through to Stage 21.

6.2.2 Outside Extraction Area

The rehabilitation works outside the extraction area (Zone 3 and Zone 4) will also be undertaken gradually but are not dependent on the pace of extraction. The works on Zone 3 and Zone 4 can commence as soon as the proposed extraction has been approved (local government and other approvals) and progress on an annual basis. The approach and staging of rehabilitation works in Zone 3 and Zone 4 will further be defined as part of environmental approvals processed.



7. ADVANCED PLANNING AND MANAGEMENT

7.1 BLUE GUM REMOVAL

The remaining blue gums within the proposed extraction area will be harvested prior to extraction (Zone 1 and Zone 2). The stumps and excess litter will be removed by pushing into windrows and burning. Burnt vegetative matter will be spread over the native revegetation areas, which will provide accessible carbon for seedlings.

The blue gums outside of the extraction area (Zone 3) are proposed to be cleared gradually (staging to be confirmed), to maximise the following benefits:

- Maintain site erosion control and slope stability.
- Maintain visual screening of the extractive operations from the neighbouring properties and the South Western Highway.
- Opportunities for site specific learnings from previous rehabilitation works.

Within the previously approved extraction area on Lot 287 and Lot 393, blue gum removal has involved removal of all stumps. All stumps will continue to be removed within the proposed extraction area. In the native revegetation areas outside the extraction area, particularly the steeper eastern slopes, it may be beneficial to retain at least some blue gum stumps to maximise slope stability. Retaining stumps has drawbacks (e.g. access issues) that may adversely influence the success of revegetation, and therefore it is proposed that trials will be undertaken at the start of the revegetation works to determine the most beneficial approach to stumps.

7.2 VEGETATION RETENTION AND CLEARING

Clearing of native vegetation within the extraction area (Zone 1 and Zone 2) will be subject to conditions set in a Clearing Permit (yet to be determined). At this stage, the clearing is expected to occur as follows:

- Clearing areas will be marked in the field to avoid over-clearing.
- Clearing will be undertaken gradually, one stage at a time ahead of extraction.
- Experienced fauna handler will be present during clearing to inspect the vegetation to be cleared and relocate fauna as necessary.
- Clearing of will be undertaken with a bulldozer.
- Some of the cleared vegetation (e.g. selected trunks, branches, brush) will be stockpiled for use in rehabilitation.
- Suitable cleared vegetation will be mulched for use in rehabilitation. If stockpiling of mulch is required, it shall be kept free of weeds.
- Some plants to be cleared may be transplanted into the native revegetation areas.

7.3 TOPSOIL MANAGEMENT AND EARTHWORKS

The following earthworks and soil management will be undertaken within the extraction areas (Zone 1 and Zone 2):

- Removal of topsoil (approximately 100 mm thick) and remaining litter will proceed in stages ahead of extraction. The topsoil/litter mix will be removed using appropriate machinery and will be stored in windrows to a maximum height of 4 m.
 - Topsoil from native vegetation areas will be stockpiled separately from topsoil from other areas.

- Observations will be made of the weed load of topsoil prior to its removal and during the stockpiling period. Heavily weed infested topsoil will be suitable for respread only in the pasture rehabilitation areas.
- Sand and gravel extraction will proceed in accordance with the DA/EIL report.
- Dust generation from topsoil and other stockpiles (wind erosion) will be minimised as necessary with a water truck (spraying water).
- As each stage of extraction is completed, the permanent landform contours will be established in accordance with the latest approved Finished Development Plan. Batter slopes will be maximum 1:6 with the remainder of the pit with gentle gradients of approximately 1:10. The final contours shall be achieved and confirmed by way of digital survey.
- Ripping will be undertaken along contour lines to promote root penetration and runoff infiltration.
- To further manage runoff, increase infiltration and reduce sediment movement post mining, contour banks will be constructed along the final landform contour at 100 m intervals.
- The stockpiled topsoil/litter mix will be replaced across the rehabilitation area.

In the areas outside the extraction area (Zone 3 and Zone 4), the natural landform and soil profile will be retained.

7.4 EROSION AND SEDIMENT CONTROL

Rip lines and contour banks will 'baffle' runoff within the extraction area, providing infiltration and minimising erosion. Catchment runoff from the pit area will flow to the attenuation basins, where sediment will settle out and some infiltration will occur. Further details on runoff management and sediment control as part of the extractive operations is provided in the Stormwater Management Plan (MBS 2024b). Water trucks will be used as necessary to control wind generated dust and minimise dust impacts on surrounding bushland and residents (see Dust Management Plan for further details, MBS 2024a).

7.5 MULCH SUPPLY

As described in Section 7.2, some of the native vegetation to be cleared will be mulched. Should there be insufficient quantities of site mulch for use in the rehabilitation works, mulch will be imported to site. Imported mulch must either have originated from a dieback free area of similar vegetation type or composted for a period of three to six months to neutralise pathogens and weeds. Mulch is to be between 10 - 50 mm in diameter.

7.6 SPECIES SELECTION AND PLANT ALLOCATION

The species selected for native revegetation on Lot 287 will be based on species recorded on Lot 287 and species known to occur in similar habitats in the local area. Species selection will focus on easy to propagate species and dieback resistant species that will provide the highest likelihood of success in achieving completion criteria. An indicative species list is provided as Appendix 2. Plant allocation within the site will be based on soil suitability, hydrological properties, and landscape features.

7.7 PROVENANCE SEED COLLECTION AND SUPPLY

Provenance seed and cutting collection is scheduled generally over the spring and summer periods (but can vary for different species), occurring over a number of years, as the seeds of different species mature at different times and depending on the progress of staged extraction and rehabilitation.

Seed and cuttings shall be collected from onsite and within 50 km of the site, where possible. In situations where provenance seed and cuttings cannot be sourced, material will be sourced from other local areas, or alternative species with provenance seed may be considered.

Prior to clearing of native vegetation on site, seed and plant material will be collected to supplement the rehabilitation process. Transplanting of species such as *Xanthorrhoea* sp. will be undertaken where possible.

7.8 SEEDLING PROPAGATION

All seedlings shall be sourced from NIASA certified nurseries, with preference to local nurseries, where possible. Tubestock will be grown from provenance seed, where possible and will either be grown in forestry tubes or deep cells (50 mm square by 120 mm deep) to ensure appropriate root development.

All containers must be sterilised prior to any soil material being placed in them to avoid the introduction or spread of soil borne pathogens. Only suitably mature tube stock with well developed roots, 10 to 15 cm high foliage that has been hardened off and is of a generally good health condition, is accepted.

