

Albemarle Lithium Pty Ltd

Albemarle Kemerton Plant Response to EPA Notice of Decision to Assess: Additional Information Request

April 2018



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1. Introduction

1.1 Background

Albemarle Lithium Pty Ltd (Albemarle) is proposing to establish the Albemarle Kemerton Plant, a Lithium Hydroxide Product manufacturing plant and associated infrastructure, within the Kemerton Strategic Industrial Area (KSIA), approximately 17 kilometres north-east of Bunbury, Western Australia (WA) (referred to as the Proposal). The KSIA is a 7,508 hectare (ha) Industrial Park comprising a 2,024 ha Strategic Industry Zone (Industrial Core), a 284 ha Ancillary Industry Zone (support industry area) and a 5,200 ha Industry Buffer Zone (Buffer) (Raymond 2015). The KSIA was established in 1985 to provide an area for downstream processing and value-adding to the South West region's primary resources, especially its substantial mineral resources. It is the largest industrial area in the South West of WA and is one of the State's designated strategic industrial areas (Markovic 2015).

The Proposal includes the construction and operation of a Lithium Hydroxide Product manufacturing Plant (the 'Plant') and associated infrastructure including; administration facilities; workshop; supply warehouse / store; fuel and reagent storage; amenities, laboratory; control centre; water management infrastructure and a service corridor. It is expected that the Plant will be classified as a Category 44 prescribed premise (metal smelting or refining) in accordance with the *Environmental Protection Regulations 1987* (EP Regulations). Secondary categories 5 (processing or beneficiation of metallic or non-metallic ore), 31 (chemical manufacturing), 67 (fuel burning) and 73 (bulk storage of chemicals) will also apply to the Proposal.

Lithium hydroxide monohydrate (Lithium Hydroxide Product) will be produced from spodumene ore concentrate from the Talison Lithium Australia Pty Ltd (Talison) Lithium Operations located in Greenbushes, WA. Albemarle has 49% ownership of Talison who own and operate the Greenbushes Operation. Lithium Hydroxide Product will be transported via truck from the Plant to Fremantle Port for export. Tailings from the process, will be transported to a licensed Class III landfill facility for deposition into a dedicated storage cell. Approval and development of dedicated tailings storage and management infrastructure will be managed by the landfill owner/operator and is separate to this Proposal.

Development of the Proposal is planned to commence in Q3 2018 subject to final investment decision and receipt of required approvals. Initial production from the Plant is scheduled to commence by 2020 and the Proposal has an intended operating life of approximately 25 years.

The Proposal was formally referred to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act) on 7th November 2017. The referral included an Environmental Referral Supporting Document (GHD 2017) which describes the Albemarle Kemerton Plant Proposal in detail along with receiving environments, potential impacts and mitigation strategies to address the identified impacts. The Project was advertised for a seven day public comment period on 20th November 2017. The EPA determined that the Project would be Assessed on Referral Information (with Additional Information required under section 40(2)(a) of the EP Act on 19th February 2018.

The Proposal was formally referred to the Commonwealth Department of Environment and Energy (DoEE) on 7 November 2017 as a potential controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to impacts on Matters of National Environmental Significance (MNES) associated with the Proposal. On 5 January 2018, the DoEE determined the Project to be a 'Controlled Action' requiring approval due to impacts on threatened species and communities (reference number 2017/8099). The DoEE advised on 28 February 2018 that under section 87 of the EPBC Act the Proposal would be assessed by an

accredited assessment with the WA Government. The EP Act Part IV Environmental Impact Assessment Process is the accredited process which applies to this Proposal.

1.2 Purpose of this report

The purpose of this document is to provide a response to the EPA's request for Additional Information (required under section 40(2)(a) of the EP Act) for the EPA's assessment of the following environmental factors identified in the Notice of Decision for the Albemarle Kemerton Plant Proposal.

Flora and Vegetation

Demonstrate that the EPA's objective for Flora and Vegetation Factor can be met including information on how the principles of Avoid, Minimise, Rehabilitate and Offset have been applied to mitigate and manage impacts of the proposal on "Low lying *Banksia attenuata* Woodlands or shrublands"

Terrestrial Fauna

Demonstrate that the EPA's objective for Terrestrial Fauna Factor can be met including information on how the principles of Avoid, Minimise, Rehabilitate and Offset have been applied to mitigate and manage impacts of the proposal on conservation significant fauna "Carnaby's Black Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Black Cockatoo";

Terrestrial Environmental Quality

Demonstrate that the EPA's objective for Terrestrial Environmental Quality Factor can be met including information on how the proposal would apply waste management hierarchy (minimise environmental impact from waste, reduce waste generation and increased recovery from waste).

This document also addresses the Additional Information for Assessment requested by the DoEE relating to impacts, and mitigation of impacts, on EPBC listed Matters of National Environmental Significance including:

- Black Cockatoos: the vulnerable Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*), the endangered Baudin's Black Cockatoo (*Calyptorhynchus baudini*) and the endangered Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*);
- Threatened orchids: the vulnerable Dwarf Bee-orchid (*Diuris micrantha*), the endangered Glossy-leafed Hammer Orchid (*Drakaea elastica*) and the vulnerable Dwarf Hammer-orchid (*Drakaea micrantha*); and
- The endangered ecological community *Banksia Woodlands of the Swan Coastal Plain*.

In addition to the above, the DoEE Additional Information for Assessment request also requires provision of information to show the Project is consistent with Recovery and Threat Abatement Plans and Conservation Advice relating to the MNES, social and economic details for the Project and details on proposed offsets.

1.3 Scope and limitations

This Report: has been prepared by GHD for Albemarle Lithium Pty Ltd and may only be used and relied on by Albemarle Lithium Pty Ltd for the purpose agreed between GHD and the Albemarle Lithium Pty Ltd as set out in section 2.1 of this Report.

GHD otherwise disclaims responsibility to any person other than Albemarle Lithium Pty Ltd arising in connection with this Report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the Report and are subject to the scope limitations set out in the Report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was prepared.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD as described in this Report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this Report on the basis of information provided by Albemarle Lithium Pty Ltd and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the Report which were caused by errors or omissions in that information.

2. Proposal Overview

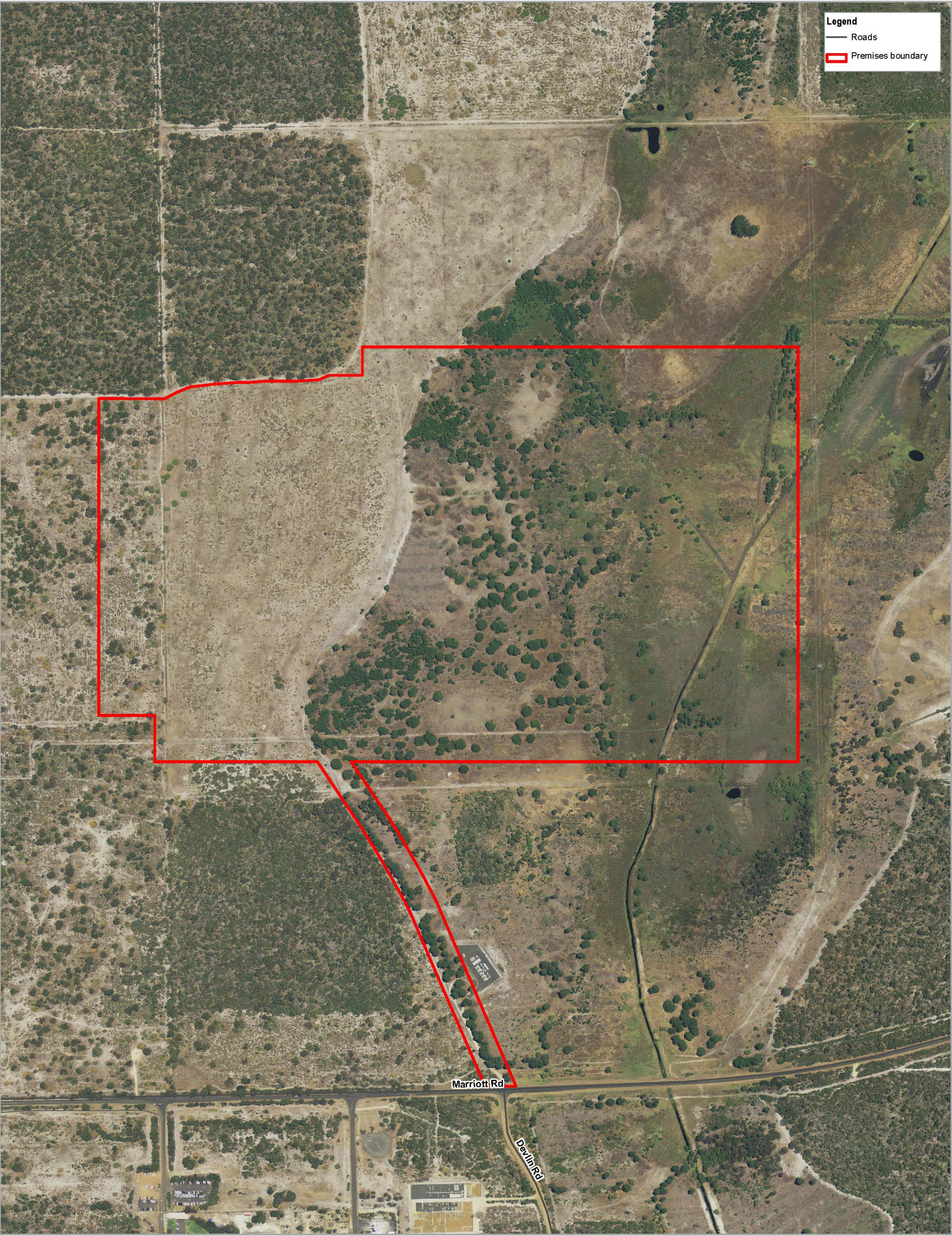
2.1 Key characteristics

Albemarle is planning to construct and operate a Lithium Hydroxide Product manufacturing Plant within the KSIA. The Proposal area is approximately 89.25 ha (Figure 2-1), which will comprise Plant infrastructure, access roads, and supporting facilities and services.

The key characteristics for the Proposal are identified in Table 2-1. A detailed description of the Project is included in the Albemarle Kemerton Plant Environmental Referral Supporting Report (GHD 2017) which was submitted to the EPA on 8 November 2017.

Table 2-1 Key proposal characteristics for the Albemarle Kemerton Plant

Proposal title	Albemarle Kemerton Plant
Proponent name	Albemarle Lithium Pty Ltd
Short description	The Proposal is to construct and operate a Lithium Hydroxide Product manufacturing Plant, in the KSIA, 17 km north- east of Bunbury, WA.
	The Proposal includes construction of up to five Lithium Hydroxide Product process trains and associated infrastructure including; administration facilities; workshop; supply warehouse / store; fuel and reagent storage; amenities, laboratory; control centre; water management infrastructure and a service corridor.
Element	Proposed Extent
<i>Physical elements</i>	
Lithium Hydroxide Product Production Plant and associated infrastructure	Clearing of no more than 87.7 ha of vegetation (54.31 ha native vegetation comprising 29.26 ha native vegetation and 25.05 ha previously cleared farmland with native vegetation re-growth) within the Proposal area.
<i>Operational elements</i>	
Waste Production from Lithium Hydroxide Product manufacturing (tailings)	Processing of up to 1 million tonnes of Spodumene Ore Concentrate per annum to produce up to 100,000 tonnes of Lithium Hydroxide Product, 200,000 tonnes of Sodium Sulfate By-product and up to 1 million tonnes of tailings per annum. Tailings will be transported to an offsite Class III landfill facility for long term storage. The facility will be operated and managed separately to the Proposal. Further details are in section 6.6.4
Transport	The key transport routes for the Proposal are: <ul style="list-style-type: none"> • Transport of spodumene ore concentrate between Greenbushes and KSIA • Transport of packaged Lithium Hydroxide Product between KSIA and Fremantle Port • Transport of packaged Sodium Sulfate By-product between KSIA and Fremantle or Bunbury Port • Transport of tailings and return leachate between KSIA and a Class III landfill, • Transport will be via B-double trucks using the suitably rated roads within the existing network.



2.2 Social and Economic Justification

The following social and economic justification for the Albemarle Kemerton Plant Project is provided in this document in order to address the DoEE's request for details of the social and economic costs and benefits associated with the Project. Albemarle considers the Kemerton Plant Proposal will deliver significant social and economic benefits to the South West Region, wider state of Western Australia, and Australia.

Economic Benefits

The key economic benefits associated with the Proposal are discussed below:

- The estimated capital investment required to establish the Plant is predicted to exceed \$1 Billion Australian Dollars (A), at least 65% of which is planned to be spent within Australia with local companies supporting the local economy.
- The Proposal will have a sustained investment in the Australian economy. More than 80% of Albemarle's ongoing operational expenditure is expected to be spent within the Australian economy. This excludes the ore concentrate which will be purchased from the Talison Lithium Australia Pty Ltd Greenbushes mine supporting this important south west Project and the indirect job opportunities this will support. Albemarle is adding significant value to what is currently a lower value Australian export.
- The Proposal will increase direct and indirect employment opportunities for the local population during both the construction (approximately 500 direct jobs) and operational phase. Direct payroll staff levels for the Project are expected to exceed 500 personnel when the first three process trains are constructed and operational. Additional jobs will be created when the final two process trains are established in the future. There will also be ongoing indirect job opportunities (such as through transport, supply and service suppliers to the plant) created through implementing the Proposal supporting the economic development of the region, state and country.
- Albemarle intends that the Proposal will support the local economy through locally sourced goods, utilities and services creating economic value and supporting job growth within WA and the broader Australian economy. Goods and services in the order of at least A\$60 million/train/yr are expected to be sourced locally.
- In accordance with the requirements of the *Australian Jobs Act 2013* Albemarle has an approved Australian Industry Participation (AIP) Plan (March 2018).
- Albemarle will also further contribute to the Australian economy over the life of the project through payment of taxes such as income, GST, payroll, and land tax.
- Albemarle will also contribute to the WA economy through payment of spodumene royalties (estimated to be A\$5 million/train/yr) over the life of the project

Social Benefits

The key social benefits associated with the Proposal are discussed below:

- Local Jobs – Albemarle's Kemerton Plant is not a mining operation. It is a value-added downstream processing operation. As such, the workers will be employed from the local community. No Fly-In, Fly-Out (FIFO) staffing is needed. The plant workers will be able to be home with their families each day/night, and will not be required to be away from the family for extended periods of time. This benefit has the potential to attract skilled workers to the South West Region. The job creation associated with the Proposal is within a rural area, diversifying and strengthening the region's economy and improving quality of life for South West Region residents.

- Diversity in Workforce – The type of jobs at Albemarle’s Kemerton Plant cover a broad diversity of roles and level of skill requirements. Albemarle expects that due to the diversity of roles on offer, it will attract a diverse workforce. Albemarle will also explore ways to increase indigenous and youth employment within its workforce.
- Fair Wages – Beyond just the number of jobs created, Albemarle will employ local labour at fair (living) wages. Albemarle has investigated and reviewed Certified Agreements in place for other major industries to its own proposed operations in South West WA, and will be negotiating to put in place its own Certified Agreement following establishment of an Operations team late in 2018. The rates of pay will be competitive with other major operations in South West WA
- Albemarle Foundation - Albemarle Foundation is a non-profit organization dedicated to community sustainability. It provides financial support to local deserving agencies. In addition to direct funding of the Foundation, Albemarle also matches dollar for dollar contributions its employees make to local deserving local agencies and charities. The Albemarle Foundation will provide support to local community projects.
- Community Support – Albemarle actively encourages its employees to participate in local schools such as tutoring, community events such as Habitat for Humanity, and fundraising for local charities.
- Sustainability - Albemarle hopes to use recycled water from the Kemerton Waste Water Treatment Plant (which services Eaton and Australind) as a source of process water supply to the Plant. If this can be successfully undertaken it will provide an economic outlet and reuse option for waste water which is otherwise discharged to the environment.
- Renewable energy – The output from the Albemarle Kemerton Plant (Lithium Hydroxide Product) will be used primarily in rechargeable batteries, in particular those used in electric vehicles, supporting the global drive to reduce greenhouse gas emissions associated with energy use.

3. Stakeholder Consultation

Albemarle has been engaged in consultation with key stakeholders since late 2016. Those consulted to date include government departments, local government, regional development organisations, neighbouring industries and environmental groups. A summary of the consultation undertaken is provided in Table 3-1. The Department of Jobs, Tourism, Science and Innovation (DJTSI) has been assigned the role of lead agency for this Proposal and is providing Albemarle ongoing advice relating to approvals and government processes relating to the Project. Consultation to date, with industrial operations in the KSIA, has revealed low or no concern regarding industrial development in the KSIA by local communities and local government authorities. Regional industry alliance and development organisations also support this Proposal.

Table 3-1 Albemarle Kemerton Plant stakeholder consultation summary

Stakeholder	Consultation type	Purpose of consultation and Outcomes
DWER (EPA Services Unit)	Meetings - June 2017 to March 2018	Pre-referral meetings to present overview/update of the Project, studies being undertaken and key impacts, and seek advice on the Part IV assessment pathway. Pre-referral presentation of draft document. Post referral meetings held to discuss aspects of the Project and the assessment.
	Site Visit - March 2018	Site visit with EPA services unit staff to assess the Proposal area and proposed offset.
EPA Chairman	Presentation – January 2018	Presentation of the Project to the EPA board post referral.
DWER (Water Services)	Meeting – August 2017	Advice sought from DWER on availability of groundwater supply, licensing requirements and likely groundwater studies needed if abstraction will be required.
	Phone meeting- November 2017	Discussion in relation to the KSIA Overarching Water Management Strategy (OWMS) and applicable stormwater management containment measures and criteria. DWER advised adherence to the OWMS requirement of retaining 1:10 year Annual Return Interval (ARI) storm event on site.
DWER (Regulation Services)	Meetings - January 2017 to February 2018	Meetings to present overview/update of the Project, status of current approval applications and discussions on the EP Act Part V licensing requirements focussing on acceptable approaches for tailings management.
DJTSI	Various meetings, phone calls, and email correspondence - November 2016 to present (ongoing)	Regular engagement undertaken in DJTSI's role as the lead agency for the Project. Update meetings occur on a regular basis.
LandCorp	Various meetings, phone calls, and email correspondence -	Regular consultation in relation to <ul style="list-style-type: none"> Site selection, Future development and timeframes

Stakeholder	Consultation type	Purpose of consultation and Outcomes
	November 2016 to present (ongoing)	<ul style="list-style-type: none"> Lease arrangements. Service provision Previous studies and reports relating to the Kemerton Structure Plan Logistics and timeframes associated with establishment of Kemerton Road Plans for permanent diversion of the agricultural drain passing through the Site Project updates Acquisition of a suitable parcel of land for offset purposes.
DoEE	Meeting - June 2017	Pre-referral meeting to inform of intention to submit an EPBC Act referral for the Project. Discussion of potentially significant matters, spatial scope of the submission and the assessment pathway
	Phone call – December 2017	Check on progress of consideration of the Referral under the EPBC Act and to obtain detail and discuss the approval process options should the proposal be deemed a controlled action. Outcome decision was yet to be made of whether controlled action. Assessment process can be conducted as bilateral/accredited or in parallel with State process.
	Phone Call - January 2018	Discussion on DoEE assessment of controlled action. Bilateral or DoEE Preliminary Documentation Assessment required if WA assessment in Part V.
	Site Visit - March 2018	Site visit with DoEE staff to assess the Proposal area and proposed offset.
Department of Industry, Innovation and Science	Meetings - Nov 2017, Feb 2018	Introduction to Albemarle and overview of the Project. Discussions focused on Australian Industry Participation Plan.
Chamber of Commerce & Industry, WA (Industry Capability Network)	Meetings – Dec 2017, March 2018 (ongoing)	Introduction to Albemarle and overview of the Project. Discussions focused on Australian Industry Participation Plan, communication of opportunities for Australian entities to supply and service the Construction and Operational phases of the Project.
Coogee Chemicals	Meeting – March 2018	Introduction to Albemarle and overview of the Project. Discussion on potential opportunities and constraints of establishing the Plant on Marriott Road Discussion on potential operating synergies

Stakeholder	Consultation type	Purpose of consultation and Outcomes
Cristal	Meetings – December 2016, June 2017, March 2018	Discussion on potential opportunities and constraints of establishing the Plant on Marriott Road Discussion of potential use of Cristal's ocean outfall for wastewater from the Plant.
Simcoa	Meeting – December 2016	Discussion on potential opportunities and constraints of establishing the Plant on Marriott Road
Port of Bunbury	Site Visit – June 2017 and December 2017	Visit to the Port of Bunbury to understand the opportunities and constraints to potentially shipping Lithium Hydroxide Product from the Bunbury Port.
Talison Lithium	Site Visit – June 2017	Visit to the Greenbushes mine to understand the current operations. Opportunities and constraints for the ore supply discussed, along with logistics and transport of the ore from the Greenbushes mine to Kemerton.
	Site Visit – December 2017	Tour of the mining operation
Main Roads WA	Phone Call – April 2017	Enquiry regarding requirements for transport of spodumene ore concentrate and Lithium Hydroxide Product via road.
Kemerton Industrial Park Coordinating Committee (KIPCC)	Presentation – October 2017 and February 2018	<p>Introduction to Albemarle and overview of the Project, followed by a question and answer session with the attendees relating to;</p> <ul style="list-style-type: none"> • Transport; • Plant and emissions; • Water; • Jobs; • Synergies within the KSIA; and • Timeframes
Bunbury Wellington Economic Alliance (BWEA) and South West Development Commission (SWDC)	Presentation – October 2017	Introduction to Albemarle and overview of the Project. Discussions primarily focussed on jobs, skills and maximising local involvement.
Bunbury – Geographe Chamber of Commerce and Industry	Presentation - January 2018	Introduction to Albemarle and overview of the Project.
City of Bunbury	Presentation – October 2017	Introduction to Albemarle and overview of the Project. Discussions primarily focussed on jobs and maximising local involvement.

Stakeholder	Consultation type	Purpose of consultation and Outcomes
Shire of Harvey	Presentation – October 2017	Introduction to Albemarle and overview of the Project. . Discussions primarily focussed on emissions and community consultation.
	Presentation – February 2018	Meeting in February to provide and update on the Project Development Application progress
Leschenault Catchment Council	Presentation – January 2018	Introduction to Albemarle and overview of the Project. Discussions after the presentation primarily focussed on water impacts, tailings, emissions, potential for environmental enhancement within the KSIA and traffic impacts. LCC indicated their support for the Project and interest in partnering with Albemarle on potential environmental enhancement projects.
South West Catchment Council	Presentation – January 2018	Introduction to Albemarle and overview of the Project. Discussions after the presentation primarily focused on water supply and impacts, tailings, development of the KSIA and traffic impacts. SWCC indicated their support for the Project.
Chamber of Minerals and Energy	Presentation – February 2018	Introduction to Albemarle and overview of the Project.
	Resource Tour – February 2018	Albemarle representative participated in a resource tour organised by the CME and attended by several members of parliament.
	Meeting - March 2018	Meeting to discuss Environmental Permitting
Austrade	Meetings – March 2018	Various meetings have been held in relation to Albemarle's planned investment in the Australian economy.
WA Minister for Regional Development, Hon Alannah MacTiernan	Meeting – January 2018	Introduction to Albemarle and overview of the Project.
WA Premier, Hon Mark McGowan	Meeting – February 2018	Introduction to Albemarle and overview of the Project.
Commonwealth Minister of Trade, Hon Steven Ciobo	Meeting – February 2018	Introduction to Albemarle and overview of the Project.

Stakeholder	Consultation type	Purpose of consultation and Outcomes
WA Minister for Environment , Hon Stephen Dawson	Meeting – February 2018	Introduction to Albemarle and overview of the Project.
Advisor to the Commonwealth Minister for the Environment, Mark Richards	Meeting – February 2018	Introduction to Albemarle and overview of the Project.
Department of Biodiversity, Conservation and Attractions (DBCA)	Meeting – March 2018	<p>Joint meeting between DBCA, DJTSl, LandCorp and Albemarle to discuss proposed offset for the Albemarle Project and intention to vest to the DBCA conservation estate.</p> <p>DBCA provided an overview of the process to convert the land acquisition from Freehold through to Crown Land and the requirements for a Land Tenure agreement and Land Management Agreement to be in place.</p> <p>In principle no issues to the offset proposal were identified, DBCA noted they wouldn't become actively involved until confirmation of the land acquisition and transfer was finalised.</p>

4. Flora and Vegetation

4.1 EPA Objective

To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

4.2 Policy and guidance

Legislation, policy and guidance materials relevant to this proposal for Flora and Vegetation are listed below.

- Environmental Factor Guideline Flora and Vegetation (EPA 2016b).
- Technical Guidance Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016h).
- Protection of Naturally Vegetated Areas Through Planning and Development, Environmental Protection Bulletin No. 20 (EPA 2013).
- *Environmental Protection Act 1986* (EP Act)
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations)
- *Wildlife Conservation Act 1950* (WC Act)
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- EPBC Act Environmental Offsets Policy (DSEWPaC 2012)
- WA Environmental Offsets Policy (GoWA 2011)
- WA Environmental Offsets Guidelines (GoWA 2014)

4.3 Receiving Environment

In March 2017, Eco Logical Australia (ELA) undertook a desktop assessment and Level 1 flora and vegetation (reconnaissance) survey of areas within the lease option boundary that were under consideration for development (ELA 2017a, b). The survey results were used to inform the location of the Proposal area (as discussed in Section 2.3). In September 2017, ELA undertook a detailed and targeted flora and vegetation survey within the Proposal area to verify and update the findings of the desktop assessment (where required) and to validate and supplement previously recorded vegetation and flora values (ELA 2017c). The ELA (2017a, b, c) assessment did not include part of the Proposal area (11.78 ha). GHD (2017b) completed a reconnaissance vegetation, level 1 fauna and targeted flora survey in October 2017 for the area not surveyed by ELA.

Technical reports by ELA and GHD are provided in Appendix A.

A number of flora and vegetation surveys and assessments have been undertaken within the wider KSIA. These surveys have included the Proposal area. Baseline studies relevant to the Proposal area are provided in Table 4-1 .

Table 4-1 Baseline studies – flora and vegetation

Year Survey Undertaken	Consultant	Survey Name
2017	GHD	<ul style="list-style-type: none"> Albemarle Kemerton Plant Additional Area Biological Assessment
2017	Eco Logical Australia	<ul style="list-style-type: none"> Kemerton Industrial Area Spring Flora and Fauna Survey Desktop Assessment of Selected Lots within Kemerton Industrial Area Kemerton Industrial Area Additional Assessment of Proposed Access Road Area.
2014	Eco Logical Australia	<ul style="list-style-type: none"> Targeted Ecological Surveys for Kemerton Industrial Park
2012	AECOM	<ul style="list-style-type: none"> Kemerton Industrial Park: Threatened Orchid Survey
2011	Mattiske Consulting	<ul style="list-style-type: none"> EPBC Act Significance Criteria Review of the Proposed Kemerton Industrial Park Development EPBC Act Significance Criteria Review of the Proposed Subdivision of 510 Marriott Road, Kemerton
2010	Cardno	<ul style="list-style-type: none"> Kemerton Industrial Core: Flora and Vegetation Survey
2008	Coffey Environments	<ul style="list-style-type: none"> Flora, Vegetation, Wetlands and Fauna Assessment Kemerton Industrial Park
2007	Coffey Environments	<ul style="list-style-type: none"> Kemerton Industrial Park Environmental Overview for the Kemerton Industrial Park Strategy Plan
2007	Paul Armstrong and Associates	<ul style="list-style-type: none"> Review of Vegetation Types Monitored within the Kemerton Industrial Estate and Identification of Deficiencies
1999	Muir Environmental	<ul style="list-style-type: none"> Report of Biological Survey – Phase 1: Kemerton Industrial Estate Volume 1 Report Summary Report – Kemerton Industrial Area Phase 1 Biological Survey
1999	Paul Armstrong and Associates	<ul style="list-style-type: none"> Kemerton Industrial Estate (Original Core Zone) Spring Rare Flora Search Kemerton Industrial Estate (Expanded Core Zone) Mid- and Late Spring Rare Flora Search Kemerton Industrial Estate (Support Industry Area) Spring Rare Flora Search

Regional biogeography

The Proposal area is located in the Swan Coastal Plain Bioregion and the Perth Subregion (SWA02) as described by the Interim Biogeographic Regionalisation for Australia (IBRA). The Perth Subregion is dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains and paperbark in swampy areas. In the east, the plain rises to duricrusted Mesozoic sediments dominated by Jarrah woodland. The outwash plains, once dominated by *C. obesa*-Marri woodlands and *Melaleuca* shrublands, are extensive only in the south (Mitchell *et al.* 2002).

The Proposal area supports native and plantation vegetation, as well as cleared areas (e.g. previously cleared farmland with native vegetation re-growth). The Proposal area includes both upland and low-lying areas with, multiple-use wetlands and a drain.

Vegetation communities

Vegetation communities within the Proposal area were assessed during surveys by ELA (2017a, b, c) and GHD (2017d). The areas surveyed by ELA and GHD within the Proposal area cover 75.92 ha and 11.78 ha respectively. The remaining 1.55 ha of the Proposal area comprises cleared land (i.e. access tracks).

Nine vegetation communities were identified within the Proposal area (Table 4-3, Figure 4-1). Vegetation is dominated by pine plantation (33.39 ha) and previously cleared farmland (25.04 ha), which supported *Xanthorrhoea brunonis* open shrubland over **Ehrharta calycina* (Perennial Veldt Grass) open grassland (vegetation community XbEc). A description of vegetation associations and extents within the Proposal area is provided in Table 4-3.

It is important to note that most vegetation communities in the Proposal area are low density, particularly vegetation community XbEc. This is due to the fact that the majority of the Proposal area has been previously cleared and is predominantly re-growth of native vegetation, with limited established understorey, or pine plantation. The pine plantation is also low density as the remaining pines were not harvested by Forest Products Commission at the time the plantation was harvested. Therefore, any estimates of areas to be cleared are conservative.

Conservation significant vegetation

The desktop assessment and field surveys identified the presence of two conservation significant ecological communities within the Proposal area:

- 'Low lying *Banksia attenuata* woodlands or shrublands' Priority Ecological Community (PEC)¹
- 'Banksia Woodlands of the Swan Coastal Plain (SCP)' Threatened Ecological Community (TEC).

A description of each conservation significant ecological community and its occurrence within the Proposal area is provided below.

Low lying *Banksia attenuata* woodlands or shrublands PEC

A desktop assessment identified buffered extents of the Priority 3 'Low lying *Banksia attenuata* woodlands or shrublands' PEC within the Proposal area. The field surveys identified two vegetation communities that were representative of this PEC, as described in Table 4-2.

Table 4-2 Extent of Low lying *Banksia attenuata* woodlands or shrublands PEC within Proposal area

Condition rating	Vegetation type	Extent (ha) (%)
Good/Completely Degraded/Excellent	EmKgMr	0.42* (0.47%) – 0.1 ha is Completely Degraded, 0.09 ha is Excellent**, 0.24 ha is in Good condition.
Good	EmCcXb	5.94 (6.66%)
Total		6.37 (6.46%)




* Vegetation community EmKgMr is part of a patch size of approximately 12 ha ('Banksia Block')




** Vegetation mapped as Excellent occurred during broad scale mapping undertaken by ELA (2017b).




When considered on a finer scale, this vegetation is more representative of vegetation association XbEc in Good condition.

¹ Community is also recognised as part of the *Banksia* Woodlands of the Swan Coastal Plain TEC, which is listed as Endangered under the EPBC Act.