Seedling orders are typically due around October/November the year preceding the planting works. However, some harder to source species and larger quantities of seedlings will require longer lead times.

7.9 DIEBACK MANAGEMENT

Dieback management measures applicable to the extractive operations are detailed in the Weed and Dieback Management Plan (MBS 2024c) that is part of the DA/EIL application package, and these measures apply to rehabilitation and decommissioning as well. As the property has been confirmed to be largely dieback infected, the native revegetation works will focus on establishing flora species that are dieback resistant. Dieback susceptible species will be included in the species mixture as well but the likelihood of survival of these species is expected to be lower. The implications of dieback for re-establishing native vegetation will be also be addressed as part of the Clearing Permit approval process.

7.10 ACCESS

Access to Lot 287 will be maintained off Lowrie Road through Lot 393. The property is fenced and the access track has a gate to prevent unauthorised access. Internal tracks will be established within the extraction area to facilitate extraction and subsequent rehabilitation. Outside the extraction area, internal tracks will also be established to facilitate rehabilitation.

7.11 FIRE MANAGEMENT

Fire breaks will be maintained along property boundaries as per Shire of Capel guidance. The internal tracks for extraction and rehabilitation purposes can also be used for firefighting access if necessary.

7.12 SIGNAGE

Signage will be placed at the entry gate into Lots 287 and 393 advising of the extractive operations. Signs warning of excavation will also be placed along the property boundary. Signs and/or physical barriers will be placed at the interface where rehabilitation areas immediately abut active works areas and access tracks to clearly delineate that personnel are entering a rehabilitation zone.

The area that was assessed as dieback free (Bark Environmental 2020) will be sign posted and delineated in the field. Access to this area will require clean down and instructions regarding this will also be posted. Any dieback

free topsoil will be stockpiled separately and signposted, and returned to the area it came from, and no topsoil from other parts of the property will be brought into the dieback free area.

Signage will be used to differentiate topsoil stockpiles from native vegetation areas versus other areas. The native vegetation areas to be retained will be delineated and sign posted when clearing blue gum plantation. Additional signage may be posted if considered necessary.

7.13 FENCING

Due to kangaroo and rabbit populations in the local area, fencing is considered necessary to minimise grazing impact, particularly on native revegetation. Fencing to minimise grazing would be at least 1,500 mm high, composed of ring lock and would include a rabbit proof mesh skirting. In order to allow native ground dwelling fauna to continue to move across the property, it is not desirable to apply kangaroo and rabbit fencing to the entire property boundary. Rather it is proposed that sections of the native revegetation would be fenced gradually, leaving 'unfenced' corridors for fauna movement. A one way kangaroo gate will be installed within each fenced area to facilitate safe exit for any kangaroos that may have jumped in.

8. REVEGETATION IMPLEMENTATION METHODOLOGY

8.1 DECOMMISSIONING

As part of decommissioning, any temporary site infrastructure (e.g. portable toilets) and waste/debris will be removed.

8.2 EARTHWORKS

Upon completion of an extraction stage, rehabilitation works will commence by finalising the landform. The pit batters will be formed no steeper than 1:6 slope, with the rest of the pit landform sloping gently at approximately 1:10.

8.3 TOPSOIL RESPREAD

8.3.1 Zone 1: Extraction Area to Pasture

Topsoil that was stockpiled prior to extraction will be respread across the pasture rehabilitation area to a depth of no greater than 100 mm.

8.3.2 Zone 2: Extraction Area to Native Vegetation

Topsoil and mulch that were stockpiled prior to extraction will be respread across the native revegetation area to a depth of no greater than 100 mm. Only topsoil from native clearing areas will be respread in Zone 2. Heavily weed infested topsoil will not be spread in native revegetation areas as this has potential to compromise revegetation success and additional mulch may be required instead.

8.3.3 Zone 3: Plantation to Native Vegetation

Not applicable - topsoil will remain in situ.

8.3.4 Zone 4: Native Vegetation Improvement

Not applicable - topsoil will remain in situ.

8.4 EROSION MANAGEMENT

The risk of erosion will be managed as follows:

- Gradual extraction followed by gradual rehabilitation to minimise the bare area open to the elements.
- Implementation of the Dust Management Plan (MBS 2024a).
- Implementation of the Stormwater Management Plan (MBS 2024b).
- Gradual conversion from blue gums to native vegetation (outside the extraction area) with trials to determine whether some blue gum stumps should be retained for stability.
- Any ripping, mounting or similar will occur along contour to maximise infiltration of rainfall.
- Monitoring will be undertaken for early detection of erosion and mitigation measures and additional management measures will be implemented as necessary if erosion is observed.

8.5 DEEP RIPPING AND SCARIFICATION

Ripping promotes root penetration and runoff infiltration, increasing revegetation success and reducing the risk of erosion. Ripping depth and rip line separation distances will vary, depending on the historic land use and rehabilitation objectives, as detailed below. In addition to deep ripping, scarification or other ways of creating micro depressions (e.g. tracking) will be implemented in areas where native seeding will be undertaken on slopes to assist with seed retention.

8.5.1 Zone 1: Extraction Area to Pasture

In the pasture rehabilitation areas, ripping will be undertaken along contour lines to 300 mm to 500 mm with 1 to 2 m centres between lines.

8.5.2 Zone 2: Extraction Area to Native Vegetation

In native revegetation areas, ripping will be undertaken along contour lines to a minimum of 600 mm deep with approximately 1 m centres between lines. Scarification or other ways of creating micro depressions (e.g. tracking) will be implemented in areas where native seeding will be undertaken.

8.5.3 Zone 3: Plantation to Native Vegetation

Ripping in Zone 3 will be dependent on whether, and to what degree, blue gum stumps will be retained as retaining stumps will limit access by machinery and ability to rip. Augering can be used as an alternative method in areas where ripping is not feasible.

8.5.4 Zone 4: Native Vegetation Improvement

No ripping is proposed in these areas. Planting will be undertaken with a hand auger.

8.6 HABITAT LOGS

Select plant matter, such as larger branches and or tree trunks may be salvaged from the clearing areas and be transferred to the native revegetation areas to create microhabitats and assist with topsoil retention.

8.7 MULCHING

Vegetation will be cleared in stages and mulched for respread. As far as practicable, mulching will be undertaken during or immediately after vegetation clearing and spread directly to a native revegetation area, to a depth of no greater than 25 mm. The mulch will act not only as carbon for soil microbial activity, but may also provide a source of native seed, and will assist in dust suppression and erosion control. If mulch is brought to site from elsewhere, it must meet Australian Standards AS4454-2012) (CS-037 2012), in an effort to manage weed seed, pathogens, and diseases.