Table 4-3 Vegetation communities within the Proposal area

Vegetation code	Vegetation community description	Extent within the Proposal area (ha, (%))	Representative Photograph
Pine plantation	Former pine plantation areas, dominated by <i>Pinus</i> sp.	33.39 (37.42) (Note: a canopy assessment of the former plantation area has been undertaken which determined the canopy coverage of the area to be 16.5 ha (50%). Further detail on the canopy assessment is included in Chapter 7).	
XbEc	<i>Xanthorrhoea brunonis</i> open shrubland with <i>Acacia pulchella</i> , <i>Kunzea glabrescens</i> and <i>Daviesia decurrens</i> subsp. <i>decurrens</i> isolated shrubs over <i>Ehrharta calycina</i> open grassland in previously cleared farmland. Associated species include <i>Banksia ilicifolia</i> and <i>Acacia semitrullata</i> (Priority 4).	25.04 (28.06)	
PJp	<i>Pinus</i> sp. open woodland over <i>Hypocalymma angustifolium</i> and <i>Astartea scoparia</i> isolated shrubs over <i>Cynodon dactylon</i> sparse grassland over <i>Juncus kraussii</i> subsp. <i>australiensis</i> and <i>Juncus pallidus</i> closed rushland in low lying seasonal damp land.	8.62 (9.66)	

Vegetation code	Vegetation community description	Extent within the Proposal area (ha, (%))	Representative Photograph
PEr	<i>Pinus radiata</i> and <i>Eucalyptus rudis</i> low open woodland in low lying seasonal dampland	7.90 (8.82)	
EmCcXb	Aligns with Banksia Woodlands of the SCP TEC. <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Corymbia calophylla</i> woodland with <i>Allocasuarina fraseriana</i> , <i>Banksia attenuata</i> and <i>Xylomelum occidentale</i> isolated trees over <i>Xanthorrhoea brunonis</i> , <i>Acacia pulchella</i> and <i>Adenanthos meisneri</i> shrubland over <i>Ehrharta calycina</i> open grassland over <i>Dasypogon bromeliifolius</i> open forbland on uplands. Associated species include <i>Macrozamia riedlei</i> , <i>Jacksonia furcellata</i> and <i>Melaleuca preissiana</i> in low lying areas.	5.94 (6.66)	
ErMpJk	<i>Eucalyptus rudis</i> isolated trees over <i>Melaleuca preissiana</i> and <i>Pinus radiata</i> low open woodland over <i>Juncus kraussii</i> subsp. <i>australiensis</i> and <i>Juncus pallidus</i> sedgeland over * <i>Cynodon dactylon</i> very open grassland in low lying seasonal dampland.	6.16 (6.90)	

Vegetation code	Vegetation community description	Extent within the Proposal area (ha, (%))	Representative Photograph
EmKgMr	Aligns with Banksia Woodlands of the SCP TEC and 'Low lying Banksia attenuata woodlands or shrublands' PEC. <i>Eucalyptus marginata</i> subsp. <i>marginata</i> and <i>Banksia ilicifolia</i> low open woodland over <i>Kunzea glabrescens</i> tall sparse shrubland over <i>Macrozamia riedlei</i> and <i>Xanthorrhoea brunonis</i> shrubland.	0.42 (0.47)	
CcKg	<i>Corymbia calophylla</i> closed forest over <i>Kunzea glabrescens</i> tall open shrubland over <i>Astartea scoparia</i> and <i>Xanthorrhoea brunonis</i> open shrubland over <i>Hypocalymma angustifolium</i> low open shrubland over <i>Juncus pallidus</i> isolated clumps of rushes.	0.19 (0.21)	
MpAs	<i>Melaleuca preissiana</i> low woodland over <i>Astartea scoparia</i> tall open shrubland over <i>Juncus pallidus</i> isolated clumps of rushes.	0.02 (0.03)	

Banksia Woodlands of the SCP TEC

The Banksia Woodlands of the SCP TEC, which is listed as Endangered under the EPBC Act, was recorded within the Proposal area (ELA 2017a, b, c; GHD 2017d). The field surveys identified two vegetation communities that were representative of this TEC, and met the key diagnostic characteristics of this community, as described in Table 4-4.

Vegetation community EmKgMr is intersected by the proposed access corridor on entry from Marriott Road and entry into the proposed Plant Site. Vegetation community EmCcXb is intersected by the proposed western construction corridor. Vegetation representative of this TEC is also known to occur within the densely vegetated 'Banksia block' and the western extent of the lease option boundary (ELA 2017a, b, c; GHD 2017b).

Table 4-4 Extent of Banksia Woodlands of the SCP TEC within Proposal area

Condition rating	Vegetation type	Extent (ha) (%)
Good/Completely Degraded/Excellent	EmKgMr	0.42* (0.47%) – 0.1 ha is Completely Degraded, 0.09 ha is Excellent**, 0.24 is in Good condition.
Good	EmCcXb	5.94 (6.66%)
Total		6.37 (6.46%)

* Vegetation community EmKgMr is part of a patch size of approximately 12 ha ('Banksia Block')

** Vegetation mapped as Excellent occurred during broad scale mapping undertaken by ELA (2017b). When considered on a finer scale, this vegetation is more representative of vegetation association XbEc in Good condition.

The following vegetation communities were identified adjacent to the Proposal area that are also representative of this TEC:

- *Corymbia calophylla* open woodland over *Banksia* spp. and *Melaleuca preissiana* low open woodland over *Kunzea glabrescens* and *Xanthorrhoea brunonis* open shrubland over *Dasypogon bromeliifolius* (CcBaKgXb) (1.06 ha)
- *Eucalyptus marginata* subsp. *marginata*, *Agonis flexuosa* and *Banksia attenuata* woodland over mixed sparse shrubland over *Dasypogon bromeliifolius* sparse forbland (EmBiKgAs) (11.80 ha)

The TEC assessments of each vegetation community are provided in ELA (2017a; b).

Other significant vegetation

The Proposal area intersects four multiple-use geomorphic wetlands. Vegetation within the Proposal area that grows in association with wetlands includes *Melaleuca preissiana*, *Juncus pallidus* and *Juncus kraussii*. These species are present within mapped vegetation communities described in Table 4-5.

There is up to 14.99 ha of vegetation that is associated with wetlands within the Proposal area. Wetland vegetation within the Proposal area has been historically modified through clearing and the establishment of pine plantations in the KSIA. The wetlands areas within the Proposal area are almost entirely in Completely Degraded condition and offer little to no ecological value (ELA 2017a).

Table 4-5 Extent of other significant vegetation within Proposal area

Characteristic	Corresponding vegetation community	Condition rating	Extent (ha)
Vegetation associated with wetlands	MpAs	Completely degraded	0.02
	PJp	Completely degraded	8.62
	CcKg	Good	0.19
	ErMpJk	Completely degraded	6.16
Total			14.99

Vegetation condition

The majority of the Proposal area is currently disturbed by cattle grazing, weed invasion, unauthorised access (e.g. unplanned tracks, rubbish dumping, motorbikes) and clearing/logging. As such, 92.76% of the Proposal area was mapped as either in Completely Degraded (57.75 ha) or Degraded (25.04 ha) condition (ELA 2017a, b, c; GHD 2017b) (Figure 4-2).

There is a small area (0.09 ha) of vegetation in Excellent condition. The remaining 7.14% was mapped to be Good condition (6.37 ha). The majority of this area is representative of the 'Banksia Woodlands of the Swan Coastal Plain TEC'.

Flora diversity

Field survey results recorded a total of 32 dominant species within the survey area, which included 20 species of native flora and 12 species of introduced weed species (ELA 2017a, b, c).

The existing disturbances within the Proposal area, particularly clearing for farmland, have led to a significant decrease in native species diversity (ELA 2017c). The Proposal area is not considered high in floristic diversity (ELA 2017c).

Conservation significant flora

Searches of the EPBC Act Protected Matters database, Department of Biodiversity, Conservation and Attractions (DBCA) *NatureMap* and Western Australian Herbarium (WAHERB) databases identified the presence/potential presence of 34 conservation significant flora species within the Proposal area. A likelihood of occurrence assessment conducted by ELA (2017a, b) determined that 33 species are not considered to occur due to a lack of suitable habitat, and one species is known to occur within the Proposal area, namely *Acacia semitrullata*, listed as Priority 4 by DBCA (ELA 2017c).

A total of 118 individuals of *Acacia semitrullata* were recorded within the Proposal area (ELA 2017c; GHD 2017b). The species was associated with areas of disturbance and confined almost entirely to the Degraded vegetation community XbEc; 'Xanthorrhoea open shrubland over Perennial Veldt Grass open grassland in previously cleared farmland. There are extensive areas of vegetation surrounding the Site where this species is known to occur. Locations of *Acacia semitrullata* are included in Figure 4-1.

No Threatened flora listed under the EPBC Act or Declared Rare Flora (DRF) listed under the *Wildlife Conservation Act 1950* (WC Act) were recorded within the Proposal area. However, desktop searches identified two locations of the Glossy-leafed Hammer Orchid (*Drakaea elastica*) (listed as Endangered under the EPBC Act and Threatened under the WC Act), approximately 45 m from the Proposal area northern boundary (Figure 4-1).

Two other orchids which are Threatened under the WC Act are known to occur within the KSIA; namely the Dwarf Bee-orchid (*Diuris micrantha*), and the Dwarf Hammer-orchid (*Drakaea micrantha*). Initial desktop assessments by ELA (2017a, b) identified these species has having the potential to occur, however these species were not identified during the spring survey of the Proposal area (ELA 2017c).

Orchid species are cryptic and could be missed during a spring survey; however, a post-survey likelihood of occurrence assessment confirmed that these species are not likely to occur (ELA 2017c). All orchid species recorded within the KSIA occur within 'sand patch' habitats that are relatively undisturbed and have not yet been subject to ground disturbances in the long term (AECOM 2012, ELA 2013). Sand patches within the Proposal area have been subject to grazing by livestock and dominated by a range of annual and perennial weed species, in which orchids are not expected to occur (ELA 2017c).

The closest suspected location of *Drakaea micrantha* is approximately 735 m north of the Proposal area (ELA 2013) (Figure 4-1). The closest known locations of *Drakaea micrantha* and *Diuris micrantha* are approximately 1 km south-east and 2.3 km north-east respectively (ELA 2013).

Introduced and invasive species

Vegetation in the Proposal area has been subject to weed incursion attributed to previous clearing activities, with up to 74 introduced (weed) species identified within KSIA (Cardno 2010a). The most recent survey identified 12 species (ELA 2017c). One of the species recorded is listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), namely **Zantedeschia aethiopica* (Arum Lily). Previous surveys within the Proposal area have also recorded Declared Pest **Gomphocarpus fruticosus* (Narrow Leaf Cottonbush) (ELA 2017b).

Common weed species observed within the Proposal area during the field surveys included **Ursinia anthemoides* subsp. *anthemoides* (Ursinia), **Hypochaeris glabra* (Smooth Catsear), **Ehrharta calycina* (Perennial Veldt Grass) and **Cynodon dactylon* (Couch) (ELA 2017a-c). In particular, Perennial Veldt Grass is widespread and occurs in previously cleared areas in high densities, such as the western portion of the Proposal area.

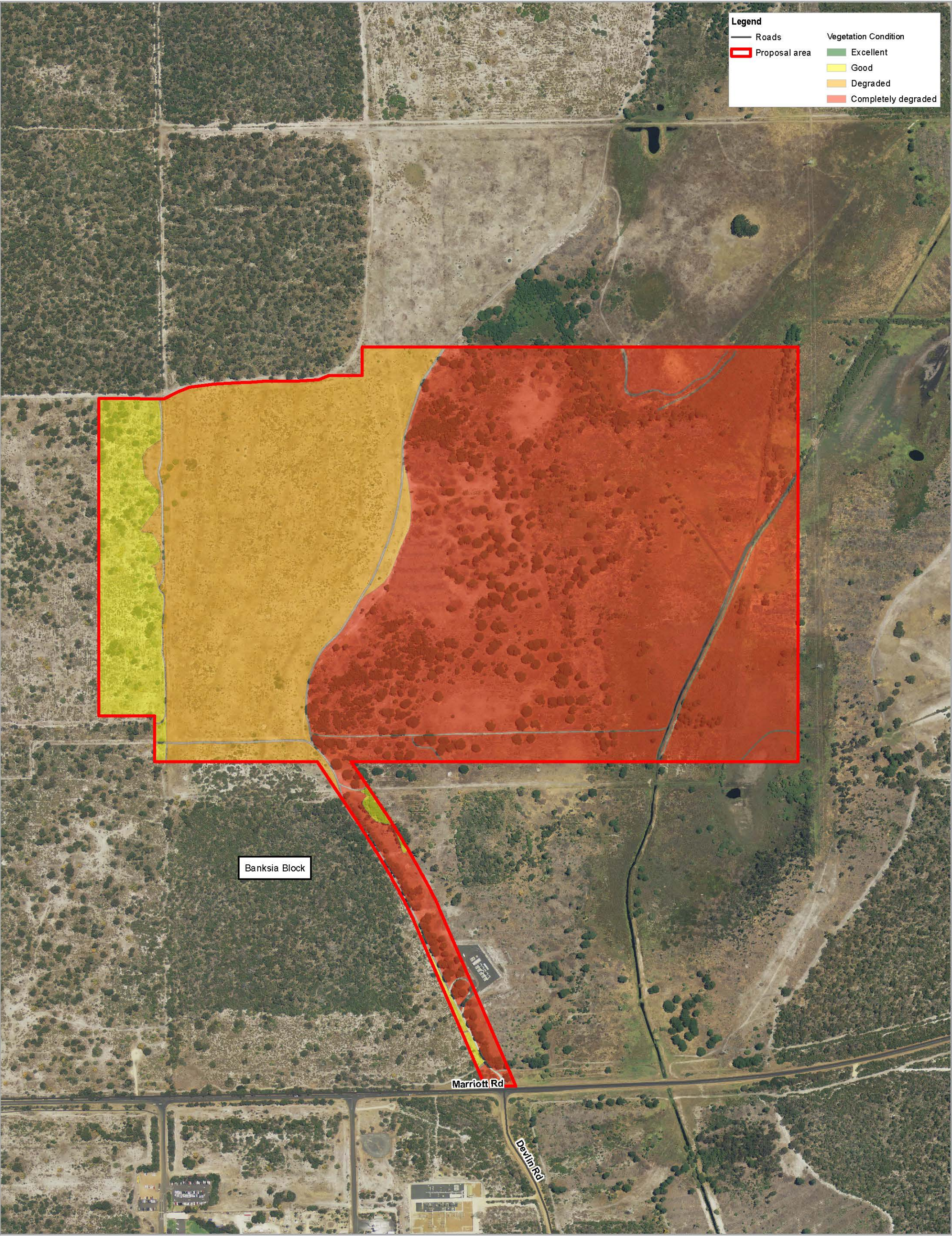
No Weeds of National Significance (WoNS) were identified during the field surveys.

Dieback

The Proposal area is considered to occur in an area at risk of *Phytophthora cinnamomi*, commonly known as Dieback. Dieback is found throughout the southern extent of Western Australia in areas with susceptible plant species that receive rainfall in excess of 400 mm/year (Dieback Working Group 2008).

No detailed Dieback mapping has been undertaken for the Proposal, however Project Dieback (2017) data shows that:

- Areas of vegetation within the Proposal area are uninterpretable for Dieback presence.
- Areas of vegetation within the surrounding KSIA are 'low' or 'moderate' confidence of Dieback presence.
- Soil on the southern side of Marriott Road has been tested positive for *Phytophthora cinnamomi*.



Comparison with other mapped vegetation

Five of the vegetation communities mapped within the Proposal area (EmCcXb, ErMpJk, EmKgMr, CcKg and MpAs) are broadly consistent with broad scale pre-European vegetation association mapping completed by Beard (1979) and vegetation complex mapping completed by Heddle *et al.* (1980).

- Mosaic: Medium forest; jarrah-marri / low woodland; banksia / low forest; teatree (*Melaleuca* spp.) (association 1000) (Beard 1979)
- Bassendean complex – central and south. Vegetation ranges from woodland of *E. marginata* – *C. fraseriana* - *Banksia* spp. to low woodland of *Melaleuca* spp. and sedgelands on the moister Sites (Heddle *et al.* 1980).

The remaining four vegetation communities (Pine plantation, XbEc, PJP and PEr) are not considered representative of any vegetation associations/complexes. This is due to previous and current disturbances within the Proposal area.

Extent of Vegetation Types

The extent of the Beard's vegetation association 1000 has been determined by the state-wide vegetation remaining extent calculations maintained by the DBCA (current as of October 2016 – Government of Western Australia (GoWA) 2016). As shown in Table 4-6, the extent of this vegetation association is less than 30% of its pre-European extent remaining at all scales with the exception of the local government authority (LGA) scale.

The extent of vegetation complexes described and mapped by Heddle *et al.* (1980) for the Swan Coastal Plain and the Shire of Harvey has been determined by the south west vegetation remaining extent calculations maintained by DBCA (latest update December 2016 – GoWA 2017). As shown in Table 4-7 and Table 4-8, the current extent of Bassendean – central and south vegetation complex within the SCP is less than 30% of its calculated pre-European extent. However, it is greater than 30% of its calculated pre-European extent within the Shire of Harvey.

Regional and Local Significance

The regional and local significance of the vegetation types was assessed by incorporating and adapting relevant characteristics as outlined in EPA (2016a). Characteristics included:

- Degree of degradation/clearing within Swan Coastal Plain IBRA Bioregion, Perth IBRA Subregion and Shire of Harvey LGA
- Size of remnant and condition/intactness of vegetation
- Heterogeneity or complexity of vegetation
- Rarity of vegetation
- Presence of other significant vegetation
- Representation of ecological refuge or linkage
- Presence of Threatened, Priority or other significant flora taxa.

The vegetation communities within the Proposal area are:

- Previously cleared, fragmented and mostly Degraded or Completely Degraded
- Not representative of an ecological linkage
- Representative of a PEC and TEC, with conservation significant (Priority 4) flora.

Table 4-6 Extent of Beard (1979) vegetation association within the Proposal area (GoWA 2016)

Scale	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)	Remaining within DBCA Managed Lands (%)	Amount within the Proposal area (ha)	% of current extent within the Proposal area
State: WA	99,835.86	26,570.66	26.61	19.24	14.3	0.05
Bioregion: Swan Coastal Plain	94,175.31	23,669.68	25.13	19.88		0.06
Sub-region: Perth (SWA02)	94,175.31	23,669.68	25.13	19.88		0.06
LGA: Shire of Harvey	20,121.61	8,224.08	40.87	29.59		0.17

Note – The amount within the Proposal area is based on the mapped vegetation communities that align with Beard (1979) vegetation association

Table 4-7 Extent of Heddle *et al.* (1980) vegetation complex on the Swan Coastal Plain within the Proposal area (DBCA 2017)

Vegetation complex	Pre-European extent (ha)	Current extent (ha)	% Remaining	Current extent remaining within all DBCA managed land (%)	Amount within the Proposal area (ha)	% of current extent within the Proposal area
Bassendean complex – Central and South	87,476.26	22,462.66	25.68	4.92	14.3	0.06

Note – The amount within the Proposal area is based on the mapped vegetation communities that align with Heddle *et al* (1980) vegetation complex

Table 4-8 Extent of Heddle *et al.* (1980) vegetation complex in the Shire of Harvey within the Proposal area (DBCA 2017)

Vegetation complex	Pre-European extent (ha)	Remaining extent (ha)	Remaining extent (%)	Proportion of the vegetation complex within the LGA (%)	Amount within the Proposal area (ha)	% of current extent within the Proposal area
Bassendean complex – Central and South	19,017.49	8,169.25	42.96	21.74	14.3	0.18

Note – The amount within the Proposal area is based on the mapped vegetation communities that align with Heddle *et al* (1980) vegetation complex

4.4 Potential Impacts to Flora and Vegetation

The Proposal will result in the direct loss of vegetation and flora through clearing including:

- 54.31 ha of non-contiguous, poor quality native vegetation, of which 22.8 ha is Completely Degraded and 25.13 ha is Degraded (Table 4-9).
- Approximately 6.37 ha of native vegetation associated with the 'Banksia Woodlands of the Swan Coastal Plain' TEC and 'Low lying *Banksia attenuata* woodlands or shrublands' PEC. This vegetation is mostly in Good condition.
- 118 plants of Priority 4-listed species (*Acacia semitrullata*) (Table 4-10).
- 14.99 ha of vegetation associated with 'Multiple Use' wetlands areas with little to no ecological value.
- Less than 0.2% of Beard (1979) and Heddle *et al.* (1980) vegetation extents at the local scale (Shire of Harvey), and 0.06% vegetation extents at the regional scale (Swan Coastal Plain).

Table 4-9 Clearing of vegetation associations and conditions

Vegetation association	Mapped area (ha)	Vegetation condition rating within mapped area (ha)
Pine plantation	33.390	Completely Degraded: 33.390
XbEc	25.045	Degraded: 25.042 Good: 0.003
PJp	8.623	Completely Degraded: 8.623
PEr	7.901	Completely Degraded: 7.901
EmCcXb	5.944	Good: 5.944
ErMpJk	6.159	Completely Degraded: 6.159
EmKgMr	0.424	Completely Degraded: 0.097 Excellent: 0.088 Good: 0.239
CcKg	0.185	Good: 0.185
MpAs	0.024	Completely Degraded: 0.024
Total native vegetation	54.31	Completely Degraded: 22.80 Degraded: 25.13 Good: 6.37
Total non-native vegetation	33.39	Completely Degraded: 33.39

Table 4-10 Conservation significant flora loss

Taxon	Number in Proposal area	State-wide records (NatureMap 2017)	Loss from clearing within the Proposal area
<i>Acacia semitrullata</i> (P4)	118	115 records on <i>NatureMap</i> with a minimum of 250 individuals based on count (frequency) data available on <i>FloraBase</i> ² . An additional 61 individuals have been recorded within the broader KSIA (ELA 2015)	27.67%

² FloraBase (WA Herbarium 1998–) records often provide the count (frequency) in descriptors such as common, frequent, scattered without providing an actual number of plants. For the purposes of this assessment these records have been counted as one plant. As such the population estimates are underrepresented with the actual number of plants expected to be much higher. Therefore, the percent impact calculated is considered to be very conservative.

The Proposal could also result in the following indirect impacts to vegetation and flora, including to vegetation associated with the 'Banksia Woodlands of the Swan Coastal Plain' TEC:

- Fragmentation of surrounding native vegetation and edge effects to adjacent vegetation.
- Changes in surface water run-off and nutrient cycling resulting in detrimental impacts to surrounding native vegetation.
- Detrimental impacts to native vegetation resulting from potential mobilisation of acid and metals due to disturbance of ASS associated with cut-to-fill earthworks and diversion of the existing agricultural drain.
- Dust impacts to surrounding native vegetation during earthworks, inclusive of DRF *Drakaea elastica* in proximity to the Proposal area.
- Possible introduction and/or spread of *Phytophthora cinnamomi*, and weeds to surrounding vegetation.
- Damage to surrounding vegetation through accidental generation of a bushfire.
- Loss of threatened orchid species due to indirect habitat degradation within the KSIA by means of the above mentioned indirect impacts.

4.5 Assessment of Impacts

Regional and Local Significance

The Proposal area will result in the reduction of approximately 0.18% of mapped vegetation (vegetation association 1000, Bassendean complex) at the local level (Shire of Harvey) and approximately 0.06% at the regional level (Swan Coastal Plain). On the local scale, moderate extents of vegetation occur in nearby DBCA managed lands (CALM Exec Body Freehold), including approximately 1,431 ha within the KSIA Buffer Zone. This vegetation has not been previously cleared and is in better condition than vegetation within the Proposal area. Therefore, the loss of vegetation within the Proposal area is not expected to result in significant impacts to the extent or type of vegetation of the area on a regional scale or a local scale (including the KSIA).

'Banksia Woodlands of the SCP' TEC

Direct Impacts

Vegetation representative of the 'Banksia Woodlands of the Swan Coastal Plain' TEC occurs within the Proposal area and will need to be cleared for the development of the Proposal (6.37 ha). The vegetation is also representative of the PEC 'Low lying *Banksia attenuata* woodlands or shrublands'. The majority of the vegetation was mapped to be in Good condition despite being previously cleared for farmland (re-growth).

Both vegetation associations to be cleared (EmKgMr and EmCcXb) are represented in the surrounding vegetation, with more than 80 ha of mapped TEC vegetation included in the remainder of the lease option area and the 'Banksia block'. In addition, two other TEC vegetation associations were identified adjacent to the Proposal area and outside of the lease option boundary (CcBaKgXb and EmBiKgAs), which appear to occur in similar extents to the south and south-east of the lease option area.

The surrounding TEC vegetation does not require clearing for the development of the Proposal and is far more dense (70 – 100%) and in better condition (Very Good – Excellent) than the vegetation within the Proposal area. The location of the Proposal area was selected to avoid the majority and best quality of TEC vegetation within the western portion of the lease option area, in order to minimise the direct impact on this TEC. It is considered that the risk of vegetation

fragmentation has been avoided through this option assessment (discussed further in Section 4.5.1).

Indirect Impacts

The surrounding vegetation that is representative of the TEC may be subject to indirect impacts during construction and operation. The clearing of the Proposal area will result in the creation of new edge zones, which will interact with a new land use element (the Proposal). Edges of woodland such as the TEC vegetation are particularly exposed to environmental conditions not experienced in the remnant interior, for example, soil nutrition, vegetation density and dominance of weed species may change with distance from the woodland edge (Beer & Fox 1997). All edge vegetation created from the Proposal will consist of vegetation that has been previously cleared for agriculture, except for a small stretch of the access road that will be marginally closer to the densely vegetated Banksia Block.

Construction of the Proposal may generate dust that may settle on adjacent (edge) TEC vegetation, which could cause detrimental health effects and in extreme cases, vegetation smothering. In addition, increased traffic during both construction and operations increase the potential for the introduction of Dieback and weeds to adjacent vegetation. This risk is the most significant for the access road where it is adjacent to the Banksia Block, which is assumed to be currently in excellent condition.

The alteration of the natural surface water run-off has the potential to indirectly impact adjacent TEC vegetation through soil erosion leading to vegetation instability and associated vegetation health impacts. Natural surface water run-off is considered very low, considering the porous nature of the soils (Bassendean sands). The drainage design of the Proposal area is self-contained preventing surface water run-off from the Proposal area to the surrounding environment.

Disturbance of ASS associated with the construction of the Proposal has the potential to cause hydrological degradation through the mobilisation of acid and metals into the soil and water, which can lead to secondary impacts on vegetation health. Actual ASS and potential ASS have been found to be present within the Proposal area (Galt 2018a). The most significant risk of ASS being mobilised is through the diversion of the existing agricultural drain, which is in the eastern portion of the site and away from the adjacent TEC vegetation, however, TEC vegetation may still be impacted through the migration of ASS impacts through groundwater.

Another potential impact that may cause a loss of TEC vegetation is through the accidental generation of a bushfire during construction or operations. A bushfire and/or other indirect impacts on surrounding vegetation over time and can lead to depleted soil nutrition and lower vegetation density, resulting in a degraded remnant of vegetation supporting a simplified community, which may no longer be representative of the TEC. However, it is considered that all potential indirect impacts can be effectively managed through the management measures discussed in Section 4.6.

Orchids

No conservation significant orchid species will be directly impacted as a result of the Proposal. Previously identified locations of Threatened orchid species (ELA 20136, AECOM 2012) have the potential to be impacted through habitat degradation, occurring indirectly through construction and operation of the Proposal. For example, dust generation and edge effect risks as discussed in the above section ('Banksia Woodlands of the SPC' TEC) also apply to orchids. The locations of the DRF, *Drakaea elastica*, are susceptible to edge effects, being located only 45 m from the Proposal area boundary.

Other Conservation Significant Flora and Vegetation

***Acacia semitrullata* (P4)**

There are 118 individuals of Priority 4 species *Acacia semitrullata* within the Proposal area that will be directly impacted. This species was associated with disturbed areas within the Proposal area, however, it was also recorded within at least 10 locations within the lease option boundary for the Project (ELA 2017a). There are a further 61 known individuals of *Acacia semitrullata* within the surrounding KSIA (ELA 2015) that are not impacted by this Proposal.

Wetlands

There is up to 14.99 ha of vegetation associated with wetlands within the Proposal area. The wetlands areas are almost entirely in Completely Degraded condition and offer little to no ecological value. Clearing of flora and vegetation during the development of the Proposal will not impact any wetlands with significant ecological value (ELA 2017c).

Summary of Impacts

The majority of the Proposal area has been previously cleared for agriculture (grazing farmland) and a harvested pine plantation, with its current land use as grazing farmland. The majority (65.46%) of the vegetation to be cleared within the Proposal area is non-native vegetation (remaining pine trees) or fragmented re-growth of native vegetation in Degraded or Completely Degraded condition. Mapped wetland areas offer little to no ecological value. Despite the known locations of Priority flora, this vegetation is weed infested and considered to have low ecological value and low floristic diversity.

A small area of vegetation within the Proposal area (6.18 ha) is in Good condition and representative of conservation significant vegetation (TEC/PEC). The same type of vegetation within the remainder of the 230 ha lease option area provided by LandCorp is in much better condition and will not be impacted by this Proposal.

With appropriate management measures in place, indirect impacts to flora and vegetation associated with the Proposal are unlikely to be significant.

4.6 Mitigation

The following sections discuss the mitigation measures that will be, or have been implemented in order of the mitigation hierarchy of avoid, minimise and rehabilitate to address potential impacts to vegetation and flora.

Proposed mitigation measures, are also discussed in Section 3.1 of the Albemarle Kemerton Plant EMP (GHD 2017a) which was submitted with the s38 referral of the Project to the EPA.

Albemarle will develop a Construction Environmental Management Plan (CEMP) which includes all mitigation measures which are relevant to the construction of the Project to ensure contractors responsible for construction are obliged to comply with the measures discussed. The CEMP will comply with the EMP (GHD 2017a).

4.6.1 Avoid

The entire Proposal area is required to be cleared of vegetation (54.31 ha) in order to develop the Proposal. Direct impacts to vegetation are therefore unavoidable within the Proposal area. However, direct impacts on the surrounding vegetation, which is considered to be in better condition and of higher value, have been avoided through the site selection process.

The key measures to avoid potential impacts to flora and vegetation associated with the Proposal are summarised in Table 4-11.