8.8 WEED MANAGEMENT

The Weed and Dieback Management (MBS 2024c) prepared for the extractive operations will apply for rehabilitation and decommissioning as well, however rehabilitation will also involve additional weed control measures. Weed control will be required across the rehabilitation areas to manage weeds during the establishment of pasture and native species.

8.8.1 Zone 1: Extraction Area to Pasture

In the pasture rehabilitation areas, weed management will aim to control weeds that could outcompete the desired pasture species and will also aim to eradicate declared pest plants, weeds of national significance and priority weeds of concern for the region.

Where necessary, weeds will be controlled prior to the seeding of pasture with a broad-spectrum or a selective herbicide. Fluazifop may be used as a grass specific herbicide and Metsulfuron-methyl for geophytes.

Manual removal and spot spraying with glyphosate or a selective herbicide will also be undertaken as necessary after seed germination and plant establishment to support the achievement of the completion criteria.

8.8.2 Zone 2: Extraction Area to Native Vegetation

As the re-spread topsoil and mulch is expected to provide a source of native seed but will also include some weed seed, weed control in Zone 2 will need to be tailored to support the establishment of natives while minimising weeds. It is proposed that an adaptive management approach is undertaken in Zone 2 comprising inspections prior to control to determine the best weed control approach. Broad spectrum, selective herbicides and/or manual removal will continue to be applied as necessary until the completion criteria have been met.

8.8.3 Zone 3: Plantation to Native Vegetation

Weed control in Zone 3 will aim to minimise weeds prior to commencement of native revegetation. Weed control will be undertaken prior to and after the removal of blue gums, and after any ground disturbance (e.g. stump removal or ripping) and ahead of seeding/planting. Planting and/or seeding should be delayed until weeds are under control to avoid weeds from compromising native revegetation. Weed control will be tailored to the specific site requirements that will vary over time and will include broad spectrum, selective herbicides and/or manual removal. Weed control will continue as necessary until the completion criteria have been met.

8.8.4 Zone 4: Native Vegetation Improvement

Weed control in Zone 4 will aim to reduce weed load in the retained native vegetation areas and eradicate any declared pest plants, weeds of national significance and priority weeds of concern (if any present). Care will be taken to ensure that weed control does not adversely affect the native vegetation already present.

8.8.5 General

Herbicides will be selected based on the target species, the receiving environment and potential sensitivities or constraints that may be present. Selective herbicide application will be favoured to reduce the likelihood of off-target damage to remnant native vegetation. Herbicide will be applied from a boom spray unit where accessible and hand sprayed in harder to access areas and in areas adjacent to sensitive receivers such as native vegetation. Manual removal of weeds will also be considered where appropriate.

Herbicides proposed for used on site include but are not limited to:

- Glyphosate Biactive - broadleaf and grasses.
- Fluazifop - grass specific.
- Metsulfuron methyl - geophytes such as arum lily.

Areas to be planted with seedlings will ideally be sprayed the winter before planting with a residual (e.g. Simazine) and knockdown (e.g. Glyphosate + Metsulfuron Methyl) herbicide mix. Simazine would typically be sprayed at 2.4 kg/ha, Roundup UltraMax (540) at a minimum 2+ litres/ha and Metsulfuron Methyl at 7 grams/ha, with the carrier 100 litres of water per hectare. If weeds are forming seed pods and the herbicide application will not kill the weeds

before this seed sets then slashing may be considered. The following year the same mix will be sprayed again during May/early June before planting (timing may vary with seasonal conditions).

Control of weeds will be undertaken in accordance with the *Agriculture and Related Resources Protection Act 1976*, BAM Act, guidance from the Department of Primary Industries and Regional Development and under industry best practise for control. Records will be kept of all herbicide applications undertaken on site.

8.9 DIRECT SEEDING

Direct seeding is proposed in Lot 287 for both pasture and native revegetation.

8.9.1 Zone 1: Extraction Area to Pasture

Revegetation to pasture will proceed in stages in areas that have been ripped and contoured:

- The site will be allowed to wet up with autumn rains before fertiliser is applied at 200 kg per hectare of NPK + Trace Elements.
- A pasture species mix will then be direct seeded into the topsoil by appropriate machinery. This will include a mix of annual grasses, clovers and other species suitable to sand over gravel/clay soils. Seeding will only take place once sufficient rains have fallen to allow for successful germination.
- Pasture seed will be sown at a rate of 25 kg of seed per hectare.

8.9.2 Zone 2: Extraction Area to Native Vegetation

Direct seeding of suitable native species will be undertaken in areas where micro depressions have been created through scarification, tracking or other means. The species mix will be selected based on position in the landscape, provenance seed availability and species with the highest probability of successfully establishing from seed.

Seed will be pretreated with a mycorrhizal bio-stimulant and will be hand broadcast at a rate of 4 kg per ha. Hand broadcasting is expected to be the most suitable method for the site considering the site topography and confidence in achieving adequate coverage.

Germination rates and survival of germinants can vary significantly depending on a wide range of environmental, site and climate factors. Anticipated death rates of germinants are estimated to range from 50-70% in the year following seeding, 20-30% in the second year and 10-20% in the third year.

Native everlastings may be broadcast at a rate of 5 kg per ha on batters or steep slopes, to control erosion and weeds whilst native germinants establish. Everlasting will reduce in abundance over time as other native species mature and increase in height.

Direct seeding should be programmed to April-June while soil temperatures are still warm, as close to as possible to the break of autumn rains.

8.9.3 Zone 3: Plantation to Native Vegetation

Methods described for direct seeding in Zone 2 above will also apply to Zone 3.

8.9.4 Zone 4: Native Vegetation Improvement

No direct seeding is expected to be undertaken in Zone 4, but rather seedlings will be planted to infill and improve existing vegetation.

8.10 SEEDLING PLANTING

Planting of seedlings will be undertaken in Zones 2, 3, and 4. Planting works may use different methodologies, depending on landscape conditions, stage of rehabilitation and site constraints or sensitivities. Where possible it is preferential that planting of seedlings is undertaken along rip lines. Alternatively, seedlings may need to be planted with a hand auger and this is expected to occur under the following circumstances:

- In Zone 4, where existing native vegetation is present.
- In areas where remnant native vegetation or blue gum stumps prevent access of machinery to complete rip lines.
- If topography of the site makes machinery access unsafe.
- During subsequent infill planting.

Each tubestock/ cell will be planted with a single 10 g native fertiliser tablet (excluding proteaceous species). The use of initiator insecticide tables will also be trialled for eucalyptus seedlings.

In Zones 2 and 3, the initial seedling planting density is expected to be one plant per 10 m², supporting the proposed seeding rate of 4 kg/ha. Infill planting will be undertaken in Zones 2 and 3 as required in alignment with completion criteria. Infill planting will be undertaken in Zone 4 to supplement existing native vegetation and the rate for this will be determined as part of the Clearing Permit application process.

8.11 SCHEDULE OF WORKS

The extraction staging plan is shown in Figure 3, with extraction in maximum 2 ha stages, however as noted earlier the rate of extraction is dependent on demand for the resource. Typically, one or two stages would be expected to be extracted in a year. Rehabilitation works in Zones 3 and 4 will also be gradual but is not dependent on the progress of extraction. Staging for Zones 3 and 4 will be developed as part of the Clearing Permit application process.

Indicative scheduling for rehabilitation works is presented in Table 5. The table presents a typical schedule for the rehabilitation actions required, subsequent to the surface preparation works. It should be noted that best efforts will be made to ensure that seedling orders are made for the next planting season if completion of extraction within a stage is projected to be completed with sufficient time to implement preparatory works for winter planting the following year.

Table 5: Indicative Rehabilitation Schedule of Works

Aspect	Year 0				Year 1				Year 2				Year 3			
	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
Initial weed control																
Seed collection																
Seedling order																
Site preparation																
Direct seeding																
Seedling planting																
Follow up weed control																
Monitoring and reporting																
Infill planting																

	= optimal timing
	= timing based on seasonal/ site conditions

Note: Following implementation of this revegetation schedule, seasonal weed control, bi-annual monitoring and reporting and potentially other maintenance actions will be required until completion criteria have been met.

9. POST INSTALLATION MANAGEMENT

Regular monitoring, maintenance and review of methodologies is key to ensuring success of the rehabilitation program. Post installation management is specified below.

9.1 MONITORING

Each rehabilitation stage will be monitored on a biannual basis (Spring and Autumn) for a two-year period after installation. Following the two-year period, monitoring will drop down to an annual basis (in Spring) until the completion criteria have been met and maintained for two years. Monthly inspections of the fencing infrastructure will be undertaken, as this is critical for rehabilitation success and monitoring will be followed by maintenance as necessary.

9.1.1 Zone 1: Extraction Area to Pasture

One permanent monitoring points per hectare will be established in the pasture rehabilitation areas. Monitoring of pasture sites will capture the following information:

- Observations of pasture establishment - vigour, resilience, % coverage.
- Soil issues evident from areas lacking growth vigour.
- Erosion damage.
- Weed presence.

Photographs will be taken of the monitoring points during each monitoring event. Additional opportunistic monitoring will be undertaken while traversing between the monitoring points. Opportunistic ad hoc monitoring will also be undertaken as part of the operations so that any emerging issues can be addressed as promptly as possible and completion criteria achieved.

9.1.2 Zone 2: Extraction Area to Native Vegetation

A mixture of permanent and random quadrats (minimum one per hectare of each) will be established in Zone 2. The permanent quadrats will also act as photo monitoring points. The quadrats will be 10 m by 10 m in size and will also include a smaller nested quadrat for germinants. Photographs will be taken of the quadrats during each monitoring event to provide a direct visual capture of rehabilitation progress. In addition to quadrat based data collection, opportunistic visual observations will also be recorded during each monitoring event. The data to be collected in each monitoring event is summarised in Table 6.

Table 6: Monitoring Data Requirements for Native Revegetation

Quantitative Data	Qualitative Data
• Density of native vegetation (stems per m²). • Native species present (species richness). • Native foliage cover (%). • Maximum height of each native species present. • Native vegetation structure. • Weed species present. • Total weed foliage cover (%). • Vegetation condition (Keighery 1994).	• Observed health of native vegetation. • Observed health of weeds. • Grazing and pest activity. • Evidence of disease (e.g. dieback, Marri canker). • Soil moisture observations. • Native fauna observations. • Soil movement/ erosion signs. • Notes on surrounds (e.g. whether the quadrat is representative of surrounds). • Photographs of quadrats and photo points. • Opportunistic observations.

Ad hoc visual observations and site inspections will also be undertaken opportunistically during day-to-day activities and site meetings, to ensure any emerging issues can be addressed promptly.

9.1.3 Zone 3: Plantation to Native Vegetation

Methods described for monitoring in Zone 2 above will also apply to Zone 3.

9.1.4 Zone 4: Native Vegetation Improvement

Monitoring in Zone 4 will target the effectiveness of the improvement actions and will continue until the completion criteria have been achieved and maintained for two years. Monitoring in Zone 4 will be further defined as part of the Clearing Permit application process with DWER but at this stage is expected to include:

- Monitoring of effectiveness of weed control.
- Monitoring the success of infill plantings.
- Monitoring of trends in native species diversity and cover following fencing.

9.2 MAINTENANCE

Ongoing maintenance will be undertaken in response to findings of the monitoring events and any opportunistic observations whilst on site. Maintenance activities will include, but are not limited to:

- Weed control.
- Infill planting or reseeding native vegetation in areas where completion criteria are projected to not be met. Reseeding will be limited to areas where appropriate soil preparation can be undertaken; elsewhere infill planting will be used.
- Reseeding of pasture.
- Fence repairs.
- Disease and pest control.
- Repairs to erosion damage and implementation of any additional erosion control measures.
- Application of fertilisers and soil improvers.

9.3 COMPLETION CRITERIA

9.3.1 Zone 1: Extraction Area to Pasture

Completion criteria for Zone 1 pasture rehabilitation are presented in Table 7. The completion criteria for pasture rehabilitation are expected to be achieved within two years of a particular stage undergoing pasture seeding, however if this is not the case, then rehabilitation works will continue until the completion criteria have been achieved. As the extraction and rehabilitation works are staged, the completion criteria will be achieved gradually across the site.

Table 7: Completion Criteria - Zone 1

Aspect	Completion Criteria
Landform	Final landform is in accordance with an approved post-extraction plan.
Pasture cover	Pasture cover is sufficient to stabilise soil.
Significant Weeds	No declared pest plants or Weeds of National Significance present.
Bare Ground	No bare patches of ground more than 30 m ² in size.

9.3.2 Zone 2: Extraction Area to Native Vegetation

Indicative completion criteria for Zone 2 native revegetation are presented in Table 8. These are expected to be further refined during the Clearing Permit application process with DWER.