Table 4-11 Mitigation measures to avoid flora and vegetation impacts

Potential impact	Mitigation Measures to Avoid Impact
Clearing of native vegetation, including vegetation representative of a TEC	<ul style="list-style-type: none"> Avoidance of high value conservation significant flora and vegetation and preferential use areas which have previously been subject to disturbance within an initial 257 ha lease option boundary through implementation of a Site selection process. <p>Within the lease option boundary for the Albemarle Kemerton Plant a 12 ha area referred to as the 'Banksia Block' was excluded from consideration for the plant site due to the block supporting:</p> <ul style="list-style-type: none"> Vegetation representative of the Banksia Woodlands TEC/PEC in Very Good condition. <p>Following this an east and west option was identified for further consideration. This option was subject to further ecological assessment to confirm the site avoided areas of higher ecological value. Further explanation of the site selection process, and ecological values which have been avoided through this process, is included in the following section (Site Selection).</p> <ul style="list-style-type: none"> Restrictions will be in place to limit vehicles to driving only on designated tracks or within the Proposal area to avoid impacts to vegetation outside the site boundary
Fragmentation of surrounding native vegetation and edge effects to adjacent vegetation.	<ul style="list-style-type: none"> Avoidance of fragmentation within the KSIA through the site selection process through selection of a site which is predominantly regrowth and disturbed areas in preference to an alternate location comprising largely remnant vegetation with only a small area of regrowth. Process plant, reagent, hydrocarbon storage areas will be located at least 100 m from the Proposal area boundary to prevent any releases from impacting on surrounding vegetation if the occur. Reagents and hydrocarbons will also be stored within secondary containment bunding to prevent releases.
Detrimental impacts to surrounding native vegetation due to altered hydrological regime and nutrient cycling.	<ul style="list-style-type: none"> Uncontaminated site runoff will be captured to prevent sedimentation and flooding of surrounding vegetation. A northern and southern perimeter drain will be established which will capture runoff and direct flow, via gravity, to two infiltration basins at the eastern boundary of the site. (Refer to the site Preliminary Water Management Plan, RPS 2018 in Appendix B for further details on water management) As per the above, uncontaminated stormwater will be infiltrated to maintain groundwater levels in proximity to the Proposal area. This approach is in accordance with the requirements of the Overarching Water Management Strategy (OWMS) for the KSIA (RPS 2016). Related to the above, the site topography will be constructed to slope toward the perimeter drains and eastern infiltration basins to direct stormwater flows into the site drainage system. (Refer to the Preliminary Water Management Plan, RPS 2018) The function of the existing agricultural drain, which influences groundwater flow and levels in proximity, will be retained through diversion around the site rather than infilling. Diversion of the drain will avoid altering the existing

Potential impact	Mitigation Measures to Avoid Impact
	surface water and groundwater regime which is significantly influenced by the drain.
Detrimental impacts to native vegetation resulting from mobilisation of acid and metals due to disturbance of ASS associated with cut-to-fill earthworks and diversion of the existing agricultural drain.	<ul style="list-style-type: none"> A site investigation for the presence and extent of ASS has been undertaken (Galt 2018a). Further detailed investigation of the presence and extent of ASS will be undertaken to support the initial study and determine appropriate strategies to prevent ASS impacts from occurring to enable an ASSMP to be developed prior to disturbance commencing.
Dust impacts to native vegetation (smothering) in proximity to the Proposal area (inclusive of DRF <i>Drakaea elastica</i> and Banksia woodlands TEC/PEC) due to dust emissions from clearing, open areas, process dust and vehicle activity	<ul style="list-style-type: none"> Lithium Hydroxide Product and Sodium Sulfate By-Product are packaged into sealed plastic bags and stored within a warehouse preventing associated emission of dust from the products.
Introduction and/or spread of Dieback and weeds to surrounding vegetation	<ul style="list-style-type: none"> All fill material brought to site will be clean to minimise the risk of introduction or spread of weeds and plant pathogens Vegetation and soil collected during site clearing will be stockpiled within the Proposal area during clearing, at least 10 m from the site boundary to prevent spread of weeds or pathogens that may be contained.
Damage to surrounding vegetation through accidental generation of a bushfire	<ul style="list-style-type: none"> Lighting of all fires within, and in proximity to the Proposal area will be banned.
Loss of threatened orchid species due to indirect habitat degradation resulting from the Proposal activities	<ul style="list-style-type: none"> Controls for dust and surface water runoff previously discussed in this table are also applicable to avoiding impact on threatened orchid species.

Site Selection

Albemarle undertook a careful and considered approach to site selection for the Proposal area in order to, where possible, avoid impacts to high value conservation significant flora and vegetation and preferentially use areas which have previously been subject to disturbance. Albemarle entered an Option to Lease agreement with LandCorp for an initial 257 ha parcel of land. The Option to Lease land parcel was selected due to its proximity to Marriott Road and the proposed Kemerton Road as well as existing services within the KSIA. Different site configurations within the Option to Lease boundary were assessed for suitability for the Plant site resulting in an area of approximately 12 ha referred to as the 'Banksia Block', being excluded from consideration for the plant site due to the block comprising:

- High value native vegetation foraging habitat for conservation significant Black Cockatoo species,

- High value native vegetation breeding habitat for conservation significant Black Cockatoo species, inclusive of potential breeding trees with DBH >500 mm and hollows >100 mm; and
- Vegetation representative of the 'Banksia Woodlands of the SCP' TEC and 'Low lying *Banksia attenuata* woodlands or shrublands' PEC in Very Good condition.

From this high-level assessment and exclusion of the 'Banksia Block', two potential options were identified for the Plant location, an east and a west option. These site options were subject to ecological assessment by Eco Logical Australia (ELA 2017a, Appendix A) which encompassed a desktop review of ecological studies undertaken in the KSIA, supported by a site visit for ground truthing purposes. The ecological assessment identified the east site as likely to have the lower ecological impact of the two options. The site options and associated vegetation communities and conservation significant flora locations which have been identified across the Proposal area and east and west site options are illustrated in Figure 4-3. The assessed condition of the vegetation in these areas is also illustrated in Figure 4-4.

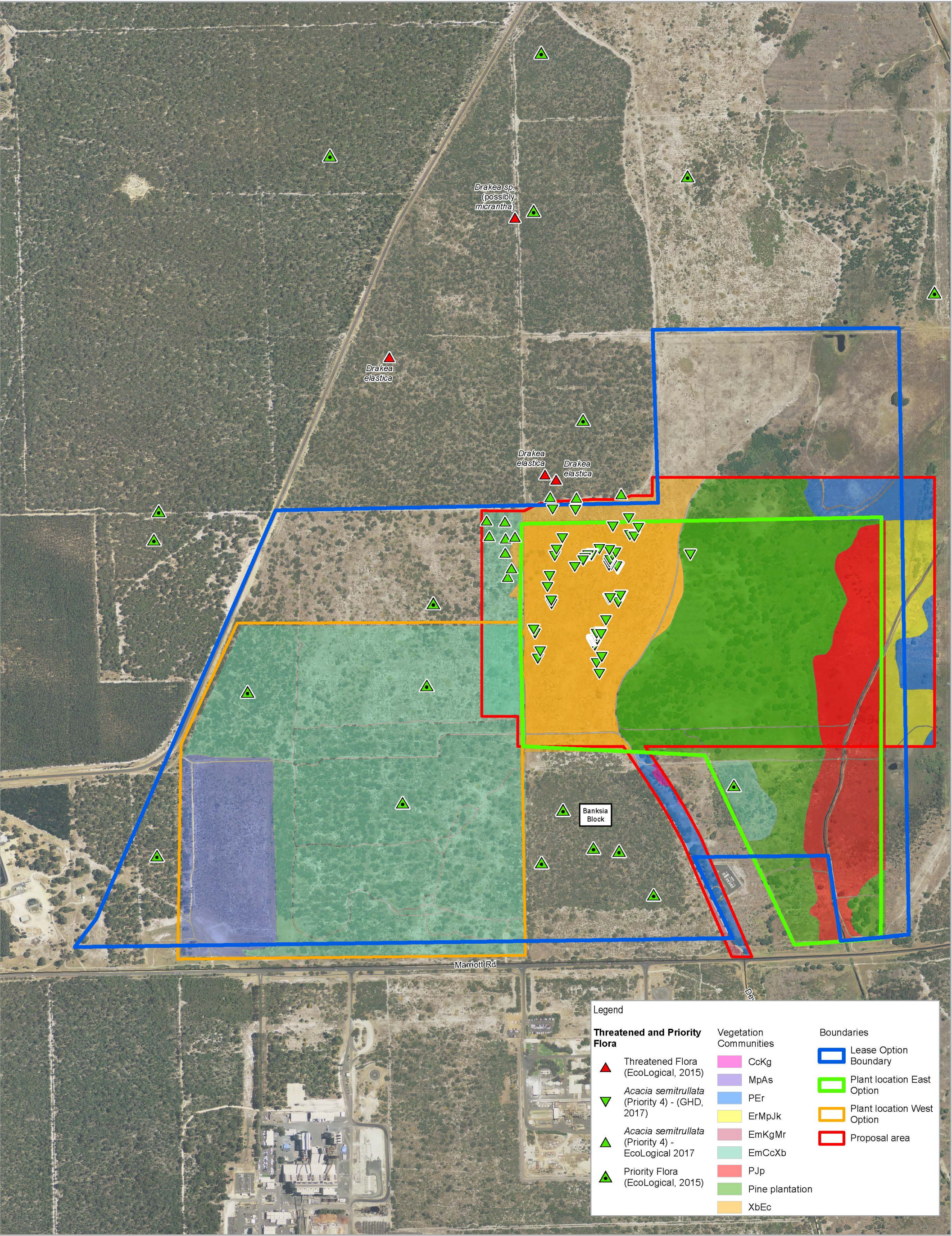
The west option site is almost entirely remnant vegetation of mostly Very Good to Good condition with significantly less disturbance than the east option. The east option site has limited remnant vegetation (2 ha) and is predominantly pine plantation and previously cleared paddocks with native vegetation re-growth in mostly Completely Degraded or Degraded condition (ELA 2017a). The east option therefore avoids extensive clearing of remnant vegetation in Very Good to Good condition.

Additionally, approximately 81% of the west option contains vegetation representative of the 'Banksia Woodlands of the SCP' TEC in mostly Very Good to Good condition whereas the east option only contains 2.5% of 'Banksia Woodlands of the SCP' in Very Good condition (ELA 2017a). The final Proposal area was modified from the conceptual east option with the final Proposal area containing 7.14% vegetation representative of the 'Banksia Woodlands of the SCP' TEC in mostly Good condition.

The choice of the east option also avoids further native habitat fragmentation within the KSIA as the east option is predominantly regrowth and disturbed areas whereas the west option is largely remnant vegetation with only a small area of regrowth (ELA 2017a).

At the time of the options assessment, the west option was considered to contain more recorded locations of the Priority 4 species, *Acacia semitrullata*. However, a targeted search during the 2017 spring survey identified that the Proposal area contained a higher number of this species (predominantly within the XbEc community).

In summary, the western option was avoided as it comprises a significantly smaller area of previously cleared land and is therefore in better condition and higher density than the east option and it contains a significantly larger area of vegetation representative of the 'Banksia Woodlands of the SCP' TEC and 'Low lying *Banksia attenuata* woodlands or shrublands' PEC.



Paper Size ISO A3
0 75 150 225
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

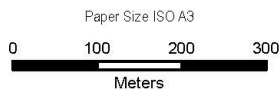
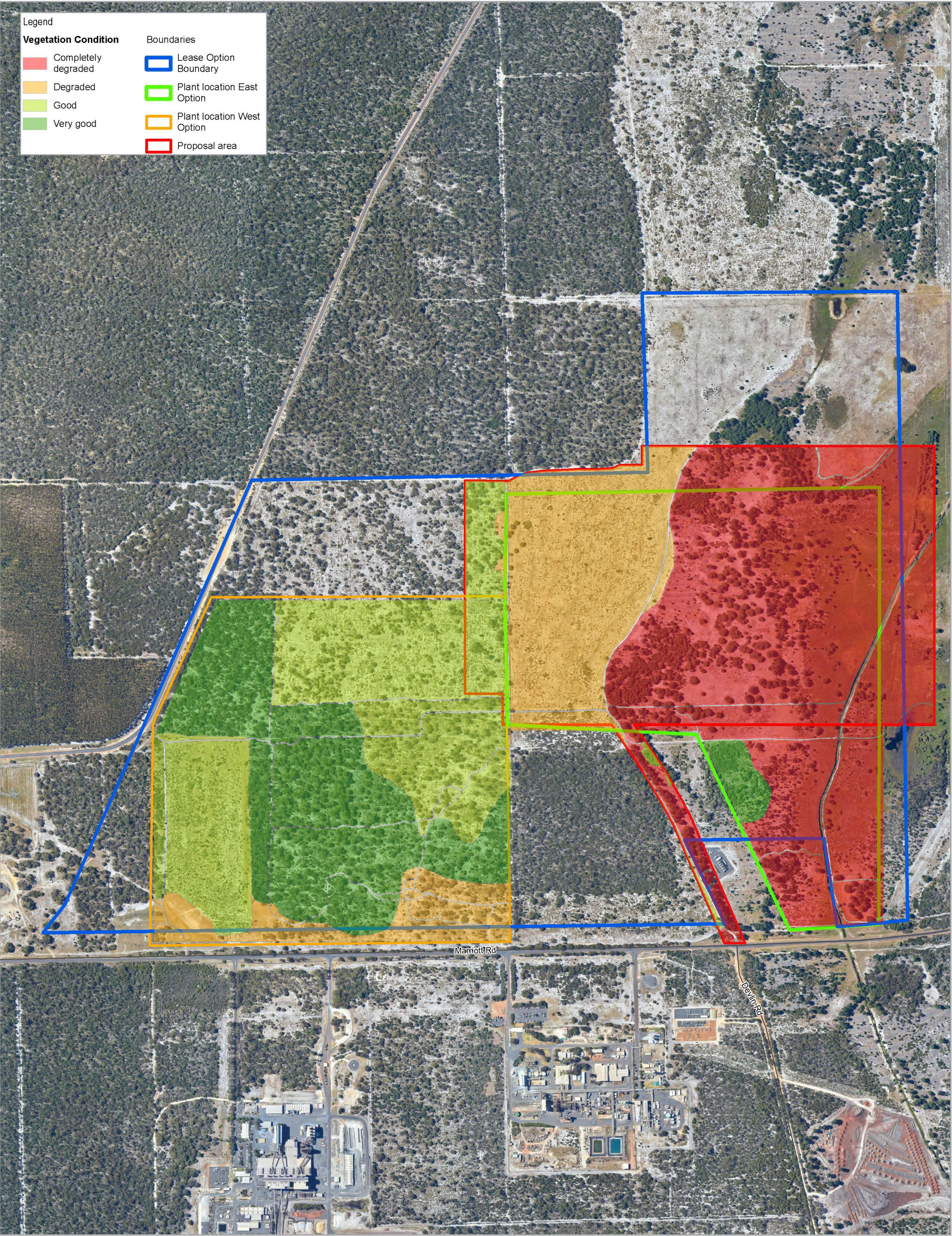


Albemarle Lithium Pty Ltd
Albemarle Kemerton Plant

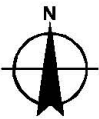
East and West Plant Location Options Vegetation Communities

Project No. 61-36286
Revision No. A
Date 24/10/2017

FIGURE 4-3



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Albemarle Lithium Pty Ltd
Albemarle Kemerton Plant

East and West Plant Location Options
Vegetation Condition

Project No. 61-36286
Revision No. A
Date 24/10/2017

FIGURE 4-4

4.6.2 Minimise

The key measures to minimise potential impacts to flora and vegetation associated with the Proposal are summarised in Table 4-12.

Table 4-12 Mitigation measures to minimise flora and vegetation impacts

Potential impact	Mitigation Measures to Minimise Impact
Clearing of native vegetation, including vegetation representative of a TEC	<ul style="list-style-type: none"> Minimise native vegetation clearing through the site selection process (described in Site Selection above) to select an area which has largely been previously cleared for pine plantation and agriculture/grazing. The western corridor of the site, which comprises 5.94 ha (93%) of the area of TEC proposed for clearing, is designed as a construction activity areas only, and is not required for the operational site. This area will only be cleared if necessary for construction. Albemarle is committed to avoid clearing of this unless necessary for construction. The overall clearing within the Proposal area may therefore be smaller than proposed, significantly reducing the area of TEC clearing, if it is not required for construction. Implementation of a land clearing procedure to minimise the risk of accidental clearing of flora and vegetation adjacent to the Proposal area inclusive of the 'Banksia Woodlands of the SCP' TEC /'Low lying <i>Banksia attenuata</i> woodlands or shrublands' PEC. The land clearing procedure will include the following requirements intended to prevent accidental clearing outside the Proposal area and potential loss of Banksia Woodlands TEC/PEC and DRF. <ul style="list-style-type: none"> An authorised internal clearing permit must be issued prior to undertaking any vegetation clearing. Clear demarcation of all clearing boundaries. Checks to confirm clearing boundaries are demarcated and are correct prior to undertaking clearing. Daily inspection of cleared areas to confirm clearing has occurred within the designated clearing boundary. Survey of cleared areas post clearing to confirm boundaries have been adhered to. Adherence to the site hygiene procedure to prevent weed and <i>Phytophthora cinnamomi</i> introduction or spread. Demarcation of an exclusion area (40 m) around the known DRF location (with physical barriers between the site boundary and the DRF location if necessary). A spotter will be used when clearing in proximity of the DRF to ensure the exclusion boundary is maintained. Stockpiling of all soil and vegetative materials from clearing will be within the Proposal area extents to avoid impacting areas outside the Proposal area boundary Vegetation clearing associated with the site services and access corridor during construction has been minimised through use of an existing access track which will be widened to establish the service and access corridor

Potential impact	Mitigation Measures to Minimise Impact
Fragmentation of surrounding native vegetation and edge effects to adjacent vegetation.	<ul style="list-style-type: none"> The entire Proposal area will be fenced to prevent encroachment of activities beyond the site boundary. Dust suppression will be applied in a controlled manner (i.e. using dribble bars on water carts) to prevent overspray of site impacting on adjacent vegetation.
Detrimental impacts to surrounding native vegetation due to altered hydrological regime and nutrient cycling.	<ul style="list-style-type: none"> Site topography and drainage will be established as early as practical during the construction phase of the project to control surface water. The Proposal does not require ongoing groundwater abstraction. Minor dewatering may be required in the eastern part of the Proposal area to enable site foundation development works to be undertaken. However, this would only be temporary in nature and would not have ongoing impact on the hydrological regime.
Detrimental impacts to native vegetation resulting from mobilisation of acid and metals due to disturbance of ASS associated with cut-to-fill earthworks and diversion of the existing agricultural drain.	<ul style="list-style-type: none"> An acid sulfate soils management plan (ASSMP) is being developed in accordance with Department of Environment Regulation (DER) 2015, <i>Identification and investigation of acid sulfate soils and acidic landscapes</i>. The management plan will be implemented to prevent release of acid and metals which could potentially impact upon flora and vegetation in the vicinity of the Proposal area. The ASSMP will include appropriate strategies for management of temporary dewatering if required for diversion of the drain and establishing the site foundation, to prevent ASS impacts from resulting.
Dust impacts to native vegetation (smothering) in proximity to the Proposal area (inclusive of DRF <i>Drakaea elastica</i> and Banksia woodlands TEC/PEC) due to dust emissions from clearing, open areas, process dust and vehicle activity	<ul style="list-style-type: none"> Dust suppression will be applied where necessary, including during site clearing to minimise generation of dust emissions from open areas, clearing activities and vehicle movement. Vehicles will obey site speed limits of 25 km/hr on unconsolidated roads to minimise dust generation Meteorological conditions will be reviewed on a daily basis during construction to receive warning of adverse weather conditions likely to cause windblown dust from unconsolidated areas or clearing activities. Activities will be modified and dust suppression applied as necessary when such conditions are expected to prevent excessive dust emissions. Stockpiles (Spodumene ore concentrate) will be stored within covered warehouses to minimise dust emissions.

Potential impact	Mitigation Measures to Minimise Impact
Introduction and/or spread of Dieback and weeds to surrounding vegetation	<ul style="list-style-type: none"> • A site hygiene procedure will be implemented throughout to construction stage of the Project which will require: <ul style="list-style-type: none"> – all vehicles and machinery entering the site to be cleaned before arrival and presented for inspection to confirm they are free from soil and vegetative material. – No offsite driving unless on designated roads. – No bringing of plant or soil material to site unless approved for a specific purpose. – No storage of cleared vegetation or soils outside the Proposal area. • Weed control (spraying) will be conducted if new weed infestation are observed within or in proximity to the Proposal boundary. Permission will be sought from the landowner (Landcorp) before undertaking any control program outside the Proposal area.
Damage to surrounding vegetation through accidental generation of a bushfire	<ul style="list-style-type: none"> • Management of fire risk through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-specific emergency response plan as outlined in the EMP (GHD 2017a). • Shire restrictions in relation to fires and vehicle movement bans will be communicated to all employees and strictly adhered to minimise the risk of igniting a bushfire • Implementation of a Hot Work system as a control to ensure Hot Works are only carried out in suitable areas, not a risk of fire.
Loss of threatened orchid species due to indirect habitat degradation resulting from the Proposal activities	<ul style="list-style-type: none"> • Albemarle will develop a Threatened Orchid Management Plan for the Proposal which will detail threatening processes relevant to the orchids and relevant mitigation measures to prevent loss of known threatened orchids in proximity to the Proposal area. The plan will also detail the proposed monitoring strategy for the orchid population which has been recorded (ELA 20136, AECOM 2012) within 50 m of the northern boundary of the Proposal area. The monitoring strategy will include: <ul style="list-style-type: none"> – Objectives, targets and performance indicators for threatened orchids – the proposed location for monitoring (which will be subject to change as the orchid locations must first been identified in the field through an appropriately timed survey) – the proposed monitoring method (likely to be a combination of techniques such as photography, population count, plant health assessment, assessment of surrounding vegetation health including identification of evidence of impact from any threatening process)

Potential impact	Mitigation Measures to Minimise Impact
	<ul style="list-style-type: none"> – the proposed frequency of monitoring – Contingencies to be implemented if plant decline is detected. <p>The management plan will be developed and submitted for approval prior to commencing site works.</p>

4.6.3 Rehabilitate

The Proposal requires the clearing of 87.7 ha of vegetation (inclusive of 33.39 ha of pine plantation) to establish the Plant and associated infrastructure. The infrastructure will be in place for at least 25 years post construction therefore rehabilitation within this timeframes is unlikely unless as a result of early closure of the Plant.

The Plant will be located within the KSIA within an area zoned for Industrial Use. Use of the Proposal area following completion of Albemarle's activities will be at the discretion of the KSIA park manager and landowner LandCorp. LandCorp may have an alternate use for the site at the end of Albemarle's tenure, and in line with the principle of utilising existing disturbed areas for development where possible, LandCorp may choose to retain the area for future development. Rehabilitation of the site at the end of the Plant life will therefore only be undertaken with the agreement of LandCorp, if an alternate development of the land is not planned. If no alternate use of the Proposal area is proposed within the final five years of Plant life Albemarle will commence planning for rehabilitation and investigation of suitable rehabilitation strategies for the Site.

Some locations within the Proposal area may be able to be rehabilitated post the construction phase. Construction activity areas within the Proposal area will initially be designated for use by construction contractors for laydown and workshop purposes. If these areas are not required to be retained for the Plant operation they will be rehabilitated when no longer required for construction purposes.

Additionally, the site service corridor is initially required to be wide enough to provide access for large, wide construction loads while the primary site access (Kemerton Road) is being established, in addition to providing sufficient space for service installation. When services have been installed, and the road is no longer required as the primary access to the Site (Kemerton Road is complete), the size of the corridor will be reduced to a single access track and service corridor width (~15 m). The remaining cleared area will be rehabilitated.

When available for rehabilitation the construction areas and the service corridor will have the appropriate surface treatment applied (surface ripping to break up consolidated ground) and be seeded with a representative selection of native species. The species mix will be based on the pre-existing vegetation communities present. Advice will be sought from an appropriately qualified and experienced botanist to make an appropriate selection of species. Albemarle will also refer to the Steven's *et al* 'Banksia woodlands: A restoration guide for the Swan Coastal Plain' (2016) for guidance on rehabilitation. If rehabilitation is undertaken the area will be monitored and weed control will be applied as required. The aim of rehabilitation will be to re-establish a vegetation community which is representative of the pre-existing community.

In addition to the above, Albemarle has already contributed to rehabilitation in the broader Leschenault Catchment area, which the KSIA is located within, by commissioning an experienced revegetation consultant to harvest seed from native vegetation within the Proposal area in March 2018. The seed will be donated to the Leschenault Catchment Council for use in rehabilitation projects within the Catchment area.

4.7 Predicted Outcome

The outcomes of the Proposal will include:

- Clearing of 54.31 ha of non-contiguous, poor quality native vegetation, within the 89.25 ha Proposal area, of which 22.8 ha is in Completely Degraded condition and 25.04 ha is in Degraded condition.
- Permanent loss of up to 6.37 ha of TEC and PEC vegetation mostly in Good condition (6.18 ha).
- Permanent loss of 118 known individuals of Priority 4 species, *Acacia semitrullata*
- No detrimental impact to adjacent native vegetation during construction or operations through implementation of a CEMP and EMP

Clearing of the vegetation representative of the 'Banksia Woodlands of the SCP' TEC, and 'Low lying *Banksia attenuata* woodlands or shrublands' PEC is considered to be a potentially significant residual impact. The area of clearing is not significant within a local (KSIA) or regional (SCP) context, however, the clearing is considered to be potentially significant due to the conservation state of the ecological community. Albemarle proposes to provide an appropriate offset to counterbalance the impact of the clearing of vegetation representative of the TEC and PEC. The proposed offset strategy is discussed further in Chapter 7.

Through the implementation of the mitigation and management measures described, and implementation of an appropriate offset, Albemarle considers that the Proposal can meet the EPA objective for this factor.

5. Terrestrial Fauna

5.1 Objective

To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

5.2 Policy and guidance

Legislation, policy and guidance materials relevant to this proposal for terrestrial fauna are listed below.

- Environmental Factor Guideline Terrestrial Fauna (EPA 2016g)
- Technical Guidance Sampling methods for terrestrial vertebrate fauna (EPA 2016i)
- Technical Guidance Terrestrial Fauna Surveys (EPA 2016j)
- *Wildlife Conservation Act 1950*
- *Biodiversity Conservation Act 2016*
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Commonwealth)
- EPBC Act Environmental Offsets Policy (DSEWPoC 2012)
- WA Environmental Offsets Policy (GoWA 2011)
- WA Environmental Offsets Guidelines (GoWA 2014)

5.3 Receiving Environment

In March 2017, ELA undertook a desktop assessment and Level 1 fauna survey of two site options (east and west) which were under consideration for establishment of the Plant within a 257 ha lease option boundary (ELA 2017a, b). In September 2017, ELA undertook a Level 1 (spring) fauna survey within the Proposal area to verify and update the findings of the desktop assessment (where required) and to validate and supplement previously recorded fauna values (ELA 2017c). GHD (2017b) completed a Level 1 fauna and targeted Black Cockatoo survey in October 2017 for an area within the selected site boundary which had not previously been surveyed by ELA (2017 a, b, c).

Technical reports by ELA and GHD are provided in Appendix A.

There have been a number of terrestrial fauna surveys and assessments within the wider KSIA, which include the Proposal area. Baseline studies relevant to this Proposal are provided in Table 5-1.

Table 5-1 Baseline studies – terrestrial fauna

Year Survey Completed	Consultant	Survey Name
2017	GHD	<ul style="list-style-type: none"> • Level 1 and targeted fauna survey of areas within the Proposal area not included in ELA surveys
2017	Eco Logical Australia	<ul style="list-style-type: none"> • Kemerton Industrial Area Spring Flora and Fauna Survey • Desktop Assessment of Selected Lots within Kemerton Industrial Area • Kemerton Industrial Area Additional Assessment of Proposed Access Road Area.
2014	Eco Logical Australia	<ul style="list-style-type: none"> • Targeted Ecological Surveys for Kemerton Industrial Park
2010	Cardno	<ul style="list-style-type: none"> • Kemerton Industrial Core: Fauna Survey
2011	Bamford Consulting	<ul style="list-style-type: none"> • Black Cockatoo and Western Ringtail Possum Habitat Assessment, Kemerton Industrial Park, Bunbury
2008	Coffey Environments	<ul style="list-style-type: none"> • Flora, Vegetation, Wetlands and Fauna Assessment Kemerton Industrial Park
1999	Muir Environmental	<ul style="list-style-type: none"> • Report of Biological Survey – Phase 1: Kemerton Industrial Estate Volume 1 Report • Summary Report – Kemerton Industrial Area Phase 1 Biological Survey

Fauna habitats

Fauna habitat types within the Proposal area were assessed during surveys by ELA (2017a, b, c) and GHD (2017b). The areas surveyed by ELA and GHD cover 75.92 ha and 11.78 ha of vegetated land respectively. The remaining 1.55 ha of the Proposal area comprises cleared land (i.e. access tracks).

Nine fauna habitat types were identified within the Proposal area, which directly correlate to the vegetation communities (see Section 4.3). A description of these fauna habitat types, correlating vegetation communities, and extents within the Proposal area is provided in Table 5-2. The extent of the habitat types within the Proposal area is shown in Figure 5-1

Table 5-2 Fauna habitat types identified within the Proposal area

Habitat type and description	Corresponding vegetation code	Extent within the Proposal area Total (ha) (%)
Pine Plantation <i>Pinus</i> species (previously harvested plantation) (Note: a canopy assessment of the former plantation area has been undertaken which determined the canopy coverage of the area to be 16.5 ha (50%). Further detail on the canopy assessment is included in Chapter 7).	Pine plantation	33.39 (37.41)
Regenerating farmland Previously cleared farmland with <i>Xanthorrhoea</i> open shrubland over and open grassland of Perennial Veldt Grass	XbEc	25.05 (28.06)
Sedgeland <i>Juncus kraussii</i> subsp. <i>australiensis</i> and <i>Juncus pallidus</i> closed rushland in low lying seasonal dampland with scattered pine trees	PJp	8.62 (9.66)
<i>Pinus/Eucalyptus</i> Woodland <i>Pinus</i> sp. and <i>Eucalyptus rudis</i> low open woodland in low lying seasonal dampland	PEr	7.90 (8.85)
Jarrah/Marri Woodland Woodland of Jarrah (<i>Eucalyptus marginata</i> subsp. <i>marginata</i>) and Marri (<i>Corymbia calophylla</i>) with occasional isolated <i>Banksia attenuata</i> trees over <i>Xanthorrhoea brunonis</i> shrubland on uplands.	EmCcXb	5.94 (6.66)
Woodland over Sedgeland Woodland to low open woodland of Flooded Gum, <i>Melaleuca</i> and <i>Pinus</i> sp. over <i>Kunzea</i> shrubland and sedgeland of <i>Juncus</i> sp. on seasonally inundated areas/damplands	ErMpJk	6.16 (6.90)
<i>Eucalyptus/Banksia</i> Woodland Woodland of Jarrah and Marri with <i>Banksia</i> sp. low open woodland over <i>Xanthorrhoea</i> shrubland on uplands	EmKgMr	0.42 (0.47)
Marri Forest Marri forest over mixed myrtaceous shrubland and <i>Xanthorrhoea</i> over isolated clumps of rushes on fringes of low lying damp areas	CcKg	0.19 (0.21)
<i>Melaleuca</i> Woodland <i>Melaleuca preissiana</i> low woodland and myrtaceous shrubland over isolated clumps of rushes on low lying damp areas	MpAs	0.02 (0.03)

Fauna habitat value

Seven of the nine fauna habitat types recorded have been assessed as suitable foraging and potential breeding habitat for Black Cockatoos listed as threatened under the EPBC Act and specially protected under the Wildlife Conservation Act 1950 (WC Act) (Carnaby's Black Cockatoo (*Calypthornychus latirostris*), Forest Red-tailed Black Cockatoo (*Calypthornychus banksia naso*) and Baudin's Black Cockatoo (*Calypthornychus baudini*)).

Fauna habitats identified within the Proposal area are unlikely to represent significant feeding or breeding habitat for species other than Black Cockatoo's (ELA 2017a, b, c). The wetland area may provide foraging opportunities for wetland birds, however it does not form core habitat for any fauna species (ELA 2017a).

Ecological linkages

The Proposal area occurs within the KSIA Industrial Core, less than 1 km from two known ecological linkages, namely:

- The McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup Link, which occurs within the KSIA Buffer Zone (east and west) and contains approximately 1,431 ha native vegetation within Department of Biodiversity Conservation and Attractions (DBCA) managed land (unofficial CALM Executive Body Freehold land).
- The Leschenault/Kemerton Link, which runs east to west and links the KSIA Buffer Zone to the Leschenault coastline (ELA 2015).

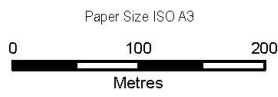
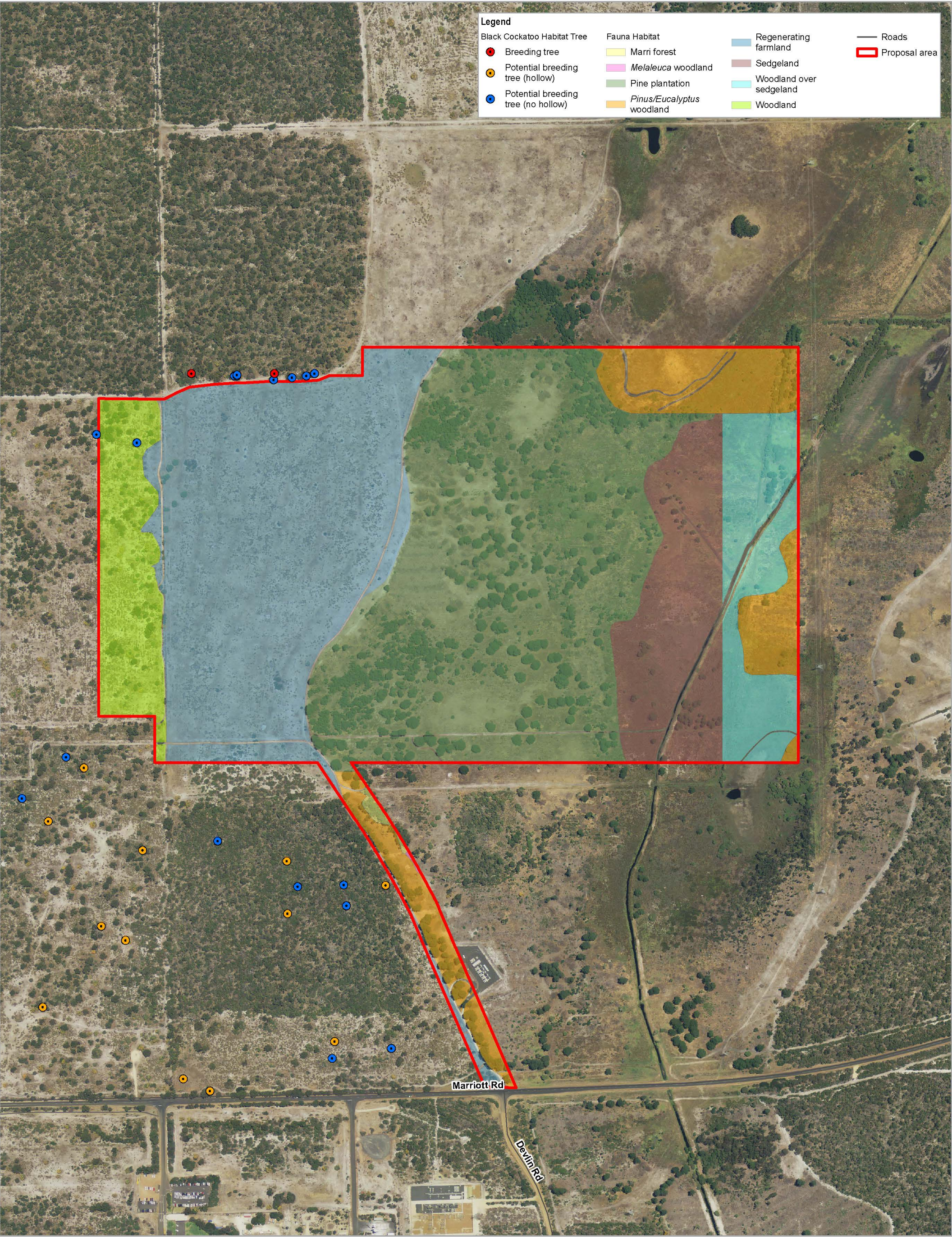
The linkages have been identified as providing a regional biodiversity function, by linking significant remnant vegetation patches within the south-west region (ELA 2015). The Proposal area does not represent part of these links.

Fauna diversity

A Level 1 fauna survey within the Proposal area recorded a total of 22 fauna species (ELA 2017c). The survey recorded 19 birds, two mammals and one reptile over an area of approximately 76 ha. Two introduced fauna species were recorded, including the Laughing Kookaburra (*Dacelo novaeguineae*) and Rabbit (*Oryctolagus cuniculus*).

Forty four fauna species comprising 35 birds, four reptiles and five mammals were also recorded within the additional survey area (GHD 2017b). Of these, four are introduced (feral) species, Red Fox, European Rabbit, Pig and Laughing Kookaburra.

The Proposal area is not considered to have high fauna diversity.



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Albemarle Lithium Pty Ltd
Albemarle Kemerton Plant

Project No. 61-36286
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Fauna habitat types

FIGURE 5-1

Conservation significant fauna

Searches of the EPBC Act Protected Matters database and DBCA *NatureMap* database identified the presence/ potential presence of 56 conservation significant fauna species within 10 km of the Proposal area. The desktop searches recorded:

- 36 species listed under the EPBC Act and/or the WC Act
- 13 migratory birds protected under international agreement (Schedule 5)
- Seven DBCA Priority listed species.

Two conservation significant species were directly and indirectly observed within the Proposal area, namely Carnaby's Black Cockatoo (*Calypthornychus latirostris*) (Endangered, Schedule 2) and Forest Red-tailed Black Cockatoo (*Calypthornychus banksia naso*) (Vulnerable, Schedule 3) (ELA 2017a-c; GHD 2017b).

A likelihood of occurrence assessment identified another two conservation significant species as likely to occur within the Proposal area;

- Baudin's Black Cockatoo (*Calypthornychus baudinii*) (Endangered, Schedule 2) and
- Rainbow Bee-eater (*Merops ornatus*) (Schedule 5) (ELA 2017c).

The assessment also identified a further four species that have the potential to occur within the Proposal area:

- Cattle Egret (*Ardea ibis*) (Migratory, Schedule 5)
- Eastern Great Egret (*Ardea modesta*) (Migratory, Schedule 5)
- Peregrine Falcon (*Falco peregrinus*) (Schedule 7), and
- Western Brush Wallaby (*Macropus irma*) (Priority 4).

The remaining 48 species are considered unlikely to occur within the Proposal area due to lack of suitable habitat (ELA 2017c).

The Proposal area provides habitat for the Rainbow Bee-eater (*Merops ornatus*) (Schedule 5) which is considered as being likely to occur (ELA 2017c). This species is likely to occur only on a transitory basis utilising the Proposal area for opportunistic foraging. The Proposal area is unlikely to be a significant feeding or breeding Site for this species (ELA 2017c).

Black Cockatoos

The Proposal area provides areas of suitable foraging habitat (62.63 ha) and potential breeding habitat (14.45 ha) for Black Cockatoos (Carnaby's Black Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Black Cockatoo). These areas contain a mix of plant species documented by DSEWPaC (2012) as foraging species for one or more of the three threatened Black Cockatoo species. Suitable foraging species present within the Proposal area include Marri, Jarrah, Flooded Gum, Banksia and Pines. Pine trees are prominent at this Site. *Pinus/Eucalyptus* woodland habitat types are scattered throughout the Sedgeland and Woodland over Sedgeland habitat types.

Vegetation which has been classified as suitable Black Cockatoo foraging habitat within the Proposal area is highly modified due to previous agricultural and pine plantation land use. The majority (54%) of the area classified as suitable Black Cockatoo foraging habitat is considered to be of moderate value, due to the scattered to moderate density of regrowth *Pinus radiata* plants with minimal other feeding species present. Low value areas (36.2%) have been classified as those consisting of isolated trees of *Pinus radiata* with no other feeding species present. High value foraging habitat (9.8%) has been defined as vegetation which consists of a range of *Eucalyptus*, *Allocasuarina* and *Banksia* species in moderate density.

Within the area of foraging habitat there is 6.55 ha of habitat which has moderate to high potential breeding value due to the presence of Jarrah and Marri trees which are preferred for breeding. The remaining areas comprise sparse regrowth of species primarily not suitable for breeding with the exception of *Eucalyptus rudis*, however this species occurs typically as isolated trees within areas which have been predominantly cleared and is not a preferred species. Observations have been made within the Proposal area of Carnaby's and Forest Red-tailed cockatoo foraging of the pine, marri and Jarrah trees.

GHD (2017b) and Bamford (2011) identified large Jarrah trees that had DBH greater than 500 mm to the immediate north of the Proposal area. Two trees had large hollows and potential chews. These trees also had insitu markings. GHD (2017b) also identified one potential breeding tree with DBH greater than 500 mm within the Proposal area. Additional trees with and without hollow occur within the local area within the 'Banksia Block'.

A summary of the fauna habitat types, Black Cockatoo habitat value and condition within the Proposal area is included in Table 5-3.

Table 5-3 Fauna habitat types and Black Cockatoo habitat identified within the Proposal area

Habitat type and description (corresponding vegetation code)	Extent within the Proposal area Total (ha) (%)	Black Cockatoo habitat		Vegetation Condition	Habitat value and rationale
		Foraging (ha)	Potential Breeding value		
Pine Plantation <i>Pinus</i> species (previously harvested plantation)	33.39	33.39	None	Completely Degraded	Moderate : Consists of scattered to moderately dense patches of regrowth <i>Pinus</i> plants over introduced grasses and very scattered shrubs. (Note: a canopy assessment of the former plantation area has been undertaken which determined the canopy coverage of the area to be 16.5 ha (50%). Further detail on the canopy assessment is included in Chapter 7).
Regenerating farmland Previously cleared farmland with Xanthorrhoea open shrubland over and open grassland of Perennial Veldt Grass	25.05	-	None	NA	NA
Sedgeland <i>Juncus kraussii</i> subsp. <i>australiensis</i> and <i>Juncus pallidus</i> closed rushland in low lying seasonal dampland with scattered pine trees	8.62	8.62	None	Completely Degraded	Low : Isolated <i>Pinus</i> trees over sedges and grasses.
<i>Pinus/Eucalyptus</i> Woodland <i>Pinus</i> sp. and <i>Eucalyptus rudis</i> low open woodland in low lying seasonal dampland	7.90	7.90	Low (within <i>Eucalyptus rudis</i> only)	Completely Degraded	Low : Scattered <i>Pinus</i> and <i>Eucalyptus rudis</i> over introduced grasses
Jarrah/Marri Woodland Woodland of Jarrah (<i>Eucalyptus marginata</i> subsp. <i>marginata</i>) and Marri (<i>Corymbia calophylla</i>) with occasional isolated <i>Banksia attenuata</i> trees over <i>Xanthorrhoea brunonis</i> shrubland on uplands.	5.94	5.94	Moderate to High	Good	High : Moderately dense <i>Eucalyptus marginata</i> / <i>Corymbia calophylla</i> woodland with <i>Banksia attenuata</i>

Habitat type and description (corresponding vegetation code)	Extent within the Proposal area Total (ha) (%)	Black Cockatoo habitat		Vegetation Condition	Habitat value and rationale
		Foraging (ha)	Potential Breeding value		
Woodland over Sedgeland Woodland to low open woodland of Flooded Gum, <i>Melaleuca</i> and <i>Pinus</i> sp. over <i>Kunzea</i> shrubland and sedgeland of <i>Juncus</i> sp. on seasonally inundated areas/damplands	6.16	6.16	None (not likely to breed within a sedgeland)	Completely Degraded	Low: Isolated <i>Eucalyptus rudis</i> and <i>Pinus</i> plants over sedges and introduced grasses
Eucalyptus/Banksia Woodland Woodland of Jarrah and Marri with <i>Banksia</i> sp. low open woodland over <i>Xanthorrhoea</i> shrubland on uplands	0.42	0.42	Moderate to High	Completely degraded to Excellent	Moderate: Scattered to patchy <i>Eucalyptus marginata</i> and <i>Banksia ilicifolia</i> trees over <i>Xanthorrhoea brunonis</i> shrubland
Marri Forest Marri forest over mixed myrtaceous shrubland and <i>Xanthorrhoea</i> over isolated clumps of rushes on fringes of low lying damp areas	0.19	0.19	Moderate to High	Good	High: <i>Corymbia calophylla</i> forest over <i>Kunzea glabrescens</i> open shrubland
Melaleuca Woodland <i>Melaleuca preissiana</i> low woodland and myrtaceous shrubland over isolated clumps of rushes on low lying damp areas	0.02	-	None	NA	NA
TOTAL	87.7	62.63	14.45 ha (6.55 ha Mod-High potential) (7.9 ha Low potential)		

5.4 Potential Impacts to Terrestrial Fauna

To establish the Albemarle Kemerton Plant, the Proposal area is required to be cleared of all vegetation, which will result in unavoidable direct impacts to fauna habitat within the defined Proposal area. Potential indirect impacts to fauna and their habitat may also occur as a result of the Proposal.

Unavoidable clearing of 87.7 ha of vegetation to establish the Plant will result in the direct loss of the following significant fauna habitat within the Proposal area:

- Up to 62.63 ha of suitable foraging habitat for threatened Black Cockatoo species; and
- One potential breeding tree (Jarrah) which is > 500 mm DBH, with no observed hollows.

Accidental direct fauna habitat loss could also potentially occur outside the Proposal area due to the proximity to potential breeding trees and other fauna habitat.

Other direct impacts to fauna associated with the Proposal activities include:

- Death or displacement of native fauna species through interaction with vehicles and machinery, entrapment or drowning

Potential indirect impacts to fauna associated with the Proposal activities include:

- Fragmentation of fauna habitat within the KSIA (local area)
- Degradation of fauna habitat in proximity to the Proposal area due to impact from known threats such as *Phytophthora cinnamomi* and weeds.
- Displacement of native fauna due to secondary impacts such as noise, vibration, light and dust.
- Local increase in feral / introduced fauna species due to establishment of permanent water storage facilities

5.5 Assessment of impacts

Fauna Habitat Loss

Development of the Proposal will result in the unavoidable loss of 87.7 ha area of fauna habitat. The area of habitat to be cleared is relatively small on the regional scale and does not represent high value habitat for any conservation species, with the exception of Black Cockatoos

The overall Black Cockatoo foraging habitat footprint within the Proposal area (62.63 ha) is highly modified due to previous and ongoing agricultural and pine plantation land use. The majority (54%) of the area is considered to be of moderate value due to the previous and current land impacts including grazing. High value foraging habitat is limited to 9.8% of the Proposal area (western corridor) comprising a range of *Eucalyptus*, *Allocasuarina* and *Banksia* species in moderate density. The remaining foraging habitat (36.2%) is considered to be of low value due to comprising isolated trees (*Eucalyptus rudis* and *Pinus sp.*) over grasses. (Refer to Table 5-3 for detail on how the assessment of habitat value has been made) Within the area of foraging habitat there is 6.55 ha of vegetation which has moderate to high potential breeding value due to the presence of Jarrah and Marri trees which are preferred for breeding.

The former pine plantation forms part of the Black Cockatoo foraging habitat. This area has limited ecological value other than as foraging habitat for Carnaby's and Forest Red-tailed Black Cockatoos only. Due to its limited ecological value, and the sparse and scattered nature of the pines in this area, a canopy assessment was undertaken to determine the true area of foraging habitat. The area of canopy within the 33.4 ha area of former pine plantation was calculated to be 16.5 ha. Based on this calculation the true area of foraging habitat impacted by the Proposal

area can be reduced to 45.73 ha. More details on the canopy assessment are provided in Chapter 7. The foraging habitat can be broken in to two further classifications based on the detail in Table 5-3, habitat of low quality (22.68 ha) and habitat of moderate to high quality (23.05 ha). Low quality habitat has been defined as that which has limited foraging species, is sparse and has no or low breeding value.

Black Cockatoo habitat is well represented within the locality. There are large expanses of vegetation within the broader KSIA which also provides high value foraging habitat for Black Cockatoos. An assessment of the Black Cockatoo habitat value of the KSIA was undertaken by Eco Logical Australia in 2013 (ELA 2013). Based on the results of this assessment it is estimated that there is up to 4,275 ha of moderate to high, or high quality foraging habitat within the broader KSIA that could be utilised by birds currently foraging within the Proposal area. An illustration of the Black Cockatoo Foraging habitat, as assessed by ELA 2013, is included in Figure 5-2.

The estimated area of suitable foraging habitat available within the Shire of Harvey (based on current extent of Beard (1979) vegetation associations) is estimated to be 87,007.51 ha (GoWA 2016). The Proposal will reduce the overall area of habitat by less than 0.06% within the Shire of Harvey as a result of direct loss of habitat from clearing. The majority of this foraging habitat is in DBCA managed land (approximately 76%). Given the habitat is highly modified and well represented both in land adjacent to the Proposal area and the greater locality, the impacts of the clearing are not considered significant.

Six potential breeding trees greater than 500 mm DBH without visible hollows, and three breeding trees greater than 500 mm with hollows (two with evidence of prior use and one with evidence of bee invasion), have been identified within 10 m of the Proposal area. Given the close proximity of these trees to the Project boundary there is a risk of loss if clearing is not contained within the defined boundary. There is also a risk that other surrounding fauna habitat could be lost as a result of accidental clearing outside the Proposal area if suitable clearing controls are not implemented.

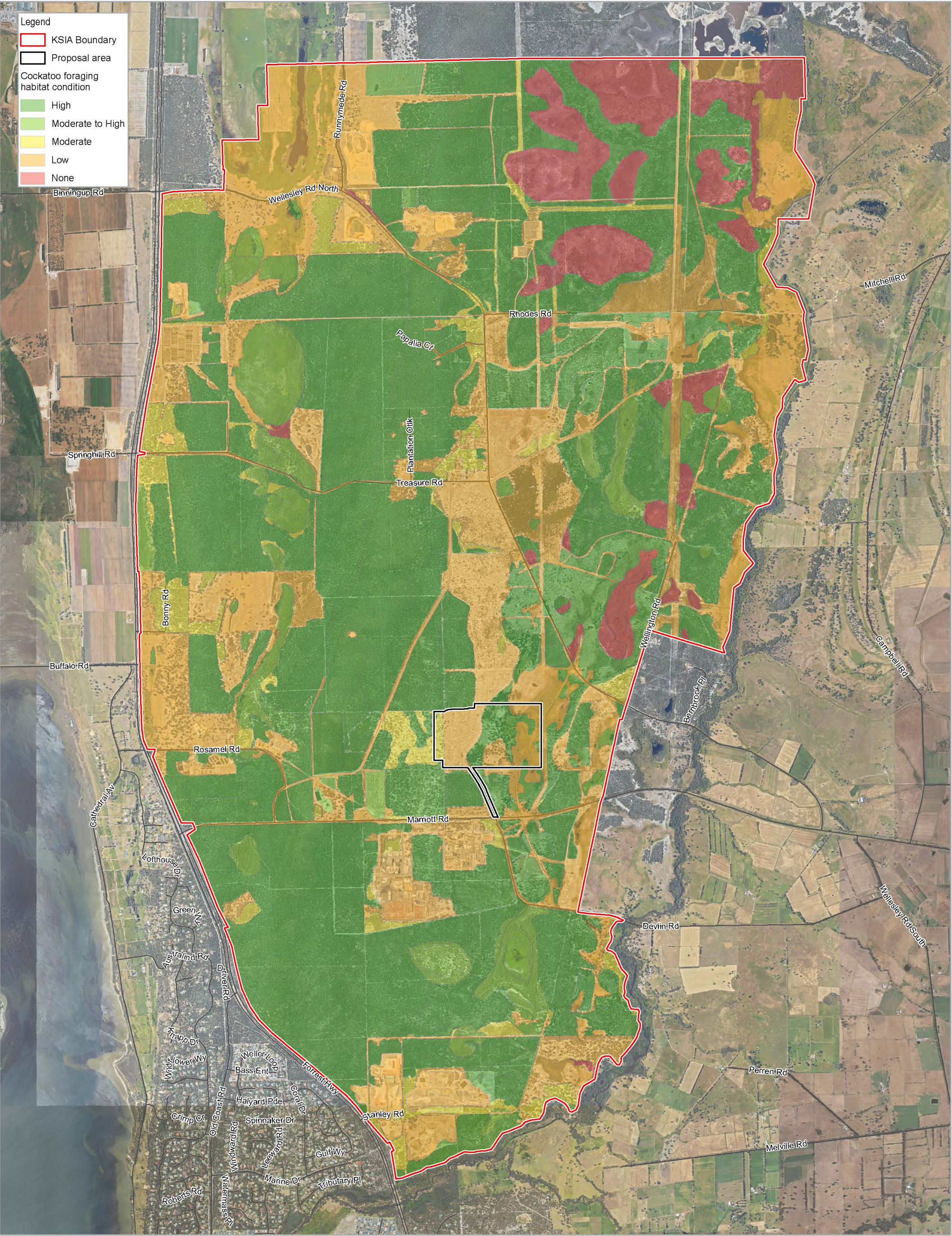
Vegetation within the Proposal area does not represent an ecological linkage, therefore clearing will not impact established fauna movement corridors

Death, injury or displacement of native fauna species

Fauna within the Proposal Area and immediate surrounds are at risk of death, injury or displacement due to interaction with heavy and light vehicles undertaking vegetation clearing and construction works within the Proposal Area. Fauna may also become entrapped within excavations or infrastructure such as water storage ponds, pipes or service lines resulting in injury or death.

Interaction between vehicles/machinery and fauna species, is most likely to occur during vegetation clearing activities as resident fauna could potentially be struck by vehicles undertaking the activity, or injured as they try to escape. Suitable management practices during planning and undertaking vegetation clearing will reduce the likelihood of death or injury to native fauna occurring as a result of this activity.

There will also be an increase in vehicle movements within the KSIA as vehicles (including transport trucks) arrive and depart the site. The KSIA contains extensive areas of Black Cockatoo habitat. Elevated speeds coupled with increased traffic numbers are a known cause of decline in all three species of Black Cockatoo (DPAW 2013) as well as being a known hazard to fauna in the vicinity of transport routes. As the KSIA is an operating industrial park, it is expected that fauna have become accustomed to existing transport routes and vehicle use along these routes and therefore may already avoid these areas.



Excavations will be developed during the construction of the Plant and installation of services (gas, telecommunications, water, power) along the service corridor. Fauna could potentially become entrapped within these excavations if suitable egress is not available, leading to death or illness.

Water storage facilities (ponds) will also be a hazard to native fauna. Good quality, fresh process water will be stored within an open pond and therefore attract fauna seeking water. If fauna are able to access the pond there is a risk of drowning within the facility if appropriate egress is not available. Saline brine reject will be stored in an open pond however this facility is unlikely to attract fauna due to its high salinity concentrations. There is no requirement to store contaminated process water, therefore the risk of mortality associated with fauna ingesting contaminated water is considered to be negligible.

Fragmentation of fauna habitat within the KSIA (local area)

Vegetation clearing for the Proposal will result in some fragmentation of fauna habitat by contributing to increased patches and/or edges at a local scale. Fragmentation of fauna habitat at a regional scale is not anticipated given the relatively small size of the Proposal area and the surrounding area comprising already linked remnant vegetation areas. The Proposal area does not form part of the regional ecological linkages within the KSIA.

Degradation of fauna habitat in proximity to the Proposal area due to impact from known threats such as *Phytophthora cinnamomi* and weeds

The Proposal has the potential to introduce and/or spread invasive pathogens (*Phytophthora cinnamomi*) and invasive flora species (weeds) as a result of vehicle or heavy equipment movements and land clearing activities. *Phytophthora cinnamomi* can potentially result in widespread vegetation death in infested areas and weeds can outcompete native vegetation potentially reducing the availability of native vegetation habitat in the surrounding area.

Given that the Proposal area already has a high population and range of weeds (74 species have been identified) as a result of past clearing and grazing activity, and there is, a risk of *Phytophthora cinnamomi* presence (it has been recorded south of Marriott road) spread weeds and *Phytophthora cinnamomi* could potentially occur as a result of the Proposal. Vegetation in the surrounding area contains species known to be susceptible to dieback.

Spread is mostly likely to occur as a result of poor hygiene practices when vehicles enter the Proposal Area or if they drive in areas outside the Proposal area where dieback may occur. Cleared soils could also potentially cause the spread of weeds and dieback if they are not contained within the Proposal area.

Six potential breeding trees greater than 500 mm DBH without visible hollows, and three breeding trees greater than 500 mm with hollows (two with evidence of prior use and one with evidence of bee invasion), have been identified within 10 m of the Proposal area. Given the close proximity of these trees to the Project boundary there is a risk of loss as a result of indirect impacts from dieback, weeds and flooding.

Disturbance and displacement of fauna due to noise, light, dust and vibration

There will be an increase in noise, vibration, light and dust in the Proposal area and immediate surrounds associated with land clearing, vehicle and machinery operation, construction activities and operation of the Plant. Increased noise, vibration light and dust may result in native fauna being displaced from, or avoiding use of, habitat in the local area surrounding the Proposal area that is affected by these impacts.

The Proposal area is not considered to have high fauna diversity or represent significant feeding or breeding habitat for species other than Black Cockatoos due to the disturbed nature of the

site. It is therefore unlikely to comprise the core habitat for fauna species and permanent displacement of fauna from the area associated with establishing the Proposal is unlikely to impact a significant number of species or individuals.

The surrounding area is considered likely to have higher fauna diversity and density due to the higher quality of the habitat. However the presence of nearby industries (Cristal Titanium Dioxide Plant, Kemerton Silicon Smelter, Kemerton Waste Water Treatment Plant and the Tesla Peaking Power Station), with the same or greater associated impacts, is likely to impact use of the surrounding habitat by native fauna. It is considered that, to some degree, local fauna are already accustomed to these impacts. They may therefore not be affected by the increase in the emissions attributable to the Albemarle Kemerton Plant.

There are more than 1,431 ha of DBCA managed lands within the KSIA Buffer Zone surrounding the Industrial Core. These areas support native vegetation where fauna can find habitat/refuge if displaced from the Proposal area or surrounds. A number of ecological studies of the buffer have found that these areas provide high quality breeding and foraging habitat for Black Cockatoos and other conservation significant fauna.

Increase in introduced fauna species

As previously discussed, water storage facilities (ponds) will be established within the Proposal area to store process water (and saline brine reject from process water treatment) for supply to the Albemarle Kemerton Plant. The process water supply will be a mix of good quality 'fresh' water, and treated recycled water from the Kemerton Waste Water Treatment Plant, and will therefore be an attractant to fauna, particularly introduced species such as feral cats and foxes. Introduced fauna may also be attracted to the area due to availability of food in the municipal waste stream from the site. There is potential for an increase in the population of introduced fauna (notably feral cats and foxes) if they are able to gain access to water sources and municipal waste within the Proposal area. An increase in introduced fauna is likely to lead to a corresponding decrease in native fauna in the surrounding area as they are prey for some introduced species. Restricting access to water and food sources is key to preventing this impact from occurring.

5.6 Mitigation

The following sections discuss the mitigation measures that will be or have been implemented in order of the mitigation hierarchy of avoid, minimise and rehabilitate to address potential impacts to terrestrial fauna.

Proposed mitigation measures, are also discussed in Section 3.2 of the Albemarle Kemerton Plant EMP (GHD 2017a) which was submitted with the s38 referral of the Project to the EPA.

Albemarle will develop a Construction Environmental Management Plan (CEMP) which includes all mitigation measures which are relevant to the construction of the Project to ensure contractors responsible for construction are obliged to comply with the measures discussed. The CEMP will comply with the EMP (GHD 2017a).

5.6.1 Avoid

The Albemarle Kemerton Plant site is required to be cleared of vegetation to establish the necessary infrastructure for the Plant. Direct impacts to fauna habitat are therefore unavoidable within the Proposal area. Rather, as described in section 4.6.1, Albemarle has primarily avoided impacts to fauna habitat through the site selection process undertaken when deciding on the location for the Plant. Mitigation measures will also be employed to avoid direct and indirect impacts to fauna habitat outside the Proposal area and fauna present within and adjacent to the Proposal area.

The key measures to avoid potential impacts to terrestrial fauna associated with the Proposal are summarised in Table 5-4.

Table 5-4 Mitigation measures to avoid terrestrial fauna impacts

Potential impact	Mitigation Measures to Avoid Impact
Fauna habitat loss due to clearing	<ul style="list-style-type: none"> Avoidance of significant fauna habitat (Black Cockatoo) within an initial 257 ha lease option boundary through implementation of a Site selection process. <p>Within the lease option boundary for the Albemarle Kemerton Plant a 12 ha area referred to as the 'Banksia Block' was excluded from consideration for the plant site due to the block supporting:</p> <ul style="list-style-type: none"> High value native vegetation foraging habitat for conservation significant Black Cockatoo species; High value native vegetation breeding habitat for conservation significant Black Cockatoo species; and Potential breeding trees with DBH >500 mm and hollows >100 mm. <p>Following this an east and west option was identified for further consideration. This option was subject to further ecological assessment to confirm the site avoided areas of higher ecological value. Further explanation of the site selection process, and ecological values which have been avoided through this process, is included in the following section (Site Selection).</p> <ul style="list-style-type: none"> Avoidance of potential Black Cockatoo breeding trees with hollows through modification of the proposed site boundary. The initial site boundary was redefined within the north east corner when the proposed boundary included potential breeding trees, including two with large hollows that had potential chew marks (GHD 2017b). Restrictions will be in place to limit vehicles to driving only on designated tracks or within the Proposal area to avoid impacts to vegetation outside the site boundary
Death, injury or displacement of native fauna species	<ul style="list-style-type: none"> Prior to the commencement of clearing, the area will be searched for native fauna. Any fauna found will be relocated into the neighbouring vegetation. Lighting of fires is prohibited.
Fragmentation of fauna habitat within the KSIA (local area)	<ul style="list-style-type: none"> Fragmentation has been avoided through the site selection process. Clearing this site will not fragment existing blocks of remnant vegetation.

Potential impact	Mitigation Measures to Avoid Impact
Degradation of fauna habitat in proximity to the Proposal area due to impact from known threats such as <i>Phytophthora cinnamomi</i> and weeds	<ul style="list-style-type: none"> Vegetation and soil collected during site clearing will be stockpiled within the Proposal area during clearing, at least 10 m from the site boundary to prevent spread of weeds or pathogens that may be contained.
Increase in introduced fauna species	<ul style="list-style-type: none"> Pets are not allowed on site. There is no onsite disposal of municipal waste.

Site selection

East and west site options were subject to ecological assessment by Eco Logical Australia (2017a, Appendix A) which encompassed a desktop review of ecological studies undertaken in the KSIA, supported by a site visit for ground truthing purposes. The assessment identified the east site as likely to have the lesser impact on Black Cockatoo species of the two options.