Table 8: Completion Criteria - Zone 2

Aspect	Completion Criteria	Intermediate Targets	Assessment Methodology
Landform	Maximum batter slopes no steeper than 1:6.	Gradual establishment of final landform in accordance with Finished Development Plan in areas where extraction has been finished.	Site survey
Soil profile	All rehabilitated areas contain at least 50 mm of topsoil (either from clearing areas or constructed from subsoil and mulch):	Gradual spreading of topsoil across areas where landform has been finalised.	Earthwork logs, rehabilitation monitoring.
Site stability	Slopes are stable.	Slope stability issues are being captured in monitoring and mitigated.	Rehabilitation monitoring.
Rehabilitation extent	All of Zone 2 has been revegetated.	Gradual revegetation of areas where extraction has been finished.	Rehabilitation monitoring.
Vegetation - Species composition	Minimum 10 native species per quadrat.	- First year - 80% of species planted / seeded represented. - Second year - 70% of species planted / seeded represented.	Rehabilitation monitoring.

Aspect	Completion Criteria	Intermediate Targets	Assessment Methodology
Vegetation - Density	Minimum 5,000 stems per ha including: • ≥750 upper storey stems per hectare. • ≥4,250 other strata stems per hectare.	First year • Minimum 1,100 stems per ha of upper storey species. • Minimum 5,500 stems per ha of other strata species. Second year • Minimum 900 stems per hectare of upper storey species. • Minimum 4,750 stems per ha of other strata species.	Rehabilitation monitoring.
Vegetation - Condition	Vegetation is self-sustaining.	Threats to self-sustaining vegetation are identified and mitigated.	Rehabilitation monitoring.
Weed Management	≤20% weed cover with no declared weeds present.	Weed control has been undertaken and weeds are not outcompeting revegetation.	Rehabilitation monitoring.

9.3.3 Zone 3: Plantation to Native Vegetation

Indicative completion criteria for Zone 3 native revegetation are presented in Table 9.

Table 9: Completion Criteria - Zone 3

Aspect	Completion Criteria	Intermediate Targets	Assessment Methodology
Site stability	Slopes are stable.	Slope stability issues are being captured in monitoring and mitigated.	Rehabilitation monitoring.
Rehabilitation extent	All of Zone 3 has been revegetated.	Gradual revegetation of areas where extraction has been finished.	Rehabilitation monitoring.
Vegetation - Species composition	Minimum 10 native species per quadrat.	• First year - 80% of species planted / seeded represented. • Second year - 70% of species planted / seeded represented.	Rehabilitation monitoring.
Vegetation - Density	Minimum 5,000 stems per ha including: • ≥750 upper storey stems per hectare. • ≥4,250 other strata stems per hectare.	First year • Minimum 1,100 stems per ha of upper storey species. • Minimum 5,500 stems per ha of other strata species. Second year • Minimum 900 stems per hectare of upper storey species. • Minimum 4,750 stems per ha of other strata species.	Rehabilitation monitoring.
Vegetation - Condition	Vegetation is self-sustaining.	Threats to self-sustaining vegetation are identified and mitigated.	Rehabilitation monitoring.

Aspect	Completion Criteria	Intermediate Targets	Assessment Methodology
Weed Management	≤20% weed cover with no declared weeds present.	Weed control has been undertaken and weeds are not outcompeting revegetation.	Rehabilitation monitoring.

9.3.4 Zone 4: Native Vegetation Improvement

Completion criteria for the improvement of existing native vegetation in Zone 4 will be defined as part of the Clearing Permit application process with DWER. At this stage it is expected that the completion criteria for Zone 4 will specify measurable targets for:

- Reduction in weeds.
- Absence of declared weeds.
- Increase in native flora species diversity.
- Increase in native flora species regeneration.

10. RECORD KEEPING, AUDITING, AND REPORTING

10.1 RECORD KEEPING

The applicant is responsible for collecting and maintaining records on the implementation of rehabilitation. This will include, but is not limited to, the following data:

- Date and location of landform finalisation.
- Date and location of preparatory earthworks (e.g. spreading of topsoil and/or mulch, ripping).
- Date and location of revegetation actions (e.g. planting and seeding).
- Date and location of weed control actions.
- Date and location of monitoring, maintenance, and mitigation actions.
- Monitoring reports issued by consultants (e.g. environmental specialist).
- Invoices relating to the implementation of this programme.

10.2 REPORTING AND AUDITING

It is expected that the Shire of Capel will require an annual audit of compliance to be prepared by a suitably qualified independent expert. This audit will cover the conditions of the DA/EIL and also include a progress report on the rehabilitation, including the following:

- Details of completed, ongoing, and future rehabilitation areas.
- Photos of rehabilitation areas.
- Monitoring and reporting details, if available.
- Start and completion dates, and expected start dates, if applicable.
- A map depicting the rehabilitation areas and their completion progress.

An environmental specialist will prepare reports for each of the monitoring surveys detailing findings, progress towards completion criteria, and recommendations for management actions. These reports can be used as evidence for the annual compliance audit.

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APPENDICES

APPENDIX 1: RISK ASSESSMENT AND MANAGEMENT

The risk of potential impacts to native rehabilitation success has been assessed using a qualitative risk assessment methodology to measure the likelihood of the risk occurring and the resulting level of consequence to designate a rating of Low, Medium, High, or Severe (DoE 2014). The designated risk rating assumes that the specified management measures are being implemented.

Table A2-1: Qualitative Measure of Likelihood

Rating	Description
Highly likely	Is expected to occur in most circumstances.
Likely	Will probably occur during the life of the project.
Possible	Might occur during the life of the project.
Unlikely	Could occur but considered unlikely or doubtful.
Rare	May occur in exceptional circumstance.

Table A2-2: Qualitative Measure of Consequences

Rating	Description
Minor	Minor incident of environmental damage that can be reversed.
Moderate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts.
High	Substantial instances of environmental damage that could be reversed with intensive efforts.
Major	Major loss of environmental amenity and real danger of continuing.
Critical	Severe widespread loss of environmental amenity and irrecoverable environmental damage.