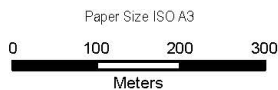
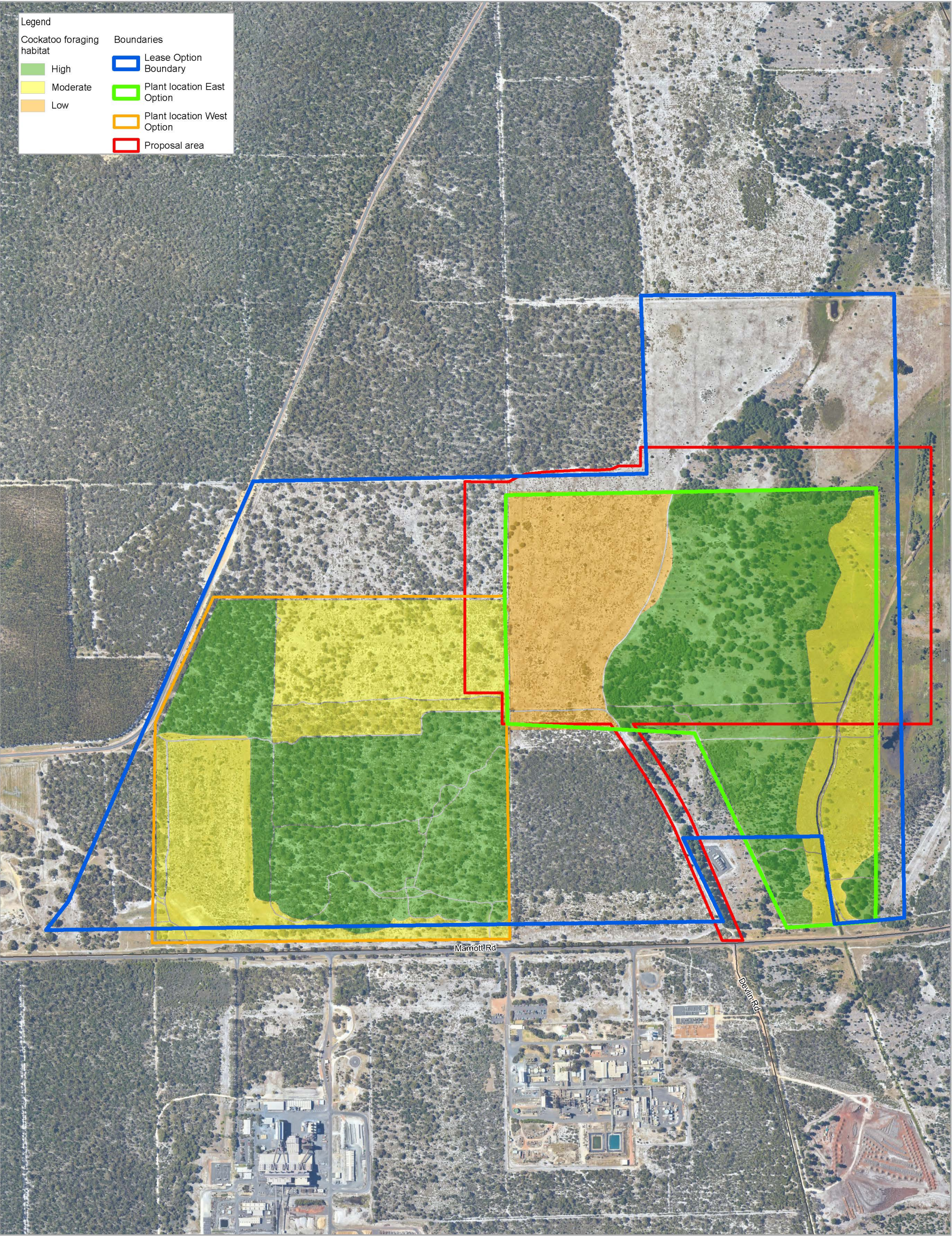
The west option site comprises almost entirely remnant vegetation of mostly 'Very Good' to 'Good' condition and has significantly less disturbance area than the preferred east option. The remnant vegetation includes many preferred native species for Black Cockatoo foraging and breeding habitat. It also contains numerous potential breeding trees. Conversely the east option contains limited native vegetation species suitable for foraging with foraging habitat primarily comprising pine plantation. At the time of the assessment the area did not contain potential breeding trees. The final Proposal area expanded from the original east option concept boundary and a subsequent assessment within the north west corner of the Proposal area identified the presence of a single potential breeding tree without hollows (GHD 2017b).

Additionally, approximately 81% of the west option contains vegetation representative of the 'Banksia Woodlands of the SCP' TEC in mostly Very Good to Good condition. This vegetation community is recognised as suitable foraging habitat for Black Cockatoos. The east option contains 2.5% of 'Banksia Woodlands of the SCP' in Very Good condition. The final Proposal area was modified from the original concept for the east option with the final Proposal area containing 7.14% vegetation representative of the 'Banksia Woodlands of the SCP' TEC in mostly Good condition, which is still significantly less than the west option.

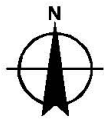
The east option avoids the numerous potential breeding trees and large area of suitable native vegetation foraging habitat, which is denser and in better condition within the west option.

In summary, the western option, was not selected as the fauna habitat within the area is of greater value for Black Cockatoo foraging and breeding than that within the east option. The habitat has had significantly less impact from agricultural and plantation land use and is in better condition and of higher density than the east option. It also predominantly comprises vegetation representative of the 'Banksia Woodlands of the SCP' TEC which is a recognised foraging habitat for Black Cockatoos. The cockatoo foraging and breeding habitats within the east and west site options are illustrated in Figure 5-3 and Figure 5-4.

The Proposal area boundary was also modified from its original planned extent to avoid the majority of the potential breeding trees, including two with hollows, which were identified within the original boundary within the area surveyed by GHD (2017b).



Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

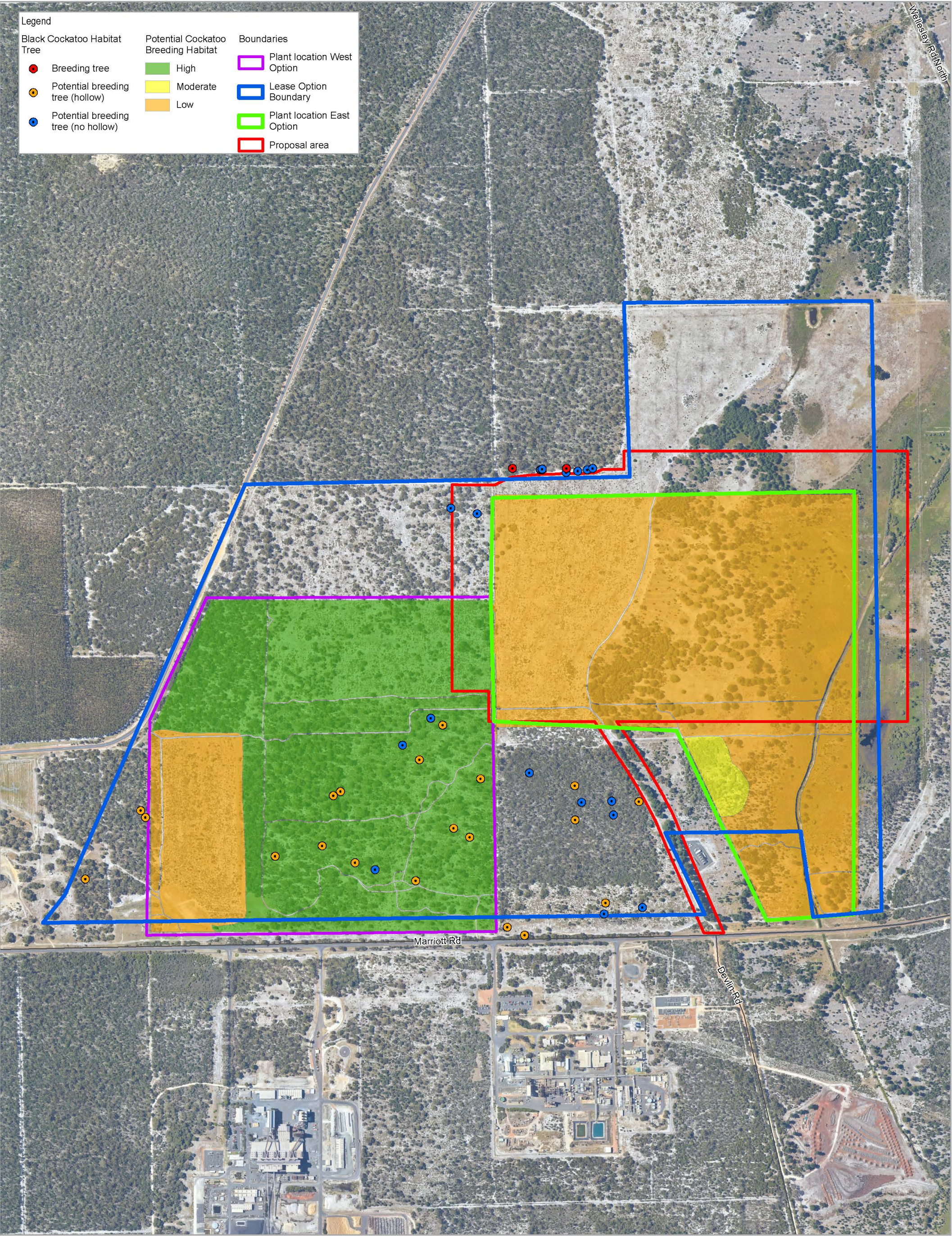


Albemarle Lithium Pty Ltd
Albemarle Kemerton Plant

**East and West Plant Location Options
Cockatoo Foraging Habitat**

Project No. 61-36286
Revision No. A
Date 24/10/2017

FIGURE 5-3



Paper Size ISO A3
0 100 200 300
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Albemarle Lithium Pty Ltd
Albemarle Kemerton Plant

Project No. 61-36286
Revision No. B
Date 24/10/2017

East and West Plant Location Options
Cockatoo Potential Breeding Habitat

FIGURE 5-4

5.6.2 Minimise

The key measures to minimise potential impacts to terrestrial fauna associated with the Proposal are summarised in Table 5-5.

Table 5-5 Mitigation measures to minimise terrestrial fauna impacts

Potential impact	Mitigation Measures to Minimise Impact
Fauna habitat loss due to clearing	<ul style="list-style-type: none"> The western corridor of the site proposed for clearing, which comprises 5.94 ha of TEC considered to be of high value as Black Cockatoo habitat (Moderately dense <i>Eucalyptus marginata</i>/<i>Corymbia calophylla</i> woodland with <i>Banksia attenuata</i>), is designated as a construction activity area only, and is not required for the operational site. This area will only be cleared if necessary for construction. Albemarle is committed to avoid clearing of this unless necessary for construction. The overall clearing within the Proposal area may therefore be smaller than proposed, reducing the area of Black Cockatoo habitat cleared, if it is not required for construction. Implementation of a Land Clearing Procedure to minimise the risk of accidental clearing of fauna habitats (including potential breeding trees) outside the Proposal area. All staff and contractors undertaking land clearing will be inducted on the requirements of the procedure. The procedure will include the following requirements. <ul style="list-style-type: none"> An authorised internal clearing permit must be issued prior to undertaking any vegetation clearing. Clear demarcation of all clearing boundaries. Checks to confirm clearing boundaries are demarcated and correct prior to undertaking clearing. Daily inspection of cleared areas to confirm clearing has occurred within the designated clearing boundary. Survey of cleared areas post clearing to confirm boundaries have been adhered to. Adherence to the site hygiene procedure to prevent weed and <i>Phytophthora cinnamomi</i> introduction or spread to fauna habitat outside the Proposal area. Demarcation of potential breeding trees which have been identified in within 10 m of the Proposal boundary (with physical barriers between the site boundary and the trees if necessary). A spotter will be used when clearing in proximity of potential habitat trees to ensure they are not impacted. Potential breeding trees with hollows will be checked prior to clearing to confirm hollows are not in use.

Potential impact	Mitigation Measures to Minimise Impact
	<ul style="list-style-type: none"> – Stockpiling of all soil and vegetative materials from clearing will be within the Proposal area extents to avoid impacting areas outside the Proposal area boundary
Indirect fauna habitat loss	<ul style="list-style-type: none"> • The site drainage features are designed to direct water flows around the site, to prevent ponding which could impact on potential Black Cockatoo habitat in proximity to the Proposal area. The natural topography also assists in draining water in an easterly direction. • Uncontaminated site runoff will be captured to prevent sedimentation and flooding of surrounding vegetation. A northern and southern perimeter drain will be established which will capture runoff and direct flow, via gravity, to two infiltration basins at the eastern boundary of the site. (Refer to the site Preliminary Water Management Plan, RPS 2018 in Appendix B for further details on water management) • Lighting of all fires within, and in proximity to the Proposal area will be banned and Shire restrictions in relation to fires and vehicle movement bans will be communicated to all employees and strictly adhered to minimise the risk of igniting a bushfire which could potentially lead to widespread loss of fauna habitat and fauna mortalities
Fragmentation of fauna habitat within the KSIA (local area)	<ul style="list-style-type: none"> • Minimised through undertaking a site selection process (described in section 5.6.1) to identify a site location which maximises inclusion of previously cleared areas.
Death, injury or displacement of native fauna species	<ul style="list-style-type: none"> • Native fauna injuries or mortalities will be recorded and reported internally and to appropriate regulatory agencies where required • Wherever practical land clearing will be undertaken on one front only in a direction which provides an opportunity for fauna to escape the clearing area to surrounding vegetation • Where trenches are established (i.e for pipelines or services) which native fauna are unable to escape from, they will be inspected by a “fauna spotter” on a regular basis (i.e. dawn, midday and prior to sunset) who will remove any entrapped fauna to surrounding • If trenches are left open overnight, ramps will be established to permit native fauna to escape • The site will be fenced (for the operational phase of the project) to prevent native fauna species gaining access to water storages on the site where they could become trapped. • Water storage facilities will have appropriate fauna egress to enable any fauna which may gain access to the water storage to escape from the facility.

Potential impact	Mitigation Measures to Minimise Impact
	<ul style="list-style-type: none"> The site induction will include education on the potential impacts to fauna and inform inductees of the following requirements: <ul style="list-style-type: none"> Stop works in the vicinity of any injured or shocked animals that are encountered to allow them to escape or be attended to if required. Feeding of animals is prohibited on the site. Signage will be placed within proximity to potential breeding trees with hollows to indicate Black Cockatoos may be present. Vehicle speeds will be restricted to 25 km/hr within the site. Native fauna injured as a result of construction or operation of the project will be taken to a designated veterinary clinic or a DBCA nominated wildlife carer. If native fauna is disturbed during clearing it should be allowed to make its own way to adjacent vegetated areas Shire restrictions in relation to fires and vehicle movement bans will be communicated to all employees and strictly adhered to minimise the risk of igniting a bushfire which could potentially lead to widespread loss of fauna habitat and fauna mortalities
Degradation of fauna habitat in proximity to the Proposal area due to impact from known threats such as <i>Phytophthora cinnamomi</i> and weeds	<ul style="list-style-type: none"> A site hygiene procedure will be implemented throughout to construction stage of the Project which will require: <ul style="list-style-type: none"> all vehicles and machinery entering the site to be cleaned before arrival and presented for inspection to confirm they are free from soil and vegetative material. No offsite driving unless on designated roads. No bringing of plant or soil material to site unless approved for a specific purpose. Weed control (spraying) will be conducted if new weed infestation are observed within or in proximity to the Proposal boundary. Permission will be sought from the landowner (Landcorp) before undertaking any control program outside the Proposal area.
Disturbance and displacement of fauna due to noise, light, dust and vibration	<ul style="list-style-type: none"> Dust suppression will be implemented and vehicles will obey site speed limits of 25 km/hr to minimise the likelihood of dust impacts to fauna Where possible, lighting will be designed to direct light flood within the Proposal area rather than toward external areas. Some lighting be require to flood on external areas for safety reasons such as at public road access points.

Potential impact	Mitigation Measures to Minimise Impact
	<ul style="list-style-type: none"> Noisy plant is identified during design of the plant and will be enclosed within sound proofing so noise levels do not exceed 85 dBA at a distance of 1 m from the equipment. Machinery will be selected and operational practices adopted that will produce the lowest practical level of noise and vibration Anti-vibration supports and interconnections will be used where required to minimise vibration associated with the Plant.
Increase in introduced fauna species	<ul style="list-style-type: none"> Feral animal control programs will be undertaken if required. The site will be fenced (for the operational phase of the project) to prevent introduced fauna gaining access to site site to access water storages Municipal waste will be stored within covered/lidded bins to prevent scavenging by introduced fauna.

5.6.3 Rehabilitate

Rehabilitation of fauna habitat will be encompassed within the strategy for rehabilitation of native vegetation presented in section 4.6.3. The Proposal area will not be available for rehabilitation until the end of the Plant's life, which is predicted to be 25 years or more. Small construction activity areas, and part of the services and site access corridor may be available for rehabilitation when construction activity is completed. Should these areas become available they will be rehabilitated as described in the section 4.6.3. Albemarle recognises that the trees species preferred for Black Cockatoo foraging and breeding will take a significant period of time post rehabilitation to reach a condition suitable for use therefore any rehabilitated area is likely to have a time lag until it can be categorised as suitable habitat for Black Cockatoos.

5.7 Predicted outcome

With the implementation of the mitigation and management measures described the Proposal is predicted to have the following residual impacts to terrestrial fauna:

- Permanent loss of a total footprint area of up to 62.63 ha of vegetation suitable for foraging by threatened Black Cockatoo species. Based on a calculation of canopy cover, the true area of available habitat for foraging within the 62.63 ha can be reduced to 45.73 ha. 14.45 ha of this area has been categorised as having value as potential breeding habitat. Of this 6.55 ha is considered to have moderate to high value as potential breeding habitat.
- Permanent loss of one potential breeding tree (Jarrah) which does not contain a hollow.

The Proposal will avoid direct impact to potential breeding trees with hollows located to the north of the Proposal area, which have evidence of past use, through alteration of the proposed site boundary at this location to avoid the trees. A site selection process was undertaken to avoid better quality foraging and breeding habitat in the surrounding area.

Suitable foraging habitat for Black Cockatoo's is available within the Shire of Harvey and the Proposal may reduce the overall area of habitat by less than 0.06% within the Shire. The loss of Black Cockatoo habitat is therefore not considered to be significant within a local context,

however, the loss is considered to be potentially significant due to the conservation status of Black Cockatoos. In order to meet the EPA objective of maintaining biological diversity and ecological integrity Albemarle proposes to provide an appropriate offset to counterbalance the impact of the clearing of 45.73 ha of suitable Black Cockatoo foraging habitat. The proposed offset strategy is discussed further in Chapter 7.

Through the implementation of the mitigation and management measures described, and implementation of an appropriate offset, Albemarle considers that the Proposal can meet the EPA objective for this factor.

6. Terrestrial Environmental Quality

6.1 Objective

To maintain the quality of land and soils so that environmental values are protected.

6.2 Policy and Guidance

Legislation, policy and guidance materials relevant to this proposal for Terrestrial Environmental Quality are listed below.

- Environmental Factor Guideline Terrestrial Environmental Quality (EPA 2016f)
- *Dangerous Goods Safety Act 2004* and associated Regulations 2007
- *Contaminated Sites Act 2003* and associated Regulations 2006
- *Environmental Protection (Controlled Waste) Regulations 2004*
- *Environmental Protection (Unauthorised Discharges) Regulations 2004*
- Department of Environment Regulation Identification and investigation of acid sulfate soils and acidic landscapes Guideline 2015
- Department of Environment Regulation Treatment and management of soil and water in the acid sulfate soil landscapes Guideline 2015
- Department of Environment and Conservation Landfill Waste Classification and Waste Definitions 2009
- *Waste Avoidance and Resource Recovery Act 2007*

6.3 Receiving Environment

6.3.1 Geology

The underlying regional geology of the KSIA is described as comprising superficial sands resting on the Leederville Formation which overlies the Yarragadee Formation or the Cattamarra Coal Measures. The Leederville Formation consists of sandstone, siltstone and shale and extends across most of the Swan Coastal Plain. The formation is divided into an upper sandy section and a lower section which is predominantly shale. The Yarragadee Formation underlies the Leederville formation in the southern part of the KSIA and consists predominantly of sandstone. The Cattamarra Coal Measure lies unconformably beneath the Leederville formation in the central to northern areas of the KSIA and underlies the Yarragadee Formation in the south. The formation consists of weakly cemented quartz sandstone and weakly consolidated siltstone and shale (Markovic 2015).

6.3.2 Soil Landscape and Landuse

The Proposal area occurs within the Swan Province and primarily intersects the Bassendean dune and sandplain system with a small area intersecting the Spearwood dune and sandplain system. The Bassendean system is described as comprising, Pleistocene sand dunes with very low relief, leached grey siliceous sand, intervening sandy and clayey swamps and gently undulating plains (Barnesby *et al.* 1994). The Bassendean system is immediately west of, and partly overlies, the Pinjarra Plain. Four soil landscapes occur within the Proposal area (Table 6-1). Galt (2018a) undertook a geotechnical and acid sulfate soils site investigation of the Proposal area which found that the typical soil profile across the Proposal area is in line with the soil landscape mapping. The typical profile of the Proposal area comprises Bassendean sand with lenses of fine grained clayey soil. A thin cemented sand layer (referred to as Coffee Rock) is present near the groundwater level.

Table 6-1 Soil landscape mapping units of the Proposal area (Barnesby et al. 1994)

Soil Landscape Mapping Unit	Description	Location and extent within the Proposal Area
Spearwood dune and sandplain system		
211Sp__S2c Phase	'Lower slopes (1-5%) of dune ridge with well drained bleached or pale sands with a yellow-brown or pale brown subsoil. Usually occurs on the eastern edge of the Spearwood Dunes.	Minor area (1.5%) in the north west corner of the Proposal Area
Bassendean dune and sandplain system		
212Bs_B1a Phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.	Western side of the Proposal Area 35%
212Bs_B3a Phase	Broad depression and narrow swales between sand ridges with moderately deep to deep, poor to very poorly drained grey and brown sands, with an iron-organic (or siliceous) hardpan at generally less than one metre.	Eastern side of the Proposal Area (32.5%)
212Bs_B6 Phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	Central part of the Proposal Area including the service corridor (31%)

The Proposal area is characterised by very low relief and comprises both upland and low lying areas. The topography of the site gently slopes in a south-easterly direction from around RL 13 m AHD, to the low lying multiple use sumpland in the south east corner of the Proposal area (RL 11 m AHD). This is with the exception of a north-south running dune ridge at the western boundary of the Proposal area which rises to approximately RL 18 m AHD (Galt 2018a).

The Proposal area supports native and plantation vegetation, as well as cleared areas (e.g. previously cleared farmland, plantations), sumplands and a drain. Grazing and forestry use has impacted the terrestrial environment of the Proposal area.

6.3.3 Acid Sulfate Soils

Acid Sulfate Soils (ASS) Risk Mapping for the Kemerton area indicates that the majority of the KSIA has a “moderate to low risk” of ASS within 3 m of natural soil surface (ELA 2015). Isolated areas of “high to moderate risk” of ASS within 3 m of natural soil surface occur across the KSIA which are typically associated with wetland areas. Peaty sand deposits can also occur within swamps and wetlands.

Both ASS risk categories occur within the Proposal area (Figure 6-1). The eastern part of the Proposal area is a higher risk area, being classified as “high to moderate risk”. This area coincides with multiple use sumplands present within the Proposal area. The western part of the Proposal area has a “moderate to low risk” for ASS. The Galt (2018a) geotechnical and ASS investigation found that actual acid sulfate soils (AASS) and potential acid sulfate soils (PASS) (together classified as ASS) are present within the Proposal area. Soils which have been classified as AASS or PASS, due to net acidity exceeding the action criteria of 0.03% sulphur, include; the topsoil and sand beneath the groundwater table within the eastern half of the premises, cemented sand (or coffee rock) at or below the groundwater table across the site, and sand with low plasticity fines variably present across the site. No significant areas of peaty soils were identified during the study (Galt 2018a).

6.3.4 Contaminated Land

There are currently no registered contaminated sites within the Proposal area. The closest registered contaminated site is located at the Cristal Titanium Dioxide Plant approximately 550 m south of the Proposal area. There are no other registered sites within 5 km. A preliminary site investigation was commissioned by Albemarle and undertaken in November 2017 by Galt Environmental. The investigation found that soil at the site is unlikely to present a risk to human health or the environment. Soil analysis results complied with the adopted assessment criteria or were below the Limit of Reporting (LOR) (Galt 2018b).

6.3.5 Tailings Characterisation

When the Plant is operating at full capacity, up to 1 million tonnes of tailings will be produced per annum. The tailings are comprised of aluminosilicates, approximately 15% gypsum, residual salts and approximately 30% water.

Characterisation of the tailings was undertaken by Ramboll (2017), and compared to the Department of Environment and Conservation (DEC) Landfill Waste Classification and Waste Definitions 2009 (DEC Waste Classification Guideline), in order to demonstrate their suitability for storage within a designated cell at a Class III landfill. Characterisation was undertaken of a tailings sample from a similar Plant in China, which processes the same spodumene ore concentrate, from the Talison Greenbushes Operation, as will be supplied to the Plant. The elemental composition of the tailings was assessed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and X-ray Diffraction / X-ray Fluorescence (XRD/XRF). All elements assessed met the contaminant threshold criteria for Class I landfill, specified in Table 3 of the DEC Waste Classification Guideline, with the exception of Beryllium, Cadmium, Lead, Mercury and Nickel which were within or exceeded the Class III contaminant threshold (Ramboll 2017).

Leachable concentrations were determined in accordance with US EPA (2012) Leaching Environmental Assessment Framework (LEAF) (Method 1313) for those elements exceeding Class I contaminant threshold criteria, and lithium for which there is no Australian criteria. The results of the assessment found that under relatively neutral and acidic (pH 4.93) conditions the leachable concentrations remain within the leachable concentration limits for a Class 1 landfill specified in Table 4 of the DEC Waste Classification Guideline (Ramboll 2017).

There are no WA waste classification concentrations for lithium. In the absence of any WA criteria, guidelines from other jurisdictions were considered. The New Zealand Ministry for Environment Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification (NZ MfE 2004) guideline value of 20 mg/L leachable concentration of lithium was selected as a proposed interim concentration limit. Leachable concentrations of lithium from the tailings were found to be within this interim concentration limit under neutral and acidic (pH 4.93) conditions. The waste characterisation results are included in Appendix C.

6.4 Potential impacts to Terrestrial Environmental Quality

Implementation of the Proposal could potentially impact on the terrestrial environmental quality within the Proposal area and immediate surrounds, along transport routes and at waste disposal locations. Contamination of terrestrial environmental quality within these areas could potentially occur as a consequence of:

- Disturbance of PASS leading to oxidation of contained iron sulphides to produce sulfuric acid and iron compounds which can leach iron and other heavy metals contained in the soils to the surrounding terrestrial environment (DER 2015a).
- Accidental release of environmentally hazardous substances (reagents, hydrocarbons, spodumene ore concentrate, processing fluids and slurries, products (Lithium Hydroxide

Product and Sodium Sulfate By-product) and tailings) from storage or handling areas or infrastructure.

- Process dust emissions (Spodumene ore concentrate, tailings, Lithium Hydroxide Product or Sodium Sulfate By-product).
- Contaminated stormwater or process water discharge to the environment via seepage or loss of containment.
- Emission of Spodumene ore concentrate, tailings, Lithium Hydroxide Product, Sodium Sulfate By-product or reagents during transport due to leaks, spillage or dust generation.
- The disposal of municipal and industrial wastes and storage of tailings.

In addition to the impacts listed, establishment of long term permanent infrastructure could also potentially cause impairment of soil function within the Proposal area.

6.5 Assessment of Impacts

Disturbance of ASS causing contamination of soils

PASS are naturally occurring soils containing iron sulphides, which are harmless when left in an undisturbed state. When exposed to air through excavation or dewatering, the contained iron sulphides can oxidise to produce sulfuric acid and iron compounds. The acid can leach metals contained in the soils to the surrounding environment (DER 2015a). Excavation works within areas containing PASS can expose PASS to oxygen and lead to the associated release of acid and heavy metals which can contaminate the terrestrial environment (soils), groundwater and surface water environments.

Disturbance of ASS will occur during land clearing, topsoil removal, cut-to-fill earthworks and establishment of a diversion for an existing agricultural drain occur. Albemarle has identified the soils which are classified as ASS within the Proposal area as being the topsoil and sand beneath the groundwater table within the eastern half of the premises, cemented sand (or coffee rock) at or below the groundwater table across the site, and sand with low plasticity fines variably present across the site (Galt 2018a). Identification allows for appropriate management to be applied to the disturbance and handling of these soils to prevent oxidation and subsequent contamination of the terrestrial environment from occurring. A nominal 100 mm of topsoil and organic peaty material will be removed during vegetation clearing which will require treatment in accordance with an Acid Sulfate Soils Management Plant (ASSMP). Once treated, the material will either be removed from site for disposal to an appropriately licensed facility, or if suitable, will be blended with clean sand to produce a suitable structural fill for road subgrade and bulk fill (Galt 2018a).

Soils identified as ASS which will be disturbed during site development works will be neutralised through application of a neutralising agent. The purpose of this is to neutralise any acid generated as a result of oxidation of the soil, and prevent the release of iron and other metals from the soil profile. Galt (2018a) determined neutralisation rates for soils classified as ASS which are outlined in Table 6-2. Neutralisation rates were estimated using the formula outlined in the Department of Environment Regulation (DER) (2015) *Treatment and Management of Soil and Water In Acid Sulfate Soil Landscapes* guideline document.

Table 6-2 ASS neutralisation rates for Albemarle Kemerton Plant Project Area (Galt 2018a)

Soil type	Presence	Maximum Net Acidity (%S)	Neutralisation Rate (kg/tonne)
Topsoil	Eastern portion of site	0.07	8.7
Sand below the groundwater table	Eastern portion of site	0.5	62.4
Cemented sand at or below the groundwater table	Across site	0.59	73.7
Sand with low plasticity fines	Across site	0.06	7.5

Cut-to-fill earthworks will be undertaken to establish a base foundation for the Project infrastructure. The KSIA Approved Structure Plan (Raymond 2017) requires a minimum separation distance of at least 1.5 m between the infrastructure foundation and the Annual Average Maximum Groundwater Level (AAMGL) in accordance with water sensitive urban design principles. The cut-to-fill earthworks design has been based around this separation requirement. The highest design elevation of the constructed site foundation at the western boundary will nominally be RL 14.8 m AHD, which will slope toward nominally RL 13.05 m AHD at the eastern boundary.

Excavation of soils to achieve the cut-to-fill requirements will only occur in the western half of the Proposal area, which is up to 5 m higher than the eastern part along the western ridgeline. The ASS risk in this area is low to medium however the Galt 2018a investigation identified the presence coffee rock below the groundwater table, and sand with low plasticity fines throughout the site which have been classified as ASS. As soil units classified as ASS have been defined across the site they can be appropriately identified and treated to prevent ASS impacts from occurring

Site development also requires the diversion of an existing agricultural drain which runs diagonally through the south east corner of the Proposal area. The location of the drain and planned diversion route are illustrated in Figure 6-1. Details on the function of the drain were described in the Albemarle Kemerton Plant Environmental Referral Supporting Report (GHD 2017). The drain requires diversion prior to undertaking cut-to-fill earthworks to ensure its function is retained, and that backfilling in this area will not cause any flooding upstream. It occurs within an area where ASS presence has been confirmed (Galt 2018a). Diversion works will therefore result in disturbance and exposure of ASS

Soils excavated from the drain are likely to oxidise upon excavation from the diversion and exposure to oxygen to release sulfuric acid, iron compounds and metals if appropriate mitigation is not implemented. There is the added risk of the quality of groundwater and surface water flowing into the diverted drain becoming impacted as a result of contact with potentially oxidised ASS within the drain, and subsequent acidification of the water. This potential contamination of groundwater and surface water may:

- impact downstream water quality within the drain,
- have secondary impacts on vegetation supported by the drain and surrounding soils, and
- impact water quality of the Wellesley River, if the drain diversion is not appropriately managed.

An ASSMP is under development which will detail a neutralisation strategy for the drain diversion to prevent water within the drain being impacted. Strategies within the ASSMP are being developed in accordance with appropriate management measures outlined in DER

guideline *Treatment and Management of Soil and Water In Acid Sulfate Soil Landscapes* (2015).

Release of environmentally hazardous substances from storage or handling areas or infrastructure causing contamination of soils

Direct contamination of soils and land could occur as a result of releases of hazardous materials (such as hydrocarbons, chemicals and reagents) from storage or handling areas, or infrastructure. Storage of hazardous materials during the initial construction period will be limited to temporary storage areas holding small quantities of oils and grease for maintenance, and fuel supply for heavy equipment and temporary power generators. Refuelling of larger equipment and generators will occur on Site but preference will be given to off-Site refuelling for general vehicles, where practical, to limit storage and handling volumes on the Site. Due to the limited scale of hazardous material storage during the construction phase, releases are expected to be small if they occur and potential contamination will be localised in nature, and restricted to the surface of the soil profile. The depth of localised contamination could increase beyond the soil surface if releases are not rectified in a timely manner.

Direct contamination of soils or land could occur if reagents, hydrocarbons or process materials, fluids or slurries are released from storage or handling areas, or infrastructure. Storage and handling of all reagents, hydrocarbons and process materials, fluids or slurries will be undertaken within appropriately sized secondary containment therefore direct release to soils or land is unlikely to occur. Reagent storage facilities will be established in accordance with the *Dangerous Goods Safety Act 2004* and associated Regulations as well as relevant Australian Standards for the design of storage tanks and secondary containment (bunding). Storage volumes are not significant therefore in the event a discharge does occur, it is unlikely to be released beyond the Proposal area and any impacts would remain localised. A summary of proposed reagent storage volumes for the Proposal is shown in Table 6-3.

Table 6-3 Proposed reagent storage volumes for Albemarle Kemerton Plant

Reagent	Storage volume m ³
Limestone	1,370
Quicklime	350
Sulphuric Acid 98%	4,080
Caustic 50% solution	3,150
Diesel	110

Process dust emissions causing contamination of soils

Soil contamination resulting from Spodumene ore concentrate, tailings, Lithium Hydroxide Product or Sodium Sulfate By-product dust is not expected to occur within the proximity of the Proposal area due to the dust control measures that will be applied to the Plant. There are no open storage areas for dust generating materials within the Proposal area. Handling, transfer and storage of dust generating materials will be undertaken within covered storage or conveyor systems. Dust extraction systems, will also be implemented, for some storage and handling areas. The level of dust emissions is unlikely to be significant enough to cause contamination within the Proposal area or surrounding soils or land. Further details on dust management are included in section 4.8 of the Albemarle Kemerton Plant Environmental Referral Supporting Report (GHD 2017).

Contaminated stormwater or process water discharge to the environment via seepage or loss of containment causing contamination of soils

Soils could potentially be contaminated if contaminated stormwater or process water is in contact with soils as a result of seepage, or release from a storage facility. No storage of potentially contaminated stormwater will occur within the site. Rather, all plant areas and reagents will be sited within concrete bunds. Stormwater from the bunded areas will drain to an internal sump and pumped directly back into the process. Stormwater occurring outside bunded areas will remain uncontaminated and therefore not impact on the terrestrial environment.

The drainage/topography of the site foundation has been designed to direct uncontaminated run-off from non-plant areas (offices, roads, open areas) to northern and southern perimeter drains which will transport water to infiltration basins. Water from the basins will be allowed to infiltrate to groundwater. This is in line with the requirements of the KSIA Overarching Water Management Strategy (OWMS) (RPS 2016). A Preliminary Water Management Plan has been developed which outlines how the requirements of the OWMS are met by the site drainage design. The Preliminary Water Management Plan is included in Appendix B.

Brine reject from process water desalinisation will require storage prior to being evaporated on cooling kilns. Storage of brine could potentially cause salinization of soils if released through seepage or loss of containment. Brine reject will be stored temporarily within a lined pond. Through appropriate sized design, lining and water level alarms on the brine storage pond the risk of release and associated soil contamination is considered to be low.

Contamination of soils along transport routes due to spillage, leaks or dust emissions from transport vehicles

Soils along the transport routes could potentially become contaminated with lithium or other metals found in spodumene ore concentrate, tailings, Lithium Hydroxide Product or Sodium Sulfate By-product if these materials are released during transport operations due to spillage, leaks or dust emissions. Lithium Hydroxide Product and Sodium Sulfate By-product will be packaged into sealed lined bags within enclosed shipping containers and therefore is not expected to leak, spill from trucks except possibly in the case of a major traffic event such as a truck rollover. Leaks or spills could potentially occur from reagent, concentrate or tailings transport trucks however this is considered to occur infrequently, most likely due to a traffic incident. Transport companies are required to have an effective emergency response plan and emergency response trailer to respond to incidents involving leaks or major releases within a timely manner. Any tailings, concentrate or product spilt would be returned to the Plant. This Project will have multiple truck movements and therefore the frequency of vehicles on the various routes provides the opportunity for drivers to identify any spills or leakages that may occur on a daily basis. This frequency of movement creates the opportunity for any incidents to be responded too quickly. Contamination resulting from direct spillage of transported materials will therefore be temporary in nature.

Due to the regional extent of trucking operations for this Proposal, dust emissions from transported materials have the potential to cause cumulative contamination on a regional scale if not appropriately managed. Dust emissions from transported materials will be prevented from occurring by appropriate containment or control. Lithium Hydroxide Product and Sodium Sulfate By-product will be packaged into sealed lined bags within enclosed shipping containers. Spodumene ore concentrate delivery trucks will have covered trailers. Tailings have a moisture content of approximately 30% and therefore are not expected to be dust generating. However, if this is not the case, due to drying of the tailings at the surface, covers will be used on these trucks. Dust emissions from transported materials are therefore not expected to occur.

Impairment of soil function due to establishment of long term permanent infrastructure

The majority of the 89.25 ha Proposal area will be covered by concrete bund infrastructure, buildings or will be a compacted soil profile. This will result in impairment of soil function within the majority of the Proposal area for the duration of the Project (at least 25 years). It is unlikely that soil function would be retained if topsoil was collected and stockpiled from the Proposal area, due to the length of time it would be stockpiled. Therefore topsoil collection is not planned for this Proposal. At the completion of the Project, soils will be rehabilitated in-situ following removal of all infrastructure (if the site is being rehabilitated to native vegetation). It is expected that soil function would return to the Proposal area over time once all infrastructure has been removed.

Disposal of municipal and industrial wastes and storage of tailings causing contamination of soils

Potential impacts to terrestrial environmental quality associated with the disposal of municipal and industrial wastes (with the exception of sewage) and storage of tailings will not occur within the Proposal area as alternate offsite locations will be utilised for waste disposal and long term storage. The KSIA is not suitable for waste disposal or long term storage due to the sandy nature of the soils within the area, the high water table and wetlands which are down gradient from the primary development area (Industrial Core). Waste disposal and storage is also not in line with the zoning of the Industrial Core, which is zoned for Industrial purposes.

The only waste treatment which will occur within the Proposal area, is for sewage as there is no reticulated sewage within the KSIA. Sewage disposal will therefore occur within the Proposal area. Appropriately, sized and designed septic systems, approved by the Executive Director, Public Health and certified to Australian Standard (AS) 1546.1 will be installed at the premises for the containment and treatment of sewage. Minor impact to terrestrial environmental quality, in the form of increased nutrients in the immediate vicinity of these systems, could potentially occur but can be minimised if appropriately sized treatment systems are installed which are regularly pumped out.

All general municipal and industrial wastes will be recycled where possible (or where there is an option to, returned to the supplier) or disposed to an appropriately licensed waste management facility within the surrounding area. Tailings will be contained at the Plant awaiting transport, via truck, to a Class III landfill facility for deposition into a dedicated storage cell/s. The landfill owner/operator will seek all necessary approvals for storage of tailings at the landfill. Further details on the options for tailings from the Project are discussed in section 6.6.4. Potential impacts to terrestrial environmental quality will therefore be applicable to the selected disposal locations for the municipal and industrial wastes and tailings from the Plant.

6.6 Mitigation

The following sections discuss the mitigation measures that will be, or have been implemented in order of the mitigation hierarchy of avoid, minimise and rehabilitate to address potential impacts to terrestrial environmental quality.

Proposed mitigation measures, are also discussed in Section 3.3 of the Albemarle Kemerton Plant EMP (GHD 2017a) which was submitted with the s38 referral of the Project to the EPA.

Albemarle will develop a Construction Environmental Management Plan (CEMP) which includes all mitigation measures which are relevant to the construction of the Project to ensure contractors responsible for construction are obliged to comply with the measures discussed. The CEMP will comply with the EMP (GHD 2017a).

- Minimise dust emissions through the following:

- Covered storage or silos for storing all dust forming materials,
- Sealed packaging of Lithium Hydroxide Product and Sodium Sulfate By-product,
- Dust forming materials will have dust extraction on transfer and delivery points and will be transferred via enclosed or covered conveyors outside buildings.
- All materials handling and transfers will occur either within covered storage or conveyor systems.
- Avoidance of soil contamination due to environmentally hazardous material releases through inclusion of level monitoring linked to alarms, and chemically resistant secondary containment at reagent storages

6.6.1 Avoid

The key measures to avoid potential impacts to terrestrial environmental quality associated with the Proposal are summarised in Table 6-4.

Table 6-4 Mitigation measures to avoid terrestrial environmental quality impacts

Potential impact	Mitigation Measures to Avoid Impact
Disturbance of ASS causing contamination of soils	<ul style="list-style-type: none"> • A site investigation for the presence and extent of ASS has been undertaken (Galt 2018a). Further detailed investigation of the presence and extent of ASS will be undertaken to support the initial study and determine appropriate strategies to prevent ASS impacts from occurring to enable an ASSMP to be developed prior to disturbance commencing.
Release of environmentally hazardous substances from storage or handling areas, or infrastructure causing contamination of soils	<ul style="list-style-type: none"> • The Project will have an approval process and register for all potentially hazardous substances to ensure checks are in place to confirm there are appropriate storage facilities on site prior to bringing new potentially hazardous substances to site • Releases of environmentally hazardous substances will be avoided through storage of all bulk chemicals and hydrocarbons within appropriately designed storage tanks which meet the relevant Australian Standard for the substance stored and relevant requirements of the <i>Dangerous Goods Safety Act 2004</i> and associated regulations. • Releases of environmentally hazardous substances will be avoided through storage and handling of all chemicals, hydrocarbons and process materials, fluids or slurries within appropriately designed secondary containment bunding (concrete bunding) designed in accordance with the <i>Dangerous Goods Safety Act 2004</i> and associated regulations where applicable and relevant Australian Standards for storage within containment infrastructure (AS 3780-2008 for Class 8 substances, and AS 1940:2017, although others may also apply) • All reagent or hydrocarbon delivery points will be located within a kerbed, concrete delivery apron or the containment

Potential impact	Mitigation Measures to Avoid Impact
	<p>bund for the storage tank to capture any spillage which may occur during transfer.</p> <ul style="list-style-type: none"> Equipment and vehicle servicing and refuelling will be undertaken within designated bunded servicing and refuelling areas designed to capture any spillages.
Contamination of soils or land along transport routes due to spillage, leaks or dust emissions from transport vehicles	<ul style="list-style-type: none"> Any open trailers transporting dust generating materials such as Spodumene ore concentrate will use covers to prevent dust emissions. Lithium Hydroxide Product and Sodium Sulfate By-Product will be packaged within sealed bags which will be loaded into sea containers for transport to prevent dust emissions.
Process dust emissions causing contamination of soils	<ul style="list-style-type: none"> Lithium Hydroxide Product and Sodium Sulfate By-Product will be packaged within sealed bags and stored within a warehouse. Tailings will comprise approximately 30% water and will therefore not be dust generating.
Contaminated stormwater or process water discharge to the environment via seepage or loss of containment causing contamination of soils	<ul style="list-style-type: none"> No storage of contaminated stormwater avoiding the risk of loss of containment from storage. Stormwater from plant areas will be collected in a concrete bunded area which is graded to a collection sump so contained potentially contaminated stormwater can be returned to the process for reuse. Saline Brine reject will be stored within a double HDPE lined pond to prevent seepage. The Saline Brine reject storage pond will have high level alarms through the site PCS to quickly respond to high levels prior to a release occurring. Design and construction of the storage infrastructure (ponds) to the relevant Australian Standard requirements
Disposal of municipal and industrial wastes and storage of tailings	<ul style="list-style-type: none"> All wastes and tailings will be transported to licensed offsite landfill, recycling or controlled waste disposal facilities avoiding associated impacts to terrestrial environmental quality within the Proposal area. Further details on the application of the Waste Hierarchy to the Project to identify alternative waste options that avoid disposal are included in section 6.6.4.

6.6.3 Minimise

The key measures to minimise potential impacts to terrestrial environmental quality associated with the Proposal are summarised in Table 6-5.

Table 6-5 Mitigation measures to minimise terrestrial environmental quality impacts

Potential impact	Mitigation Measures to Minimise Impact
Disturbance of ASS causing contamination of soils	<ul style="list-style-type: none"> • Prior to disturbance occurring an ASSMP will be developed and implemented in accordance with the DER Guideline <i>"Treatment and management of soil and water in the acid sulfate soil landscapes 2015"</i> • It is likely the ASSMP will include a combination of treatment methods which may include (Galt 2018a): <ul style="list-style-type: none"> – application of aglime across the surface of the site using an agricultural spreader (or similar) and in-situ mixing with surficial soils; – stockpiling of ASS material on a crushed limestone pad and mechanical mixing using an excavator, loader or similar; and – mixing of ASS material and neutralising agent using a pugmill • The ASSMP will also include specific mitigation measures for prevent ASS impacts as a result of the diversion of the existing agricultural drain.
Release of environmentally hazardous substances from storage or handling areas, or infrastructure causing contamination of soils	<ul style="list-style-type: none"> • Tanks storing reagents, hydrocarbons or process materials, fluids or slurries will have alarmed level monitoring linked to the Plant Control System to enable low levels which may indicate a release, or high levels which may pre-empt an overflow to be identified and responded to in a timely manner. • Albemarle will conduct regular inspections chemical and hydrocarbon storage, servicing and refuelling infrastructure as part of the site inspection program to identify any concerns in regards to containment or integrity of the infrastructure. • Releases of environmentally hazardous substances will be managed in accordance with a Spill Response Procedure
Contamination of soils or land along transport routes due to spillage, leaks or dust emissions from transport vehicles	<ul style="list-style-type: none"> • Transport operators will have effective emergency response plans and capability to respond to major and minor releases of trucked materials.

Potential impact	Mitigation Measures to Minimise Impact
Process dust emissions causing contamination of soils	<ul style="list-style-type: none"> Dust minimisation has been considered in the design of the Albemarle Kemerton Plant <p>The design includes:</p> <ul style="list-style-type: none"> Covered storage or silos for storing all dust forming materials Conveyors transferring dust forming materials outside of buildings will be enclosed or covered. The Plant will have dust extraction controls (such as scrubbers and bag filters) to remove dust from air streams prior to emission to atmosphere for key process infrastructure including the Calciner, ball mill, roast kiln, roast cooler, and product dryers. The dust extraction systems are described in further detail in Chapter 4.8 of the Environmental Referral Supporting Document (GHD 2017) Packaging of Lithium Hydroxide Product and Sodium Sulfate By-product will be undertaken within contained warehouses
Contaminated stormwater or process water discharge to the environment via seepage or loss of containment causing contamination of soils	<p>The Saline Brine reject storage pond will have a geonet mesh in between two layers of HDPE lining for leak detection (electrical conductivity based) to ensure leaks are identified in a timely manner minimising the timeframe for loss of contained water.</p> <p>Albemarle will conduct regular inspections of water storage infrastructure (at least once per shift) to confirm its integrity and assess water levels.</p>
Disposal of municipal and industrial wastes and storage of tailings	<ul style="list-style-type: none"> Albemarle will minimise the generation of wastes which require disposal (and therefore may impact terrestrial environmental quality at the disposal location) through implementing a site recycling program which will aim to recycle as much municipal and industrial wastes as possible depending on availability of suitable facilities to accept the wastes. Where there is an option, wastes from the provision of goods will be returned to the relevant goods supplier for recycling or reuse. Appropriately, sized and designed septic systems, approved by the Executive Director, Public Health and certified to Australian Standard (AS) 1546.1 will be used for the treatment of sewage to minimise the likelihood of nutrient contamination associated with sewage treatment Septic systems will be regularly pumped out and transported to a licensed liquid waste disposal facility to minimise the likelihood of nutrient contamination associated with sewage treatment

6.6.4 Rehabilitate/Remediate

The key measures to rehabilitate potential impacts to terrestrial environmental quality associated with the Proposal are summarised in Table 6-6.

Table 6-6 Mitigation measures to rehabilitate/remediate terrestrial environmental quality impacts

Potential impact	Mitigation Measures to Rehabilitate Impact
Disturbance of ASS causing contamination of soils	<p>In the event that contamination of soils occurs as a result of ASS disturbance Albemarle will implement measures to remediate the affected area. The ASSMP will include detail of relevant strategies which can be implemented to remediate an area if contamination occurs as a result of oxidation of ASS.</p>
Release of environmentally hazardous substances from storage or handling areas, or infrastructure causing contamination of soils	<p>In the event that spillage of environmentally hazardous substances occurs, the affected area will be remediated to remove/treat contamination as soon as possible. If reporting of the spill is required under the <i>Contaminated Sites Act 2003</i> and associated Regulations this will be undertaken as soon as possible.</p> <p>At the end of the Project life an assessment of soils (Preliminary or Detailed site investigation) will be undertaken to determine whether any residual contamination is present which requires remediation.</p> <p>If soils are found to require remediation a program will be implemented in accordance with the <i>DER Assessment and management of contaminated sites guideline 2014</i>.</p>
Contamination of soils or land along transport routes due to spillage, leaks or dust emissions from transport vehicles	<p>In the event that spillage or leakage of environmentally hazardous substances occurs along the transport route, the affected area will be remediated to remove/treat contamination as soon as possible. If reporting of the spill is required under the <i>Contaminated Sites Act 2003</i> and associated Regulations this will be undertaken as soon as possible.</p>
Contaminated stormwater or process water discharge to the environment via seepage or loss of containment causing contamination of soils	<p>In the event that soils become salinised or contaminated due to release of contaminated stormwater or process water the affected area will be remediated as soon as possible.</p>
Impairment of soil function due to establishment of a permanent constructed surface	<p>At the end of the Project life soils within the Proposal area will be rehabilitated in-situ following removal of all infrastructure (if the site is being rehabilitated to native vegetation). It is expected that soil function would return to the Proposal area over time after the infrastructure has been removed.</p>

6.6.5 Application of the Waste Hierarchy to Mitigate Tailings Management Impacts

A waste hierarchy that ranks waste management options in order of their general environmental desirability is set out in the Western Australian *Waste Avoidance and Resource Recovery Act 2007* (WARR Act). The objectives of the WARR Act are to contribute to sustainability, and the protection of human health and the environment, in WA and the move towards a waste free society by:

- promoting the most efficient use of resources, including resource recovery and waste avoidance;
- reducing environmental harm, including pollution, through waste; and
- the consideration of resource management options against the following hierarchy:
 - avoidance of unnecessary resource consumption;
 - resource recovery (including reuse, reprocessing, recycling, and energy recovery); and
 - disposal.

The Waste Authority, established under the WARR Act, develops and reviews the Waste Strategy for WA. The Waste Authority prepared a “Communication on the Waste Hierarchy” document (GoWA 2013) which explains the waste hierarchy and how it is applied in the decision making in delivering the Waste Strategy. The Waste Strategy, which is currently out for consultation (GoWA 2017), is based on the circular economy concept to achieve economic growth whilst producing no or minimal waste. The circular economy builds on the principles in the waste hierarchy of prioritising the options for the efficient use of resources.

The Albemarle Kemerton Plant Proposal comprises construction of five process trains which will each produce approximately 20,000 tonnes per annum (tpa) of high quality Lithium Hydroxide Product to be used in the manufacture of batteries. Each train will also produce approximately 40,000 tpa of Sodium Sulfate which will be sold as a by-product. The process trains will receive high grade (approximately 6% lithium) Spodumene Ore Concentrate feed. Processing of the Spodumene Ore Concentrate will produce a tailings stream comprising aluminosilicates, gypsum, residual salts and approximately 30% water. The tailings are produced at an approximate ratio of 10:1 tailings to Lithium Hydroxide Product. The process trains will be constructed in two stages, the first stage consisting of construction and operation of three process trains, and the second stage consisting of construction and operation of a further two process trains. The forecast schedule of tailings production for the Project based on the Project staging is illustrated in Figure 6-2.

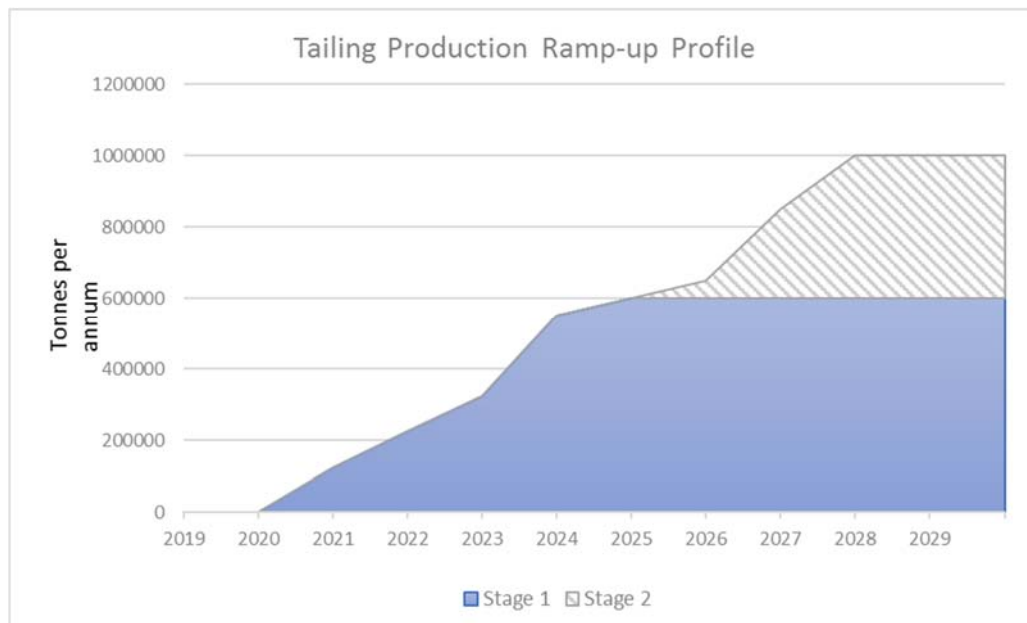


Figure 6-2 Albemarle Kemerton Plant Tailings Production Forecast

As per the details in section 6.3.5, Albemarle has conservatively categorised the tailings from the Plant as a Class III waste type in order to consider what options are available for the tailings produced by the Albemarle Kemerton Plant. This has been based on analysis of tailings samples from one of Albemarle’s Chinese Plants which processes the same Spodumene Ore Concentrate feed from the Talison Mine that the Albemarle Kemerton Plant will receive. In order to obtain the specific characterisation of the tailings which will be produced by the Albemarle Kemerton Plant, the actual tailings produced by the Plant will also need to be tested and assessed when the plant is operational.

Waste Hierarchy Application

The waste hierarchy ranks avoidance as the most preferred option with various recovery options (reuse, reprocessing, recycling, energy recovery) being the next preferred options to disposal as the least preferred. Other considerations such as environmental, economic and social must be considered whilst applying the waste hierarchy in assessments and decision making. Albemarle has applied the waste hierarchy and principles of waste management to their Proposal to establish a Lithium Hydroxide production plant within the KSIA in order to demonstrate options available for residual tailings produced by the plant. The application of the hierarchy is discussed in the following sections.

Avoidance

The highest point in the waste hierarchy is Avoidance, or the prevention or minimising the generation of waste (GoWA 2013). One approach to avoidance is improving the efficiency of production processes, which Albemarle has maximised. Elements of the Proposal which minimise, and therefore avoid, tailings generation are discussed in Table 6-7.

Table 6-7 Waste Avoidance considerations

Waste Avoidance Options/Considerations	Application to the Albemarle Plant
Use of high grade spodumene ore concentrate	The Albemarle process is based on using the highest grade of Spodumene ore concentrate that is available. Use of the highest grade feed results in the lowest volume of tailings production per tonnes of Lithium Hydroxide Product produced. The Greenbushes deposit is recognised as one of the world's highest grade spodumene ore bodies in the world.
Efficient process method and design to maximise lithium recovery and minimise production of tailings	The process design selected for the project achieves a minimum 92% lithium recovery from the Spodumene ore concentrate. The process design has been developed over many years, is demonstrated in Albemarle operating plants and is the best level of efficiency that Albemarle has identified. Optimal recovery also results in the lowest concentration of residual Lithium in tailings. Alternative process technologies are available that are less Capital intensive but they achieve recoveries of only 50% - 60% of contained lithium.
Tailings dewatering to maximise water recovery and minimise production of tailings	The tailings recovery process within the Plant uses high efficiency vacuum filtration technology to maximise the moisture recovery from the tailings slurry resulting in a reduced quantity of tailings produced in comparison to less efficient technology, and maximum water recovery for reuse.

Recovery

Recovery relates to recovering materials that may otherwise be disposed as waste. There are four key recovery options as set out in the waste hierarchy; Reuse, Reprocessing, Recycling and Energy Recovery (GoWA 2013).

Reuse is the most preferred form of recovery as the material is used again (GoWA 2013). For the Albemarle tailings the use of the material for other purposes is considered reuse.

Albemarle is investigating the potential for reuse of the tailings material such as supplemental cementitious material, fill material or other chemical manufacturing uses. The reuse options for the tailings material have been subject to desktop and university studies but to date a demonstrated reuse for the tailings has not been confirmed. Significant research and development is required to test the viability of reuse of the material. Albemarle is continuing to progress these research studies and the longer-term goal is for the reuse of the tailings.

Albemarle is conducting research and development studies in the USA and China on alternate uses for tailings from our similar operating facilities in China. Studies to date for use as supplementary cementitious material on tailings from their China based Plants also show promise. Further testing and development is needed to confirm this use and Albemarle will continue to pursue incorporating the best technology and practices for tailings at the Albemarle Kemerton Plant. The Kemerton plant design team is working with the global Albemarle operations team to ensure that the best technology and best practices are transferred between their lithium production facilities.

Albemarle is currently conducting additional test work on tailings material from their Chinese Plants which process the same Talison Spodumene Ore Concentrate feed. Additional US EPA LEAF testing has been commissioned by Albemarle, the results of which will be used in further research and development studies of longer term alternate reuse options for the tailings

material. Albemarle is committed to continuing to conduct research into alternate uses of tailings from the Lithium Hydroxide production process.

The various reuse options in consideration by Albemarle are discussed in Table 6-8.

Table 6-8 Waste Recovery - Reuse considerations

Recovery - Reuse Options/ Considerations	Application to the Albemarle Kemerton Plant
Concrete Aggregate (supplementary cementitious material) / Manufactured Sand	The tailings requires further testing to AS2758 Aggregate and Rock for Engineering, Part 1 Concrete Aggregates to allow classification of the material as a fine aggregate or manufactured sand. Should the tailings pass the requirements for classification as a manufactured sand/concrete aggregate, then broader marketing of the product to the construction material supply and concrete industries will be undertaken to assess whether a viable market for the product exists. Albemarle intends to progress further testing of tailings material from the Plant once operational to confirm whether the tailings is a marketable product.
	Manufactured sand (tailings) could be substituted up to 30% for river sand, based on published studies using gold and iron ore tailings, to produce a concrete mix conforming to at least the technical requirements for standard strength concrete. Currently, due to the residual contaminant concentrations within the tailings the material does not meet the definition of a Class I –Type 1 waste type in accordance with the DEC Waste Classification Guideline, primarily as the Guideline does not specify limits for lithium content. Tailings is therefore unable to be utilised as manufactured sand. When a regulatory position on limits for lithium content is made, further investigation of this potential use will be undertaken by Albemarle.
	The tailings may be suitable for use as a sand substitute in filling stabilised sand applications in civil earthworks. As per comments above, when a regulatory position on limits for lithium content is made, further investigation of this potential use will be undertaken by Albemarle.
	Another potential application is for shotcrete production. However, the geographical spread for this application and relatively low level of demand limits the opportunity.

Recovery - Reuse Options/ Considerations	Application to the Albemarle Kemerton Plant
Construction fill	<p>Albemarle has considered reuse of tailings material as construction fill. The tailings has been conservatively categorised as a Class III waste type by Albemarle in accordance with the DEC Waste Classification Guideline. If tailings are able to meet the definition of a Class I –Type 1 waste type in accordance with this Guideline they could potentially be reused for construction fill. The DEC Waste Classification Guideline currently lacks definition of limits for lithium content but tailings could potentially be classified as Class I/II once regulatory criteria on lithium is determined. Further investigation of this option will be undertaken by Albemarle when a regulatory position on acceptable lithium concentration for Class I/II/III/IV wastes has been made.</p> <p>Blending of the tailings with suitable clean fill could potentially yield a composite clean fill material below the thresholds for Ecological Investigation Levels (EIL) and Health Investigation Levels (HIL) as adopted by DWER and based on Environmental Investigation Levels listed in the Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC/NHMRC, 1992). Under current guidelines, which do not set lithium criteria, a blended mix of up to 1 parts tailings to 1 part Clean Fill may yield a suitable composite clean fill material. This is however dependant on availability of clean fill for mixing and DWER acceptance of the composite material meeting Class I requirements. This option would also require a large area for mixing and a market demand for the product which has not been identified. It is therefore not currently a viable consideration but will be further investigation through the Project life.</p>
Mine backfill	<p>Should the tailings material be suitably classified as a Class I or II waste it may be suitable for use as mine backfill. This is not considered to be a viable waste reuse however as mines will typically use their own waste or tailings material for backfill at operations where the viable resource has been extracted from the ground. Transport costs, and associated resource consumption for transport are also likely to prohibit this from being a viable reuse option.</p>
Agricultural Soil Conditioner	<p>The tailings contains approximately 15% gypsum and exhibits water retention properties, which may make it suitable as a soil conditioner. Other beneficial properties such as Cation exchange capacity (CEC) require further testing. Albemarle will continue to investigate this option dependant on the appropriate classification of the tailings material to allow application to land.</p>
Brick component	<p>The tailings material may be suitable as a component in brick making. Albemarle will investigate this further however limited local demand, manufacturing capacity and an unknown acceptable rate of substitution might define this as a limited opportunity in the context to the total volume of tailings expected to be produced.</p>

Reprocessing is using material that may become waste during processing or re-processing (GoWA 2013). The reprocessing options considered by Albemarle are discussed in Table 6-9.

Table 6-9 Waste Recovery – Reprocessing considerations

Options/Considerations	Comment
Recovery of other metals from tailings	Other contained metal concentrations fall well below DWER EIL and HIL levels let alone economic cut-off grades for commercial extraction as a by-product. On this basis, this option has been discounted from further consideration

Options/Considerations	Comment
Production of By-products	The process design of the plant includes a process stream to extract Sodium Sulphate (Na ₂ SO ₄). This material can be used for downstream manufacture. Recovery of Na ₂ SO ₄ is an integral part of the Albemarle process. For every tonne of Lithium Hydroxide Product produced up to two tonnes of Sodium Sulfate will be produced as a By-product to be sold. The Lithium Hydroxide Product manufacturing process also generates potassium sulfate which is another by-product that will be on-sold. The quantity of potassium sulfate which will be produced has not been determined at this stage.

Recycling is using recovered waste materials as substitutes for extracted raw materials, or turning recovered waste materials into materials that have a market value (GoWA 2013). The recycling option considered by Albemarle is discussed in Table 6-10.

Table 6-10 Waste Recovery – Recycling considerations

Recovery – Recycling Options/Considerations	Comment
Leachate recovery and reuse	The tailings storage cell (not located within the Proposal area) will be designed for the recovery of any leachate that may be leached from the stored tailings. Any available leachate will be collected and reused as dust suppression on the tailings or returned to the plant for reuse as process water. An additional benefit to this process is that the tailings properties will gradually reduce contaminant levels as a result of leaching improving their potential for Reuse in the future. Residual chemicals within the leachate will also be recovered.

Energy Recovery is the conversion of waste products into some form of energy. Energy recovery is not applicable to the tailings as the waste material is non-combustible and unable to store or emit energy for any known form of energy recovery system.

Disposal

Disposal refers to the discharge of waste to the environment (GoWA 2013). Disposal is at the bottom of the waste management hierarchy and therefore the least preferred option which should only be applied when there is residual waste after consideration of all other options higher within the hierarchy. , Albemarle has considered avoidance and recovery options for tailings from the Albemarle Kemerton Plant however, at this time, has been unable to identify a viable option which can be implemented for the volume of tailings which will be produced by the Plant.

The current Australian market and classification of the tailings material do not provide certainty on the reuse of the material. Therefore, as part of the whole of life management strategy for the Project, Albemarle considers an appropriate and responsible management strategy for the tailings is to include the option of storage of the tailings in a dedicated cell/s at an appropriately licenced facility. This approach provides safe and contained storage of the material, and also allows for its recovery in the event a solution for the material reuse or recycling is developed in the future.

Albemarle will continue to investigate alternative options for tailings waste management throughout the Project life. In the absence of other options, Albemarle proposes to store the tailings within a dedicated landfill storage cell/s at a licensed Class III landfill facility until an alternative viable solution for reuse is identified and authorised. Albemarle has identified a preferred, existing licensed (in accordance with part V of the EP Act) Class III landfill facility for disposal of the tailings. The landfill operator will seek necessary supplementary approvals to authorise acceptance of the tailings at the facility.