Table A2-3: Risk Rating

	Consequence				
	Minor	Moderate	High	Major	Critical
Highly Likely	Medium	High	High	Severe	Severe
Likely	Low	Medium	High	High	Severe
Possible	Low	Medium	Medium	High	Severe
Unlikely	Low	Low	Medium	High	High
Rare	Low	Low	Low	Medium	High

Risk Factors to Rehabilitation	Risk Rating*	Reasoning	Management/Mitigation
Weeds	Low	Likelihood: likely. Consequence: minor. Weeds can be spread or introduced via wind, vehicle movement, rain runoff, fauna activity (e.g. kangaroos), movement of soil (including rabbit movement and diggings), dust, and introduction of soil/plant matter from external sources. The surrounding properties support a range of rural land uses, including paddocks for grazing and hay production, timber plantations, extraction site, residential dwellings and associated gardens, and bushland. Many of these activities either involve weed species or they pose a risk for introducing and spreading weed species in the local area. Past and current rural activities on Lot 287 also pose a risk of introducing and spreading weed. Considering the local setting, the site history, the post-extraction land use and establishment of pasture through rehabilitation, the occurrence, introduction and spread of weeds are expected to continue. Weeds have potential to outcompete rehabilitation.	- Access to site will be restricted to authorised personnel only. - Clean on entry and exit requirements will be established. - Weed control will be undertaken as specified in this document. - Monitoring will be carried out as specified in this document. - Any mulch externally sourced will be weed free. - Fencing will be used to restrict access by fauna as described in this document. - A Weed and Dieback Management Plan will be implemented.
Dieback	Low	Likelihood: possible. Consequences: low. Dieback is spread through infected soil by fauna movement, surface water runoff, soil movement on sloping surfaces, spores, and human activity. Infected soil can contaminate vehicles, footwear, and equipment. Additionally, the transport of infected soil as import or export material from a site can contribute to dieback spread. Dieback may occur on site already. Historical and current land uses on the property and the surrounding area have potential to introduce and spread dieback and it may also spread via natural means (e.g. kangaroos). Dieback poses a risk to rehabilitation, particularly native revegetation. The rehabilitation works themselves, have potential to spread dieback e.g. through movement of soil, mulch, and seedlings.	- Access to site will be restricted to authorised personnel only. - Clean on entry and exit requirements will be established. - Seedlings will be sourced from an accredited nursery only. - Any externally sourced mulch will be certified dieback free. - Fencing will be used to restrict access by fauna as described in this document. - A Weed and Dieback Management Plan will be implemented. - Active revegetation works will focus on dieback resistant species.

Risk Factors to Rehabilitation	Risk Rating*	Reasoning	Management/Mitigation
Erosion	Low	Likelihood: possible Consequence: minor Wind erosion has potential to occur in the bare ground areas and will be managed through staged clearing and dust management measures. Due to the sloping nature of the site and gravelly soils (clay at depth), there is potential for water erosion, mostly in association with major rainfall events.	• Revegetation will be undertaken in stages and closely following the completion of extraction to ensure soil is stabilised in a timely manner. • Mulch and/or other soil stabilisers will be used as described in this document. • During operations, water truck will be available to water dust suppression. • Ripping will be undertaken along contour to capture any localised runoff and increase retention of moisture (and thus reduce potential for erosion). • Contour bunds will be established in extraction area as part of rehabilitation to reduce runoff. • Potential retention of blue gum stumps will be trialled along the steeper slopes where plantation will be converted to native vegetation. • Monitoring and mitigation will be undertaken for erosion as described in this document. • Separate Dust Management Plan will also be implemented for the extraction operations. • Separate Stormwater Management Plan will be implemented for the extraction operations.
Fire	Medium	Likelihood: possible. Consequence: moderate. Fire presents a threat to all native vegetation in the local landscape, including revegetation. It is unlikely a fire will be started as a result of operations; however it is considered possible for a fire to occur in the local area over the course of the project and therefore fire could impact the site.	• Weed control will be undertaken as described in this document and in the separate Weed and Dieback Management Plan to reduce weed load and therefore fire risk. • Firebreaks will be maintained as required by local government. • Access tracks will be maintained across the property to facilitate fire-fighting access.

Risk Factors to Rehabilitation	Risk Rating*	Reasoning	Management/Mitigation
Grazing	Low	Likelihood: unlikely. Consequence: minor. Grazing poses a low risk because of the management measures that will be put in place. Without these management measures, the risk grazing poses would be much higher due to the presence of horses, kangaroos, and rabbits.	- The property is fenced to prevent access by livestock from surrounding properties. - Additional fencing will be undertaken to exclude kangaroos and rabbits from native revegetation areas as described in this document.
Poor Soil Moisture (e.g. due to low rainfall, prolonged heatwave)	Low	Likelihood: possible. Consequence: minor. The South West region experiences reasonably predictable seasons, including seasonal rainfall that allows for planning to seeding/planting at opportune times of year. However, sometimes unexpected periods of low rainfall and high temperatures result in poor soil moisture that will reduce germination and seedling survival.	- Ripping of soil pre-seeding/planting. - Mulch to help retain soil moisture. - Selection of drought tolerant native species suited to the conditions. - Using significantly larger than required volume of seed and/or initial seedling numbers to offset losses. - Infill seeding/planting as required to meet rehabilitation targets.
Climate Change	Low	Likelihood: possible. Consequence: minor. Whilst climate change is expected to have long-term impacts on all native vegetation, it is not expected to have a significant impact on the proposed rehabilitation over the duration of the works, beyond what is already factored in due to variability in existing climate records.	- Seeding/planting will be undertaken during the winter when temperatures are low and expected rainfall maximised. - Only local endemic species will be selected for rehabilitation. - Selection of drought tolerant species suited to the conditions. - Local provenance stock will be used for rehabilitation to maximise adaptation to local environment.
Insufficient Mulch	Low	Likelihood: possible. Consequence: minor. It is possible that mulch available from site clearing will be insufficient to meet rehabilitation demands on site. Lack of mulch has potential to result in poorer rehabilitation outcomes e.g. through poor soil moisture..	- Where possible, mulch will be sourced from onsite vegetation proposed for clearing as described in this document. - If necessary, mulch can be brought in as described in this document.