The identified landfill is preferred as it meets the following important requirements:

- It has sufficient air space within its existing licence boundary to store the predicted volume of tailings which will be generated over the initial five years of operation of the Plant. Acceptance of the Albemarle tailings will not impede on the capacity of the landfill to accept existing and predicted municipal waste volumes.
- An expansion area has been identified for the landfill which has sufficient capacity to store tailings for 25 years, which will meet the predicted life of the Plant.
- The expansion area can be dedicated to storage of the tailings to separate this activity from municipal waste storage at the existing landfill.
- Access to the expansion area has been acquired.
- The landfill operator has commenced necessary studies to support expansion of the landfill to the identified location. The studies to be undertaken include hydrogeological study, geotechnical study, visual impact assessment, air emissions study, flora and fauna studies, aboriginal heritage study, traffic study and amenity study.
- The existing landfill and expansion area are located within an area which has been designated as a Waste Disposal and Processing precinct within the Local Planning Strategy for the area.
- The landfill is sited in a location considered appropriate for waste disposal and storage as it is:
 - not located on the Swan Coastal Plain;
 - more than 500 m from the nearest rural residences;
 - at least one kilometre from the nearest surface water feature; and
 - The surficial aquifer is approximately 30-40 m below the surface.

Although the landfill will not be under the operational control of Albemarle, the company will ensure the storage of tailings at the chosen facility meets the following requirements prior to receiving the waste in order to minimise the likelihood of impacts to terrestrial environmental quality and other environmental factors:

- The landfill will be licensed for acceptance of Class III waste.
- The landfill EP Act Part V Operating Licence will authorise acceptance of tailings which has the characteristics of the Albemarle tailings as a specific waste type.
- Tailings will be stored within a dedicated tailings storage cell/s to prevent mixing with other wastes and so the tailings will be available to access in their natural state in the event a viable use for the material is identified in the future.
- The tailings storage cell/s will be designed and constructed in line with DWER expectations for Class III landfills. In the absence of published regulatory guidance for landfill design requirements in WA, relevant requirements of the EPA Victoria 2015 Best Practice Environmental Management: Siting, Design, Operation and Rehabilitation of Landfills 788.1 document (Victoria EPA Landfill BEMP) which are applicable to Class III facilities will be applied to the design and construction of the tailings storage cell/s.
- The tailings storage cell/s will have a leachate collection system to recover leachate for reuse for dust suppression or for return to the Albemarle Kemerton Plant for process use.
- The tailing storage cell/s will have an operational management plan which will include appropriate management measures to prevent release of tailings and leachate.

- The tailings storage cell/s will have groundwater monitoring wells and a regular monitoring program to detect any potential leakage from the facility.

Albemarle has not pursued the option of a company owned and operated tailings storage facility within proximity of the KSIA for storage of the tailings. This option has been discounted by Albemarle due to the difficulty in identifying and purchasing an environmentally suitable location for a tailings storage facility. There would also be a long lead time involved in finding and purchasing a suitable location, conducting geotechnical and environmental investigations and obtaining development and environmental approval. The timeframe to develop a company owned and operated facility does not align with the Project schedule. Storage within an existing landfill, in an area which is specified as a Waste Disposal and Processing precinct within the Local Planning Strategy, is therefore viewed by Albemarle as the preferred solution.

6.7 Predicted outcome

With the implementation of the mitigation and management measures described it is predicted the Proposal can avoid and minimise impacts to terrestrial environmental quality associated with the Proposal therefore Albemarle considers that the Proposal can meet the EPA objective for this factor. There is not expected to be any permanent or significant impact on the terrestrial environmental quality resulting from the construction or operation of the Plant as the majority of impacts are short term or localised and can be minimised or avoided through the proposed design features of the plant and on-going management.

Disturbance of ASS, is considered to have the highest risk of impact upon the terrestrial environmental quality in areas outside the Proposal area if appropriate management is not implemented prior to disturbing soils identified as high to moderate risk. Albemarle is committed to developing a site specific ASSMP prior to ground disturbance occurring to identify appropriate mitigation measures which can be implemented to prevent this impact from occurring.

Albemarle is committed to continue to undertake research and development activities designed to identify an alternative solution to management of tailings than the current strategy of landfill storage.

7. Offsets

Environmental offsets are conservation actions which provide environmental benefits intended to counterbalance the significant residual environmental impacts associated with a Proposal (EPA 2014). Offsets differ to mitigation measures in that they are undertaken outside of a Proposal area. They are applicable where a Proposal has a significant residual impact after the hierarchy of mitigation measures (avoid, minimise and rehabilitate) has been applied. Offsets should directly correlate to the impacts of a proposed action.

Albemarle has implemented, or will implement through undertaking of the Proposal, mitigation measures intended to avoid, minimise and rehabilitate (where appropriate) impacts to flora, vegetation and fauna. These measures have been described within Chapters 4 and 5 of this document. Following application of these measures, Albemarle believes the Proposal will have a significant residual impact due to direct impacts to MNES including the 'Banksia Woodlands of the Swan Coastal Plain' TEC (also meets the definition of the Priority 3 'Low lying *Banksia attenuata* woodlands or shrublands' PEC) and threatened Black Cockatoo species habitat (Carnaby's Black Cockatoo (Endangered), Forest Red-tailed Black Cockatoo (Vulnerable) and Baudin's Black Cockatoo (Endangered.) . Albemarle intends to counterbalance this residual impact through implementation of an environmental offset strategy that is relevant and proportionate to the significance of the environmental impact.

Significant residual impacts occur as a result of the removal of MNES through land clearing for the establishment of the Albemarle Kemerton Plant. This includes clearing of:

- Up to 6.37 ha of vegetation representative of the 'Banksia Woodlands of the Swan Coastal Plain' TEC and the 'Low lying *Banksia attenuata* woodlands or shrublands' PEC; and
- Up to 45.73 ha of suitable foraging habitat for EPBC and WC Act listed Black Cockatoo species (Carnaby's Black Cockatoo (Endangered), Forest Red-tailed Black Cockatoo (Vulnerable) and Baudin's Black Cockatoo (Endangered.) which includes a single potential breeding tree greater than 500 mm DBH. The habitat comprises 23.05 ha of habitat considered to be of moderate to high value, and 22.68 ha considered to be of low value.

Direct residual impacts to flora, vegetation, and fauna, which are not considered to be significant, but are none the less associated with the Proposal, include:

- Removal of at least 118 individuals of Priority 4 flora (*Acacia semitrullata*);
- Removal of approximately 14.99 ha of vegetation associated with 'Multiple Use' wetlands areas with little to no ecological value; and
- Reduction of Beard (1979) (vegetation association 1000) and Heddlé *et al.* (1980) (Bassendean complex – central and south) vegetation extents by less than 0.2% of the vegetation extent at the local scale (Shire of Harvey) and 0.06 % at the regional scale (SCP).

These impacts will be a secondary consideration in the development of the offset strategy for the Proposal. The residual impact associated with the vegetation, flora and fauna habitat loss will remain an impact through the 25 years or more, life of the Plant.

7.1 Offset calculation

The DoEE Offset Assessment Guide has been used to assess the quantum of residual impact associated with the Proposal and quantify offset requirements. The values input to the calculator are described in Table 7-1 and Table 7-2.

Prior to using the calculator, an assessment of canopy area within the former pine plantation was undertaken to provide an accurate indication of the potential impact (refer Section 5.5). This involved the use of GIS software to digitise each individual tree canopy or group of tree canopies to exclude cleared areas or areas with no canopy. The results of this assessment are shown in Figure 7-1. Based on this assessment, 16.5 ha of pine canopy will be removed by the Proposal, reducing the total loss of foraging habitat from 62.63 ha to 45.73 ha.

Due to the varying quality of foraging habitat within the Proposal area, the habitat has been divided into two classifications for the purpose of quantifying the quantum of residual impact:

- moderate to high value habitat (23.05 ha) which comprises the canopy of mature pines remaining from the former plantation and denser Jarrah/Marri woodland and forest areas; and
- low value habitat (22.68 ha) comprising isolated trees (*Eucalyptus rudis* and *Pinus sp.*) over grasses.

Calculation of the required offset area was undertaken in two parts based on the differing habitat values (refer to Appendix D). The calculator predicts a residual impact of 9.07 ha associated with the removal of low value foraging habitat and 16.14 ha associated with the removal of moderate to high value foraging habitat. A total area of 105 ha of Black Cockatoo foraging habitat is required to offset 100% of this impact.

An assessment of the 'Banksia Woodlands of the SCP' TEC / 'Low lying *Banksia attenuata* woodlands or shrublands' PEC predicts a residual impact of 3.19 ha associated with the loss of 6.37 ha. An area of 18 ha of Banksia woodland TEC/PEC in Good condition or better could achieve a direct offset of >100% of this impact. The 'Banksia Woodlands of the SCP' TEC is considered to provide suitable breeding and foraging habitat for all three Black Cockatoo species, and is therefore intended to comprise a key component of habitat for the offset site. The proposed offset site comprises 84.26 ha of vegetation which meets the criteria for Banksia Woodlands of the Swan Coastal Plain TEC which is suitable to offset the loss of both 'Banksia Woodlands of the Swan Coastal Plain' TEC, and Black Cockatoo habitat.

The completed offset assessment calculators are included in Appendix D. Based on the calculator output Albemarle anticipates that acquisition of an area containing at least 105 ha of suitable vegetation will achieve a direct offset of >100% of the residual impact associated with land clearing for the Albemarle Kemerton Plant. The offset area selected must comprise suitable habitat for Black Cockatoo species which meets a habitat quality scale of 7, and contain at least 18 ha of vegetation representative of the 'Banksia Woodlands of the SCP' TEC/ 'Low lying *Banksia attenuata* woodlands or shrublands' PEC. The identified potential offset site at Part Lot 509 is approximately 320 ha in total, and has been assessed as containing 117.3 ha of suitable Black Cockatoo habitat, which includes 84.26 ha of vegetation representative of the 'Banksia Woodlands of the SCP' TEC/ 'Low lying *Banksia attenuata* woodlands or shrublands' PEC. The proposed offset site is therefore considered suitable to meet the offset requirement.

Table 7-1 Offset Calculator Input Values for the Albemarle Kemerton Plant (Black Cockatoos)

Attribute	Value	Reasoning
Area of habitat impacted	<p>45.73 ha</p> <p>Comprising:</p> <p>23.05 ha moderate to high quality foraging habitat</p> <p>22.68 ha low quality foraging habitat</p>	<p>The Proposal will result in the loss of:</p> <p>23.05 ha of moderate to high quality foraging habitat which comprises mature pine trees, Jarrah, Marri and Banksia species, which are primary foraging species by Carnaby's, Forest Red-tailed and Baudin's Black Cockatoos (excluding pine).</p> <p>22.68 ha of low quality foraging habitat which comprises isolated foraging trees (<i>Eucalyptus rudis</i> and <i>Pinus sp.</i>) over grasses.</p> <p>The impacted area has limited potential breeding value within only one potential breeding tree >500 mm DBH (no hollow) being recorded and the area of pines (16.5 ha) being unsuitable for breeding.</p>
Vegetation/habitat quality of the impacted area	<p>Moderate to high quality foraging habitat - 7</p> <p>Low quality foraging habitat - 4</p>	<p>It is recognised that the Proposal area has value as foraging habitat for Black Cockatoo species as both Carnaby's and Forest Red-tailed Cockatoo's have been observed foraging within the area (ELA 2017a, GHD 2017b). The quality of the foraging habitat within the Proposal area is variable as a result primarily of previous disturbance of the Site.</p> <p>The area of mature pine canopy and good or better quality Jarrah/Marri woodland and forest areas (23.05 ha) are considered to have moderate to high value as foraging habitat, although it is noted that the pine habitat is only suitable for two of the three Black Cockatoo species impacted (Carnaby's and Forest Red-tailed Cockatoos). The area has been, and continues to be, impacted by grazing, clearing and plantation uses. The density and diversity of foraging species within moderate to high quality foraging habitat of the impact site is typically lower than the offset site due to these impacts. The impact site is considered to be of moderate importance as Black Cockatoo foraging habitat as it occurs within a larger area (4,275 ha) of moderate to high, or high quality foraging habitat within the broader KSIA (<10 km from the Proposal area).</p> <p>The area of low value foraging habitat (22.68 ha) comprises isolated trees (<i>Eucalyptus</i></p>

Attribute	Value	Reasoning
		<p><i>rudis</i> and <i>Pinus sp.</i>) over grasses which has been assessed (ELA 2017a,b,c and GHD 2017) as in completely degraded condition however it is recognised that the isolated trees will have value as foraging habitat, but are not suitable as breeding habitat. By comparison, foraging habitat within the proposed offset area contains a greater density and diversity of tree species which are also suitable as breeding habitat. The isolated pines are also only suitable for two of the Cockatoo species impacted (Carnaby's and Forest Red-tailed Cockatoos).</p> <p>For reference a map of the foraging and breeding habitat value of the KSIA, as assessed at a broad scale by Eco Logical Australia (2013) has been included in Figures 7-2 and 7-3. The location of the Proposal area and Part Lot 509 are highlighted.</p>
Start quality of the offset area	7	<p>The current potential offset site is within Part Lot 509 (Certificate of Title Volume 2649 Folio 98) (Part Lot 509) in the KSIA. Part Lot 509 is approximately 320 ha of which 84.26 ha has been assessed as being representative of the 'Banksia Woodlands of the Swan Coastal Plain' TEC and the 'Low lying <i>Banksia attenuata</i> woodlands or shrublands' PEC, and also suitable for Black Cockatoo foraging. The Banksia woodland contains at least five suitable foraging species. A further 33.05 ha of the Lot is comprised mature Marri woodland and former pine plantation providing high quality foraging habitat. The vegetation is in Good to Very Good condition, with a small area of Excellent condition (Ecoedge 2018).</p> <p>The habitat within the offset area appears to not have been subject to the same level of clearing and grazing impacts. Both canopy and mid storey density and diversity are greater within the offset area than the Proposal area. As it is these strata that contain species utilised by black cockatoos for foraging and potential nesting habitat, vegetation in Part Lot 509 is considered to have the higher habitat value of the two sites.</p> <p>For reference a map of the foraging and breeding habitat value of the KSIA, as assessed at a broad scale by Eco Logical Australia (2013) has been included in Figures 7-2 and 7-3. The</p>

Attribute	Value	Reasoning
		location of the Proposal area and Part Lot 509 are highlighted.
Future Quality without Offset	5	Without an offset, the potential offset site (Part Lot 509) is expected to degrade over time. Current (macropod) grazing levels are impacting floristic diversity and vegetation condition in the area. In some areas pasture grasses and other annuals are well established and will continue to spread. <i>Phytophthora</i> Dieback is present and impacting or has already impacted isolated locations throughout the <i>Banksia</i> woodlands. Feral pigs are also present within the site and have caused physical damage to vegetation and soil structure. (Ecoedge 2018)
Time Horizon Over which loss is averted	20 years	The offset area will be protected in perpetuity (20 years) once the offset area has been vested with the DBCA for conservation purposes (or a conservation covenant placed).
Time until ecological benefit	1	Vegetation within the identified potential offset site is in better condition than that within the Proposal area, achieving an immediate conservation benefit once it has been acquired. A timeframe of one year has been allowed for the time it is anticipated to take to identify, purchase and apply protection to the offset area.
Risk of loss without offset	30%	The University of Queensland 'Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act' (2017) lists the average background vegetation loss for Harvey of ~10%. This has been increased by an additional 20% as the proposed offset location (within the KSIA buffer on freehold land) is not currently included in the conservation estate, and can potentially be developed for non-sensitive private uses or industry, subject to Development Approval. There are no known current Development Approval applications for Part Lot 509 or within the broader KSIA buffer area.
Risk of loss with offset	5%	Minimal risk as it is intended that the offset area will be vested with DBCA for inclusion in the conservation estate to avert the risk of loss in perpetuity (or a conservation covenant will be placed on the site). There is still a slight chance of loss as a result of the potential for natural

Attribute	Value	Reasoning
		disaster impacts (bushfire, severe storm damage) within the area.
Confidence in result	90% confidence that the offset site can be delivered	Albemarle has a high degree of confidence that the proposed offset site can be acquired and protected through vesting with the DBCA or a conservation covenant. Albemarle has commenced consultation with the landowner, LandCorp who has indicated their support for the Proposal. Albemarle has also commenced consultation with the DBCA in regards to vesting the site in the conservation estate (see Table 3-1).
	85% confidence that the quality of the offset site can be maintained (or improved)	Albemarle has a high degree of confidence that the proposed offset area can be sufficiently protected through management to at least maintain, if not improve, the current quality of vegetation and habitat within the offset area. Management measures to protect the offset area from further degradation will be outlined in the Offset Strategy which Albemarle will develop before commencing ground disturbance.

Table 7-2 Offset Calculator Input Values for the Albemarle Kemerton Plant (Banksia Woodlands of the Swan Coastal Plain TEC/ 'Low lying *Banksia attenuata* woodlands or shrublands' PEC)

Attribute	Value	Reasoning
Area of habitat impacted	6.37 ha	Area of vegetation which has been identified as representing 'Banksia Woodlands of the Swan Coastal Plain' TEC and the 'Low lying <i>Banksia attenuata</i> woodlands or shrublands' PEC which will be removed within the Proposal area.
Vegetation quality of the impacted area	5	The vegetation quality of the 'Banksia Woodlands of the Swan Coastal Plain' TEC and the 'Low lying <i>Banksia attenuata</i> woodlands or shrublands' PEC is predominantly in Good condition (97%, refer to Table 4-3). The majority of the area has been subject to previous clearing and grazing impacts and is therefore relatively sparse and with a lower density and diversity of species than found in areas of lower impact. The area of impact occurs within the broader context of the KSIA which contains large areas of vegetation which has been identified through broad scale mapping by ELA 2013 as representative of the 'Low lying <i>Banksia attenuata</i> woodlands or shrublands' PEC.

Attribute	Value	Reasoning
Start quality of the offset area	7	The current potential offset site is Part of Lot 509 in the KSIA. Part Lot 509 is approximately 320 ha of which 84.26 ha has been assessed as being representative of the 'Banksia Woodlands of the Swan Coastal Plain' TEC and the 'Low lying <i>Banksia attenuata</i> woodlands or shrublands' PEC . The vegetation is in Good to Very Good condition and is generally in better condition than that within the Proposal area, achieving an immediate conservation benefit. (Ecoedge 2018). The Banksia woodland area within Part Lot 509 has been assessed as being of a higher quality (Good to Very Good, with a small area of Excellent) than the Proposal area as it appears to not have been subject to the same level of clearing and grazing impacts. Both canopy and mid storey density and diversity are greater within the offset area than the Proposal area. As it is these strata that contain species utilised by black cockatoos for foraging and potential nesting habitat, vegetation in Part Lot 509 is considered to have the higher habitat value of the two sites.
Future Quality without Offset	5	Without an offset, the potential offset site (Part Lot 509) is expected to degrade over time. Current (macropod) grazing levels are impacting floristic diversity and vegetation condition in the area. In some areas pasture grasses and other annuals are well established and will continue to spread. <i>Phytophthora</i> Dieback is present and impacting or has already impacted isolated locations throughout the <i>Banksia</i> woodlands. Feral pigs are also present within the site and have caused physical damage to vegetation and soil structure. (Ecoedge 2018)
Time Horizon Over which loss is averted	20 years	The offset area will be protected in perpetuity (20 years) once the offset area has been vested with the DBCA for conservation purposes (or a conservation covenant placed).
Time until ecological benefit	1	Vegetation within the identified potential offset site is in better condition than that within the Proposal area, achieving an immediate conservation benefit once it has been acquired. A timeframe of one year has been allowed for the time it is anticipated to take to identify, purchase and apply protection to the offset area.
Risk of loss without offset	30%	The University of Queensland 'Guidance for deriving 'Risk of Loss' estimates when evaluating biodiversity offset proposals under the EPBC Act' (2017) lists the average background vegetation loss for Harvey of ~10%. This has been increased by an additional 20%

Attribute	Value	Reasoning
		as the proposed offset location (within the KSIA buffer on freehold land) is not currently included in the conservation estate, and can potentially be developed for non-sensitive private uses or industry, subject to Development Approval. There are no known current Development Approval applications for Lot 509 or within the broader KSIA buffer area.
Risk of loss with offset	5%	Minimal risk as it is intended that the offset area will be vested with DBCA for inclusion in the conservation estate to avert the risk of loss in perpetuity (or a conservation covenant will be placed on the site). There is still a slight chance of loss as a result of the potential for natural disaster impacts (bushfire, severe storm damage) within the area.
Confidence in result	90% confidence that the offset site can be delivered	Albemarle has a high degree of confidence that the proposed offset site can be acquired and protected through vesting with the DBCA or through a conservation covenant. Albemarle has commenced consultation with the landowner, LandCorp who has indicated their support for the Proposal. Albemarle has also commenced consultation with the DBCA in regards to vesting the site in the conservation estate (see Table 3-1).
	85% confidence that the quality of the offset site can be maintained (or improved)	Albemarle has a high degree of confidence that the proposed offset area can be sufficiently protected through management to at least maintain, if not improve, the current quality of vegetation and habitat within the offset area. Management measures to protect the offset area from further degradation will be outlined in the Offset Strategy which Albemarle will develop before commencing ground disturbance.



Legend

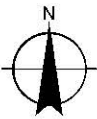
- Former pine plantation
- Pine canopy
- Bare ground
- Proposal area

Paper Size ISO A3

0 20 40 80

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50

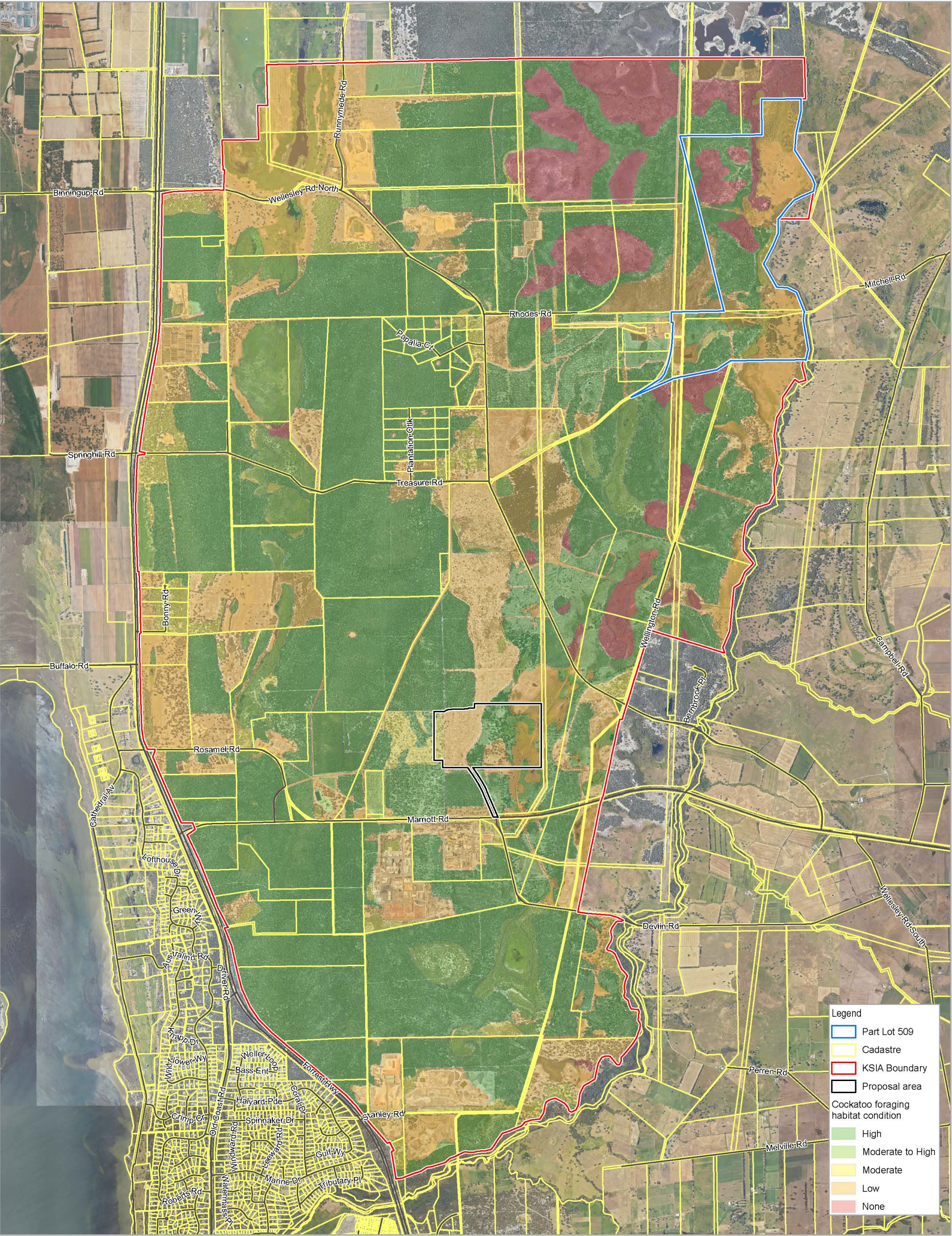


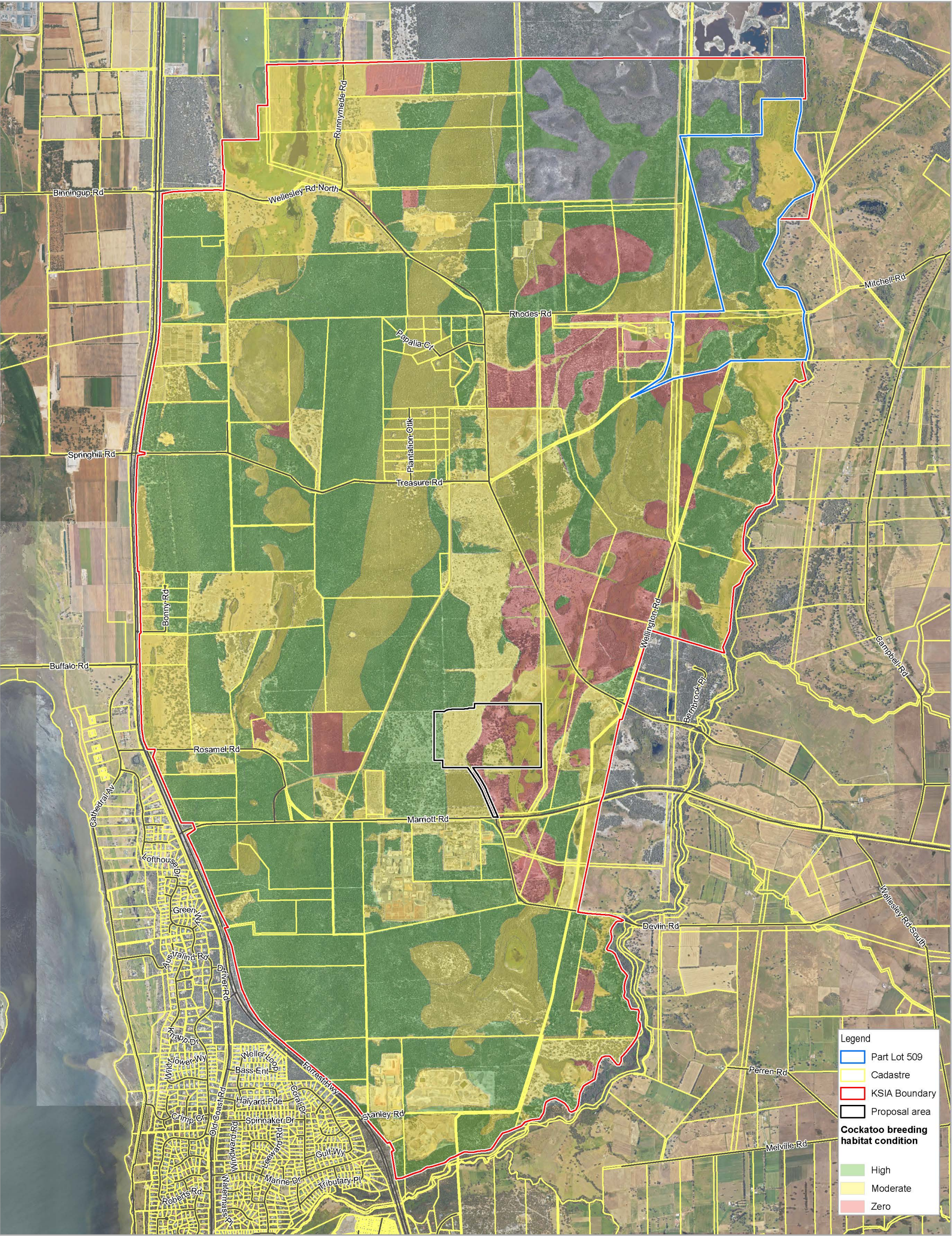
Albemarle Lithium Pty Ltd
Albemarle Kemerton Plant

Project No. 61-36286
Revision No. 0
Date 15/03/2018

Pine plantation canopy coverage

FIGURE 7-1





Paper Size ISO A3
0 250 500 750 1,000
Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 50



Albemarle Lithium Pty Ltd
Albemarle Kemerton Plant

Part Lot 509
Cockatoo Breeding Habitat

Project No. 61-36286
Revision No. A
Date 24/10/2017

FIGURE 7-3

7.2 Proposed offset strategy

Albemarle proposes to implement a direct offset through acquisition of suitable land, containing the required attributes, which will be vested with the DBCA conservation estate. In the event the identified offset site is unable to be vested with DBCA, a conservation covenant will be placed on the land and an alternative landcare group will be identified to manage the offset. A potential offset site has been identified within the KSIA buffer within Lot 509, (Certificate of Title Volume 2649 Folio 98). While the land has not yet been acquired by Albemarle, a preliminary survey was undertaken on 12 and 15 March 2018 to determine the site's suitability as a 'like for like or better' offset for the significant residual impacts of the Proposal, (i.e. whether the Lot contains vegetation representative of 'Banksia Woodlands of the SCP' TEC/ 'Low lying *Banksia attenuata* woodlands or shrublands' PEC and Black Cockatoo foraging (and breeding) habitat which is of the same or better quality than the Proposal area). Results of the preliminary field survey are presented in Section 7.2.1. Based on these results, areas of vegetation within Part Lot 509 are anticipated to qualify as a suitable offset for the Proposal.

Should Part Lot 509 not be secured as the offset site, it is proposed that an alternative offset will be identified, also located within the KSIA buffer area. The primary objective of the KSIA buffer area is to ensure that the impacts of industries located in the KSIA Core Area do not adversely impact on sensitive premises beyond the boundary of the KSIA however it also has recognised value for biodiversity conservation purposes.

Much of the land within the KSIA buffer area (in particular in the western area) is already vested with, and managed by DBCA, for biodiversity conservation purposes. Some of this land was historically transferred to DBCA for conservation management as part of the overall concept for development of the KSIA. Provision of offset areas within the buffer area will increase the biodiversity conservation value of the buffer. In addition, the buffer area is recognised as being part of the McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup Link, a regional ecological linkage which links significant remnant vegetation patches within the south-west region (ELA 2015). Selection of an offset area within the buffer will therefore increase the amount of protected land within this valuable regional linkage.

Albemarle will prepare a detailed offset strategy for the proposed offset area that will consider appropriate management controls to address threats to the 'Banksia Woodlands of the SCP' TEC and Black Cockatoo foraging habitat that have the potential to compromise the value of these areas. The two major threats to the vegetation that were noted during the preliminary field survey were macropod (kangaroo) grazing and *Phytophthora* Dieback disease. Should Part Lot 509 not be secured as the offset site, a similar detailed offset strategy will be prepared for the alternate site. Albemarle intends to develop and submit the offset strategy to the EPA and DoEE prior to commencing ground disturbance within the Proposal area.