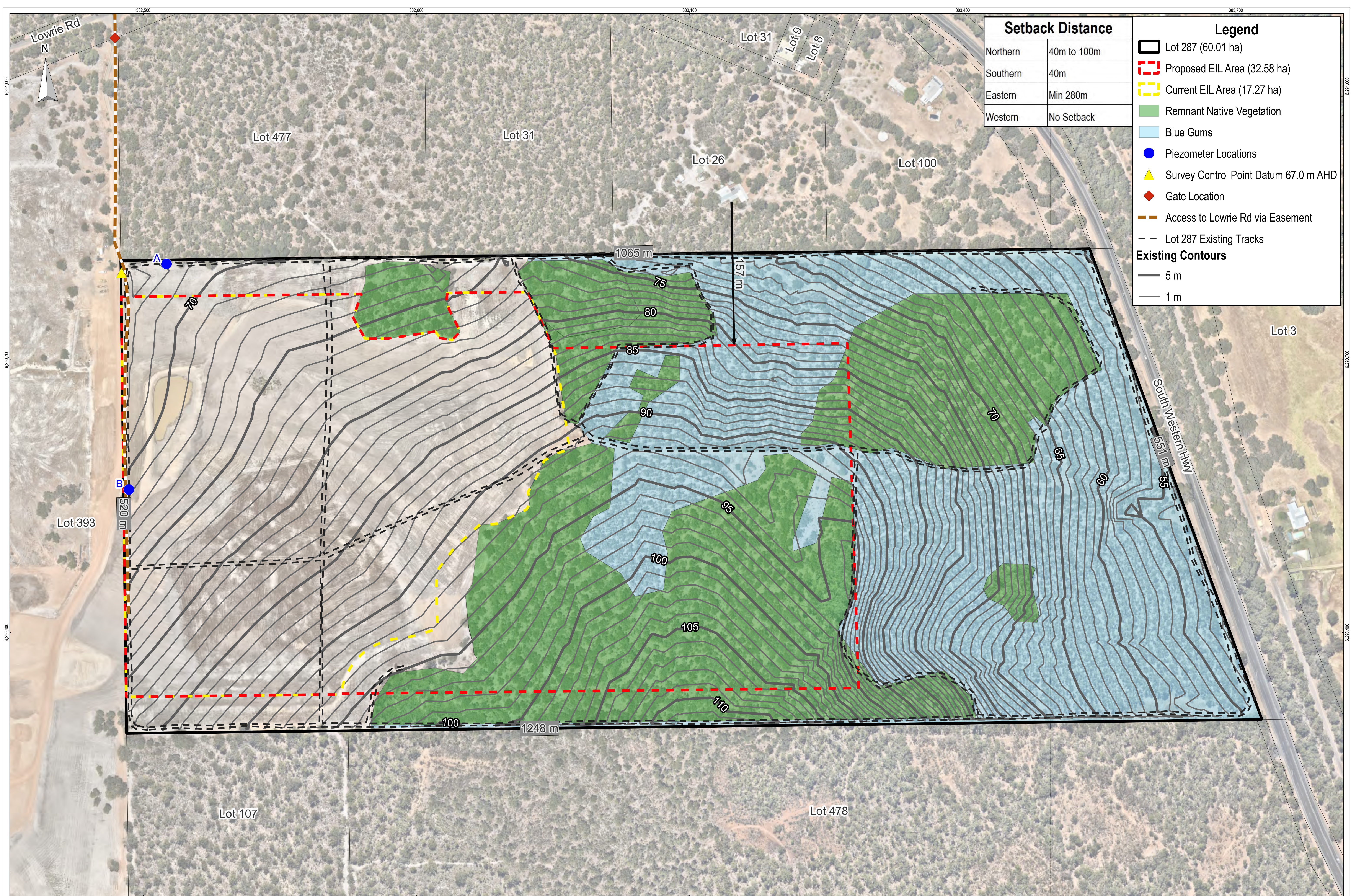
Risk Factors to Rehabilitation	Risk Rating*	Reasoning	Management/Mitigation
Availability of local provenance seed/cuttings/seedlings	Low	Likelihood: unlikely Consequence: minor The availability of local provenance seed, cuttings and seedlings is a concern in the South West as major revegetation projects are underway and stripping supply. However, the remnant native vegetation on the property outside of the proposed extraction area can be used to supply local provenance stock and the property owner also has access to other sites of local provenance.	- Seed/cuttings collected from the property as far as practicable and in accordance with RIAWA guidelines. - Additional seed/cuttings sourced from accredited collectors or nursery using local provenance stock (within 50 km).
Seed/Seedling Quality	Low	Likelihood: unlikely Consequence: minor Poor quality seedlings have higher mortality rates and poor quality seed will have lower germination rates.	- Seed will be collected, stored, treated and broadcast by experienced operators. - Seedlings will be propagated or provided by an accredited nursery. - Seedlings will be propagated from local endemic sources.
Unauthorised Access	Low	Likelihood: unlikely Consequence: minor Unauthorised access has potential to damage the revegetation and introduce weeds and disease.	- The property is fenced and further fencing will be erected around native revegetation areas as described in this document - Fence monitoring and mitigation will be undertaken as described in this document.

**Designated risk rating assumes that the specified management measures are being implemented.*

APPENDIX 2: INDICATIVE SPECIES LIST

Species	From	Seed/Seedling/ Cutting/ Transplant
<i>Acacia extensa</i>	Shrub	Seed
<i>Acacia pulchella</i>	Shrub	Seed
<i>Acacia saligna</i>	Shrub	Seed
<i>Adenanthos meisneri</i>	Shrub	Cutting
<i>Agonis flexuosa</i>	Tree	Seed, Seedling
<i>Allocasuarina fraseriana</i>	Tree	Seed, Seedling
<i>Allocasuarina humilis</i>	Shrub	Seed
<i>Banksia attenuata</i>	Tree	Seed, Seedling
<i>Banksia grandis</i>	Tree	Seed, Seedling
<i>Bossiaea eriocarpa</i>	Shrub	Seedling
<i>Bossiaea ornata</i>	Shrub	Seed
<i>Calothamnus quadrifidus</i>	Shrub	Seed
<i>Corymbia calophylla</i>	Tree	Seed, Seedling
<i>Corymbia haematoxylon</i>	Tree	Seed, Seedling
<i>Eremaea pauciflora</i>	Shrub	Seed, Seedling
<i>Eucalyptus marginata</i>	Tree	Seed, Seedling
<i>Hakea amplexicaulis</i>	Shrub	Seed, Seedling
<i>Hakea lissocarpa</i>	Shrub	Seed, Seedling
<i>Hardenbergia comptoniana</i>	Herb	Seed
<i>Hemiandra pungens</i>	Herb	Cutting
<i>Hibbertia hypericoides</i>	Shrub	Cutting
<i>Hibbertia racemosa</i>	Shrub	Cutting
<i>Hypocalymma angustifolia</i>	Shrub	Seedling
<i>Hypocalymma robustum</i>	Shrub	Seedling
<i>Jacksonia furcellata</i>	Shrub	Seed, Seedling
<i>Kennedia coccinea</i>	Herb	Seed
<i>Kennedia prostrata</i>	Herb	Seed
<i>Kunzea glabrescens</i>	Shrub	Seed
<i>Leschenaultia biloba</i>	Herb	Cutting
<i>Macrozamia riedlei</i>	Shrub	Seed
<i>Melaleuca thymoides</i>	Shrub	Seed, Seedling
<i>Patersonia occidentalis</i>	Herb	Seedling
<i>Patersonia umbrosa</i>	Herb	Seedling
<i>Rhodanthe chlorocephala</i>	Herb	Seed
<i>Stirlingia latifolia</i>	Shrub	Seed
<i>Xanthorrhoea brunonis</i>	Shrub	Seed
<i>Xanthorrhoea gracilis</i>	Shrub	Seed, Transplant
<i>Xanthorrhoea preissii</i>	Shrub	Seed, Transplant
<i>Xylomelum occidentale</i>	Tree	Seedling

APPENDIX 12: EXISTING CONTOUR AND FEATURE PLAN (A1)



Setback Distance

Northern	40m to 100m
Southern	40m
Eastern	Min 280m
Western	No Setback

Legend

- Lot 287 (60.01 ha)
- Proposed EIL Area (32.58 ha)
- Current EIL Area (17.27 ha)
- Remnant Native Vegetation
- Blue Gums
- Piezometer Locations
- Survey Control Point Datum 67.0 m AHD
- Gate Location
- Access to Lowrie Rd via Easement
- Lot 287 Existing Tracks

Existing Contours

- 5 m
- 1 m

Scale: 1:1,800
Original Size: A1
Air Photo Date: Jan 2024
Source: Extraction area contours from BCE Surveying 2012 (Surveyed in 2011)
Grid: GDA84 / MGA zone 50 (EPSG:28350)

W:\MGM\South West Hwy\GIS-Common\2024 Management Plans\MGM Lot 287 South West Hwy 2024.qgz 07/03/2024 A11 Existing Contours and Features

Mario Michele Giacci
Lot 297 Southwestern Highway

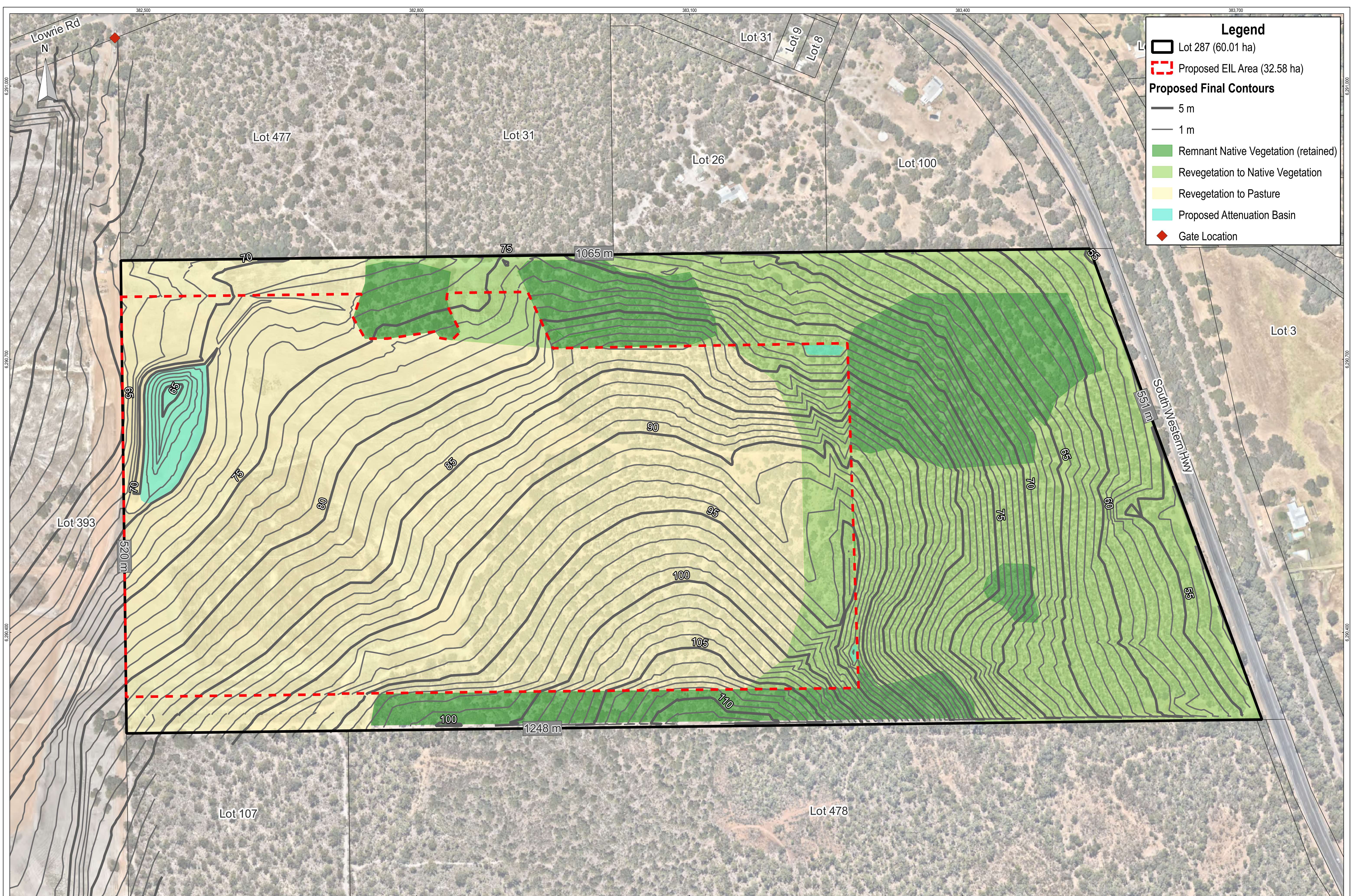
Appendix 11

Existing Contours and Features

Martwick Bosch Soil Pty Ltd
1 Cook St
West Perth WA 6005
Australia
Tel: 8 9226 5166
info@mbsoil.com.au
www.mbsoil.com.au



APPENDIX 13: FINISHED DEVELOPMENT PLAN (A1)



Legend

Lot 287 (60.01 ha)

Proposed EIL Area (32.58 ha)

Proposed Final Contours

5 m

1 m

Remnant Native Vegetation (retained)

Revegetation to Native Vegetation

Revegetation to Pasture

Proposed Attenuation Basin

Gate Location