The proposed offset strategy has been developed in line with the Principles of the WA Environmental Offsets Policy (GoWA 2011) and the EPBC Act Environmental Offsets Policy (2012). The application of the six principles of the WA Environmental Offsets Policy (2011) to the proposed strategy are summarised in Table 7-3 and the eight principles of the EPBC Act Environmental Offsets Policy (2012) are summarised in Table 7-4. A summary of the proposed offset strategy, as outlined, has been developed in accordance with the WA Offsets Template and provided in Appendix D.

Table 7-3 Application of the WA Offset Policy Principles to the proposed offset strategy

Principle	Application to the Albemarle Kemerton Proposal
Environmental offsets will only be considered after avoidance and mitigation options have been pursued.	Strategies which have been or will be implemented to avoid and mitigate environmental impacts are described in sections 4.6 and 5.6.
Environmental offsets are not appropriate for all projects.	Albemarle believes the Project is environmentally acceptable but has a potentially significant residual impact associated with the loss of MNES. Offsets are considered an appropriate counterbalance to enable the Proposal to meet the EPA's objective for Flora and Vegetation, and Fauna.
Environmental Offsets will be cost effective, as well as relevant and proportionate to the significance of the environmental value being impacted	The current proposed offset site at Part Lot 509 contains 84.26 ha of vegetation that meets the criteria for the ' <i>Banksia</i> Woodlands of the Swan Coastal Plain' TEC/ 'Low lying <i>Banksia attenuata</i> woodlands or shrublands' PEC and qualifies as Black Cockatoo foraging habitat, and a further 33.05 ha of Black Cockatoo foraging habitat comprised of Marri (<i>Corymbia calophylla</i>) woodland or former pine plantation..
Environmental offsets will be based on sound environmental information and knowledge	A preliminary survey of vegetation on Part Lot 509 was carried out in March 2018 by qualified botanists. The survey methodology was specifically designed to assess the vegetation against DOEE's criteria for ' <i>Banksia</i> Woodlands of the Swan Coastal Plain' TEC and Black Cockatoo quality foraging habit. A similar ecological assessment will be undertaken if an alternate site needs to be identified.
Environmental offsets will be applied within a framework of adaptive management.	It is intended that the land identified for offset will be vested with the DBCA conservation estate and managed by DBCA in accordance with their land management practices, which are adapted over time in accordance with developments in environmental knowledge.
Environmental offsets will be focussed on longer term strategic outcomes.	The offset proposal will add to the landholding of DBCA within the KSIA buffer. The offset area will also form part of the McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup Link, a regional ecological linkage which links significant remnant vegetation patches within the south-west region (ELA 2015) therefore increasing the protection of land within this linkage for the foreseeable future.

Table 7-4 Application of the EPBC Act Environmental Offsets Policy
Principles to the proposed offset strategy

Principle	Application to the Albemarle Kemerton Proposal
Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The current proposed offset site at Part Lot 509 contains 84.26 ha of vegetation that meets the criteria for the 'Banksia Woodlands of the Swan Coastal Plain' TEC and qualifies as Black Cockatoo foraging habitat, and a further 33.05 ha of Black Cockatoo foraging habitat comprised of Marri (<i>Corymbia calophylla</i>) woodland or former pine plantation. The vegetation is in Good to Very Good condition (with a small area in Excellent Condition) which is of higher quality overall than the Proposal area.
Suitable offsets must be built around direct offsets but may include other compensatory measures	Albemarle proposes to acquire Part Lot 509 (or part of the Lot) as a direct offset which will be vested with the DBCA, or placed under a conservation covenant. 117.3 ha of vegetation representative of 'Banksia Woodlands of the Swan Coastal Plain' TEC and suitable as Black Cockatoo foraging habitat has been identified within the 320 ha area of Part Lot 509 which would achieve a direct offset of >100% of the residual environmental impacts associated with land clearing for the Albemarle Kemerton Plant.
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	<p>Offsets for impacts on affected MNES have been calculated using the offsets assessment guide which includes International Union for Conservation of Nature data on the probability of annual extinction for different categories of threatened species as a multiplier in the offset calculations (DSEWPac 2012). The higher the level of statutory protection and associated probability of annual extinction the greater the quantum of biodiversity offset required.</p> <p>A calculated offset area of 105 ha of Black Cockatoo habitat, which achieves a habitat quality rating of 7, (and is inclusive of at least 18 ha of Banksia Woodlands TEC) will achieve a direct offset of >100% of the residual impact associated with the clearing of these MNES. The proposed offset area within Part Lot 509 contains 84.26 ha of vegetation that meets the criteria for the 'Banksia Woodlands of the Swan Coastal Plain' TEC and qualifies as Black Cockatoo foraging habitat, and a further 33.05 ha of Black Cockatoo foraging habitat comprised of Marri (<i>Corymbia calophylla</i>) woodland or former pine plantation. This exceeds the calculated offset area required.</p>
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	The proposed offset area will achieve a direct offset of >100% of the residual impact associated with land clearing for the Albemarle Kemerton Plant.
Suitable offsets must effectively account for and manage the risks of the offset not succeeding	Albemarle propose to vest the acquired offset land to DBCA conservation estate in perpetuity (20 years). The area would be managed by DBCA in accordance with their land management practices which are intended to maintain or improve the conservation estate. In the event the offset land is not able to be vested with DBCA it will be placed under conservation covenant and an appropriate landcare group identified to manage the land.

Principle	Application to the Albemarle Kemerton Proposal
Suitable offsets must be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action)	The biodiversity offsets proposed is for the WA and Commonwealth environmental impact assessment of the Albemarle Kemerton Plant and not the result of any other legal requirement that applies to the Proposal.
Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable	<p>A preliminary survey of vegetation on Part Lot 509 was carried out in March 2018 by qualified botanists. The survey methodology was specifically designed to assess the vegetation against DOEE's criteria for '<i>Banksia</i> Woodlands of the Swan Coastal Plain' TEC and Black Cockatoo quality foraging habit. A similar ecological assessment will be undertaken if an alternate site needs to be identified.</p> <p>The offset area requirements have been calculated using the offsets assessment guide and associated guidance. The rational behind the input values to calculate the offset area are described in Table 7-1 and Table 7-2.</p> <p>Albemarle is currently progressing with plans to acquire the offset area from the landholder, LandCorp.</p>
Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	It is intended that land identified for offset will be acquired and vested with the WA conservation estate vested with DBCA. The land would be managed by DBCA in accordance with their land management practices. DBCA management of the conservation estate is undertaken and reported on in accordance with the requirements of the <i>Conservation and Land Management Act 1984</i> .

7.2.1 Preliminary Field Survey of Part Lot 509 Kemerton

The preliminary field survey methodology was designed to provide sufficient information to enable assessment of the vegetation against the '*Banksia* Woodlands of the SCP' TEC / 'Low lying *Banksia attenuata* woodlands or shrublands' PEC qualification criteria as detailed in TSSC (2016). All vegetated areas were assessed on foot using a series of ground traverses. At regular intervals along the traverses, relevé surveys were carried out to record the dominant upperstorey, midstorey and ground layer species and vegetation condition. Vegetation condition was assessed according to the scale of the EPA (EPA 2016d).

Part Lot 509 is approximately 320 ha in area. Of this, around 100 ha is cleared with the remainder comprised of a mix of native wetland and upland vegetation and remnants of a former pine plantation. The field survey resulted in the identification of a total of 84.26 ha of vegetation that meets the criteria for the '*Banksia* Woodlands of the SCP' TEC/ 'Low lying *Banksia attenuata* woodlands or shrublands' PEC and 117.3 ha of Black Cockatoo foraging habitat (Table 7-5). The field survey results are illustrated in Figure 7-4. Based on the results of the preliminary survey, vegetation on Lot 509 qualifies as a 'like for like or better' offset for the Proposal and is sufficiently large (117.3 ha) to cover more than 100% of the residual impact associated with the Proposal.

Further survey may be required in order to identify the sub-community of the 'Banksia Woodlands of the SCP' TEC present for comparison with the sub-community which is removed within the Proposal area.

Table 7-5 Results of the Preliminary Field Survey

Vegetation Type	Area (ha)	Relevant MNES
'Banksia Woodlands of the SCP' TEC	84.26	'Banksia Woodlands of the SCP' TEC, Black Cockatoo foraging habitat
Marri (<i>Corymbia calophylla</i>) Woodlands	25.9	Black Cockatoo foraging habitat
Former Pine plantation	7.15	Black Cockatoo foraging habitat

Images of the vegetation classified as Banksia woodlands and Marri woodlands have been included in Plates 7-1 to 7-3 to illustrate the quality of vegetation and habitat present within the proposed offset area.



Plate 7-1 Example of Banksia woodland within the proposed offset area



Plate 7-2 Example of Banksia woodland within the proposed offset area

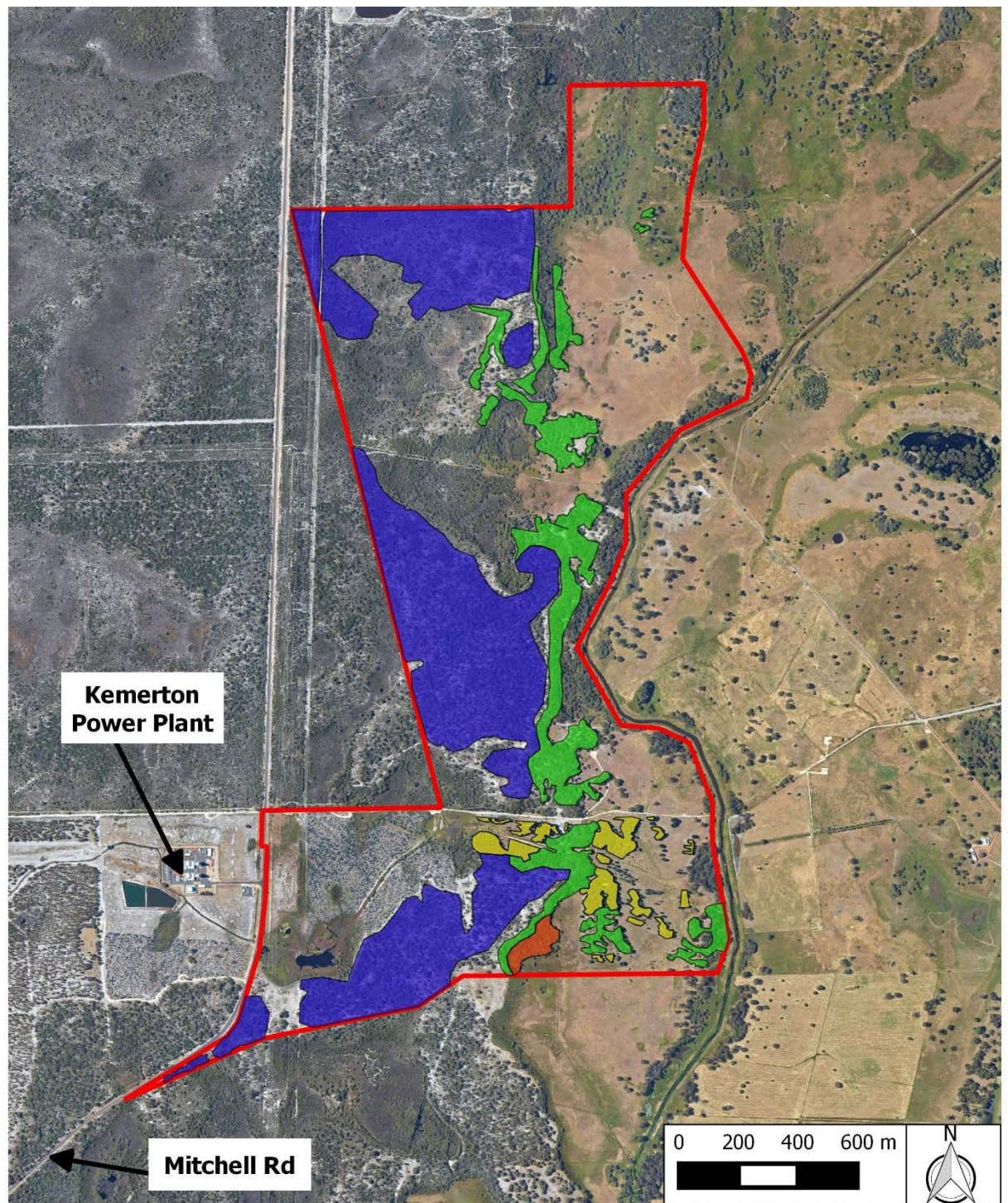


Plate 7-3 Example of Marri woodland within the proposed offset area

Other significant vegetation

In addition to the values mentioned above, during the survey of the southern portion of Part Lot 509 around 20 plants of the Priority 4-listed *Acacia semitrullata* were opportunistically observed. It is likely that more individuals of this species would be located with further survey effort.

Several intact *Melaleuca preissiana* wetlands are also present on site, contiguous with the *Banksia* woodlands. There is also a small *Melaleuca preissiana*-*M. raphiophylla* wetland in Excellent condition near the southern boundary. It is unusual for a wetland of this type to be found in such good condition. By contrast, wetlands within the Proposal area are almost entirely in Completely Degraded condition and offer little to no ecological value (ELA 2017a).



Legend

- | | |
|--|---|
| Study Area | Cadastre |
| Banksia Woodlands TEC | Road Network |
| Cocky Habitat_Marri Woodlands | |
| Cocky Habitat_Pines | |
| Wetland in Excellent condition | |

Lot 509 Kemerton
Potential Albemarle Offset Area
Map drawn 150318 by M. Portman
Aerial imagery provided by Landgate



Figure 7-4 Habitat mapping of Part Lot 509 based on field survey results

8. Matters of National Environmental Significance

8.1 Controlled action provisions

The Proposal was referred to the DoEE on 7 November 2017 as a potential controlled action under the EPBC Act. On 5 January 2018, the DoEE determined the Project to be a 'Controlled Action' requiring approval due to impacts on threatened species and communities (reference number 2017/8099). Specifically the DoEE determined that based on the information provided in the referral, the Project is likely to have a significant impact on the following matters of national environmental significance (MNES):

- Black Cockatoos: the vulnerable Forest Red-tailed Black Cockatoo (*Calyptrorhynchus banksii naso*), the endangered Baudin's Black Cockatoo (*Calyptrorhynchus baudini*) and the endangered Carnaby's Black Cockatoo (*Calyptrorhynchus latirostris*)
- Threatened orchids: the vulnerable Dwarf Bee-orchid (*Diuris micrantha*), the endangered Glossy-leafed Hammer Orchid (*Drakaea elastica*) and the vulnerable Dwarf Hammer-orchid (*Drakaea micrantha*)
- The endangered ecological community *Banksia Woodlands of the Swan Coastal Plain*.

The information presented in this chapter is intended to address the Additional Information for Assessment request sent by the DoEE to the EPA (in accordance with the *Bilateral agreement made under section 45 of the Environment Protection and Biodiversity Conservation Act 1999 (Cth) relating to environmental assessment* [between the] *Commonwealth of Australia and the State of Western Australia*). The information request relates to impacts, mitigation of impacts, and consistency with Recovery and Threat Abatement Plans and Conservation Advice for the MNES listed above. Much of the information requested can also be found within Chapter 4 and 5 of this document.

8.2 Summary of the existing environmental value(s) that relate to the MNES

8.2.1 Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community

Remnant vegetation remaining within the Proposal area has been identified as representative of the 'Banksia Woodlands of the Swan Coastal Plain' TEC which is listed as Endangered under the EPBC Act (ELA 2017a, b, c; GHD 2017d). Field surveys identified two vegetation communities that are representative of this TEC, and meet the key diagnostic characteristics of the community, as described in Table 8-1.

Vegetation community EmKgMr is intersected by the proposed access and services corridor on entry from Marriott Road and entry into the proposed Plant Site. Vegetation community EmCcXb is intersected by the proposed western construction corridor. Vegetation representative of this TEC is also known to occur within the densely vegetated 'Banksia block' and the western extent of the lease option boundary (ELA 2017a, b, c; GHD 2017b).

Table 8-1 Extent of Banksia Woodlands of the SCP TEC within Proposal area

Condition rating	Vegetation type	Extent (ha) (%)
Good/Completely Degraded/Excellent	EmKgMr	0.42* (0.47%) – 0.1 ha is Completely Degraded, 0.09 ha is Excellent**, 0.24 is in Good condition.
Good	EmCcXb	5.94 (6.66%)
Total		6.37 (6.46%)

* Vegetation community EmKgMr is part of a patch size of approximately 12 ha ('Banksia Block')

** Vegetation mapped as Excellent occurred during broad scale mapping undertaken by ELA (2017b). When considered on a finer scale, this vegetation is more representative of vegetation association XbEc in Good condition.

The following vegetation communities have been identified adjacent to the Proposal area that are also representative of this TEC:

- *Corymbia calophylla* open woodland over *Banksia* spp. and *Melaleuca preissiana* low open woodland over *Kunzea glabrescens* and *Xanthorrhoea brunonis* open shrubland over *Dasypogon bromeliifolius* (CcBaKgXb) (1.06 ha)
- *Eucalyptus marginata* subsp. *marginata*, *Agonis flexuosa* and *Banksia attenuata* woodland over mixed sparse shrubland over *Dasypogon bromeliifolius* sparse forbland (EmBiKgAs) (11.80 ha)

The TEC assessments of each vegetation community are provided in ELA (2017a; b).

8.2.2 Black Cockatoos

The Proposal area is located within the known feeding and breeding range of the Carnaby's Black Cockatoo and feeding range and predicted breeding range of the Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo (DSEWPac 2012). A number of targeted Black Cockatoo habitat surveys have been undertaken across the Proposal area and surrounding area, including most recently by Eco Logical Australia Pty Ltd (ELA) (2017a; 2017b; 2017c) and GHD (2017). All three species of Black Cockatoo have been recorded within the Proposal area or surrounding KSIA.

The Proposal area provides areas of suitable foraging habitat (45.73 ha), and potential breeding habitat (14.45 ha) for Black Cockatoos comprising the following:

- Pine plantation: 16.5 ha foraging habitat (adjusted from the 33.39 ha mapped by (ELA 2017b, c) to reflect to pine canopy coverage, refer to Chapter 7)
- *Pinus/Eucalyptus* Woodland: 7.90 ha foraging and potential breeding habitat
- Sedgeland: 8.62 ha foraging habitat
- Woodland over Sedgeland: 6.16 ha foraging habitat
- Jarrah / Marri Woodland: 5.94 ha foraging and potential breeding habitat
- *Eucalyptus / Banksia* Woodland: 0.42 ha foraging and potential breeding habitat
- Marri Forest: 0.19 ha foraging and potential breeding habitat

GHD (2017b) and Bamford (2011) identified large Jarrah trees that had DBH greater than 500 mm to the immediate north of the Proposal area. Two trees had large hollows and potential chews. These trees also had insitu markings. GHD (2017b) also identified one potential

breeding tree with DBH greater than 500 mm within the Proposal area. Additional trees with and without hollow occur within the local area within the surrounding area.

8.2.3 Threatened Orchids

No Threatened flora listed under the EPBC Act were recorded during ELA (2017a, b and c) or GHD (2017) within the Proposal area. However, desktop searches identified the presence of three EPBC Act listed orchid species within an approximate 2 km radius:

- Glossy-leafed Hammer Orchid (*Drakaea elastica*) (listed as Endangered under the EPBC Act and Threatened under the WC Act) - two locations approximately 45 m from the Proposal area's northern boundary on the west of the site. *Drakaea elastica* has a slender flower stem up to 30 cm high and a single distinctively glossy, bright green, prostrate, heart-shaped leaf 1 to 2 cm in diameter. The species grows on bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps, typically in banksia (*Banksia menziesii*, *B. attenuata* and *B. ilicifolia*) woodland or spearwood (*Kunzea glabrescens*) thicket vegetation (DEC 2009)
- Dwarf Bee-orchid (*Diuris micrantha*) (listed as Vulnerable under the EPBC Act and Threatened under the WC Act) - 2.3 km north-east of the Proposal area (ELA 2013). This orchid is up to 60 cm high with a basal tuft of narrow linear leaves, and a slender inflorescence with yellow flowers that have reddish-brown markings. It flowers from August to early October (TSSC 2008) and occurs in seasonally-wet flats amongst sedges and scattered shrubs (Brown et al 2013).
- Dwarf Hammer-orchid (*Drakaea micrantha*) (listed as Vulnerable under the EPBC Act and Threatened under the WC Act) - 735 m north of the Proposal area (ELA 2013). This small flowered orchid is 150 to 300 mm high with a heart shaped leaf and a single pale greenish-yellow and purplish-red flower and grows in open sandy patches in forests and woodlands (Brown et al 2013).

Orchid species are cryptic and could be missed during a survey; however, a post-survey likelihood of occurrence assessment confirmed that these species are not likely to occur (ELA 2017c). All orchid species recorded within the KSIA occur within 'sand patch' habitats that are relatively undisturbed and have not yet been subject to ground disturbances in the long term (AECOM 2012, ELA 2013). Sand patches within the Proposal area have been subject to grazing by livestock and now contain a range of annual weed species. Orchids are therefore not expected to occur within the Proposal area (ELA 2017c).

8.3 Assessment of Potential impacts on MNES

The potential impacts on MNES have previously been assessed within sections 4.5 and 5.5. The impacts and assessment are summarised below and includes a detailed assessment of potential impacts to threatened orchids.

8.3.1 Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community

Potential impacts to the Banksia Woodland of the Swan Coastal Plain TEC of the Proposal include.

- Approximately 6.37 ha of native vegetation associated with the 'Banksia Woodlands of the Swan Coastal Plain' TEC will be removed by the Proposal. This vegetation is mostly in Good condition.
- Changes in surface water run-off and nutrient cycling may result in detrimental impacts to surrounding native vegetation.

- The Proposal area will be graded to drain to the east using the natural topographic grade and slightly augmenting that hydraulic grade line where required to meet standard drainage requirements (RPS 2018, Appendix B).
- Any surface water flow generated within the Proposal area will be directed to the east and no stormwater or stormwater pathways will be directed to the *Banksia Woodlands* habitat to the west or south of the Proposal area (RPS 2018).
- The stormwater management strategy and preliminary drainage design has allowed for the construction of open drainage swales along the site's northern and southern boundaries. The site will be graded towards these open swales and surface water will then be graded east (RPS 2018).
- The surface water run-off regime within the development area will be altered, but the surface water regime of rainfall infiltration through the sandy lithology, which is external to the Proposal area will remain unchanged.
- Therefore, no change to the surface water run-off regime within the *Banksia Woodlands* habitat is proposed. The proposed action will also not disturb the habitat and the natural nutrient cycling of growth and decline within the ecological community itself.
- Detrimental impacts to adjacent Banksia woodlands TEC resulting from potential mobilisation of acid and metals due to disturbance of ASS associated with cut-to-fill earthworks and diversion of the existing agricultural drain.
 - ASS have been identified within the Proposal area.
 - The most significant risk of ASS occurs within the eastern part of the Proposal area where the soils predominantly occur, away from adjacent Banksia woodlands.
 - Impact to TEC vegetation from ASS impacts could still potential occur through the migration of ASS impacts through groundwater.
- Dust impacts to adjacent Banksia woodlands TEC. during earthworks.
 - Dust impacts will be most significant during clearing and development of the site however can be effectively controlled.
 - Appropriate storage of dust generating materials during the operational phase will minimise this impact.
- Possible introduction and/or spread of *Phytophthora cinnamomi*, and weeds to adjacent Banksia woodlands TEC.
 - *Phytophthora cinnamomi*, has been recorded to the south of Marriott Road and may be present within the Proposal area (it has been classed as uninterpretable) (Project Dieback 2017)
 - Up to 74 introduced (weed) species have been recorded within the Proposal area (ELAA, d, c and GHDb)
 - The risk of *Phytophthora cinnamomi*, and weeds spread will be highest during the construction phase due to land clearing and high numbers of vehicle movements however it can be effectively controlled through appropriate hygiene and land clearing procedures.
- Damage of loss of adjacent Banksia woodlands TEC. through accidental generation of a bushfire.

Refer to sections 4.5 for further assessment of these impacts.

8.3.2 Black Cockatoos

- Up to 45.73 ha of suitable foraging habitat for threatened Black Cockatoo species and one potential breeding tree (Jarrah) which is > 500 mm DBH, with no observed hollows will be removed by the Proposal.
- Death or displacement of Black Cockatoos could occur through interaction with vehicles and machinery during clearing.
 - No breeding trees with hollows will be directly removed by the Proposal
 - There are breeding trees with hollows located within the immediate surrounds of the Proposal area. Specifically, one has been identified adjacent to the services corridor which will be used for construction access (honeybees were present when hollow was observed ELA 2017b) and two (with chew marks indicating past use) have been identified adjacent to the north west corner of the Proposal area.
 - There are a number of other trees with hollows located within the immediate surrounding of the Proposal area (Figure 5.4) within which displaced birds can seek refuge.
- Degradation of Black Cockatoo Habitat in proximity to the Proposal area could occur due to impact from known threats such as *Phytophthora cinnamomi* and weeds.
 - *Phytophthora cinnamomi*, has been recorded to the south of Marriott Road and may be present within the Proposal area (it has been classed as uninterpretable) (Project Dieback 2017)
 - Up to 74 introduced (weed) species have been recorded within the Proposal area (ELAA, d, c and GHDb)
 - The risk of *Phytophthora cinnamomi*, and weeds spread will be highest during the construction phase due to land clearing and high numbers of vehicle movements however it can be effectively controlled through appropriate hygiene and land clearing procedures.
- Displacement of Black Cockatoo species due to secondary impacts such as noise, vibration, light and dust.
 - There will be an increase in noise, vibration, light and dust in the Proposal area and immediate surrounds associated with land clearing, vehicle and machinery operation, construction activities and operation of the Plant which may result in Black Cockatoos being displaced from, or avoiding use of, habitat in the local area.
 - Black cockatoos have been seen foraging within the Proposal area and its surrounds (ELA 2017a, b, c and GHD 2017) despite the presence of nearby industries with the same associated impacts (Cristal Titanium Dioxide Plant, Kemerton Silicon Smelter, Kemerton Waste Water Treatment Plant and the Tesla Peaking Power Station). These impacts from the existing industry do not currently appear to affect use of the Proposal area and surrounding habitat by Black Cockatoos.
 - There are more than 1,431 ha of DBCA managed lands within the KSIA Buffer Zone surrounding the Industrial Core. . These areas support native vegetation where fauna can find habitat/refuge if displaced from the Proposal area or surrounds.
- Increased predation due to increase in feral / introduced fauna species due to establishment of permanent water storage facilities
 - Ponds storing process water supply (good quality 'fresh' water) will be established within the Proposal area.
 - The water source is likely to be an attractant to fauna, particularly introduced species such as feral cats and foxes.

- Introduced fauna may also be attracted to the area due to availability of food in the municipal waste stream from the site.
- Effective controls can be implemented to minimise this risk.

8.3.3 Threatened Orchids

Three EPBC Act orchid species, *Drakaea elastica*, *Diuris micrantha* and *Drakaea micrantha* have been recorded within an approximately 2 km radius of the Proposal area. No records of these species have been recorded within the Proposal area. Additionally, none of these species are considered likely to occur based on the condition and disturbance history of the Proposal area. Therefore, no direct impacts (i.e. the clearing of vegetation supporting either *Drakaea elastica*, *Diuris micrantha* and *Drakaea micrantha*) on threatened orchid species are expected as a result of the Proposal.

The closest known record of *Diuris micrantha* is approximately 2.3 km north-east of the proposal area and *Drakaea micrantha* approximately 735 m north of the proposal area. Given the distance of these records from the Proposal area and their position away from the planned flow of surface water (east of the Proposal area), it is not expected these species will be indirectly impacted by the Proposal. *Drakaea elastica* has been recorded approximately 45 m from the northern boundary of the Proposal area. The Proposal has the potential to indirectly impact on this species. The key indirect impacts to *Drakaea elastica* include:

- alterations to groundwater and surface water hydrology
- altered fire regimes
- introduction and proliferation of introduced weeds
- introduction and/or spread of dieback

The impacts of the Proposal on the hydrological regime will be managed through a Preliminary Water Management Plan (RPS 2018, Appendix B). The stormwater management strategy for the site is to grade and drain the site to the east using the natural topographic grade in the pre-development state and slightly augmenting that hydraulic grade line where required to meet standard requirements. Perimeter drains will also be established along the northern and southern boundary and the topographic grade will be augmented toward these. Any stormwater generated on the development area will be directed to the east and no stormwater or stormwater pathways will be directed to the orchid habitat.

8.4 Proposed mitigation

A summary of the key mitigation measures which will be implemented to manage the potential impacts on MNES is provided in Table 8-2. Measures have previously been described in detail in sections 4.6 and 5.6.

Table 8-2 Proposed mitigation measures to address impacts to MNES

Potential Impact	Mitigation measures
Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community	
<u>Avoid</u>	
<ul style="list-style-type: none"> • Avoidance of vegetation representative of the Banksia Woodlands TEC in better condition than the proposal area through a site selection process. • Driving restrictions will be implemented to restrict driving to within the Proposal area or on designated tracks/roads only. • The site runoff will be captured via establishment of a topographic grade that directs runoff to perimeter drains which flow in an easterly direction to infiltration basins. • All vegetation and soil cleared from the Proposal area will be stockpiled within the Proposal area at least 10 m from the boundary to prevent excess clearing and spread of weeds and pathogens. • An ASS investigation has been undertaken to identify ASS locations within the Proposal area. • Lighting of fires is prohibited 	
<u>Minimise</u>	
<ul style="list-style-type: none"> • Areas of Banksia Woodland TEC which are designated to be cleared for construction purposes will only be cleared if required. • Minimise the risk of clearing of adjacent Banksia Woodland TEC through implementation of a Land Clearing Procedure (details in Table 4-12) • The Project boundary will be fenced to minimise edge effects • Dust suppression application will be controlled to prevent overspray to adjacent Banksia woodlands TEC. • An ASSMP will be developed and implemented to minimise the likelihood of acid and metalliferous mobilisation from ASS. • Speed limits will be restricted to 25 km/hr to minimise dust impacts to adjacent Banksia woodlands TEC. • Dust generating materials will be stored within covered warehouses or silos • A site hygiene procedure will be implemented. Further details are included in Table 4-12. • Weed control will be conducted if new weed infestations, attributable to the Proposal activities are identified. • Bushfire risk will be managed through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-specific emergency response plan • A Hot Work System will be implemented. 	
<u>Rehabilitate</u>	
<ul style="list-style-type: none"> • The Project will be in place for at least 25 years. 	

Potential Impact	Mitigation measures
	<ul style="list-style-type: none"> At the end of Plant life agreement will be made with the landowner, LandCorp, whether the site will be rehabilitated. This will be dependant in whether the site will be required for another industrial use. The service corridor width will be reduced and excess areas rehabilitated when it is no longer required for access. Similarly, if construction areas as not required for the operation of the Plant they will be rehabilitated. Albemarle will also refer to the Steven's <i>et al</i> 'Banksia woodlands: A restoration guide for the Swan Coastal Plain' (2016) for guidance on rehabilitation. Albemarle proposes to contribute to rehabilitation in the broader Leschenault Catchment area, which the KSIA is located within, by commissioning an experienced revegetation consultant to harvest seed from native vegetation within the Proposal area prior to clearing. The seed will then be donated to the Leschenault Catchment Council for use in rehabilitation projects within the Catchment area.
Black Cockatoos	
<u>Avoid</u>	
	<ul style="list-style-type: none"> Avoidance of Black Cockatoo foraging and breeding habitat in better condition than the proposal area through a site selection process. Avoidance of potential breeding trees with hollows through a site selection process, and potential breeding trees with hollows that have evidence of past use through change to the Project boundary. Driving restrictions will be implemented to restrict driving to within the Proposal area or on designated tracks/roads only. All vegetation and soil cleared from the Proposal area will be stockpiled within the Proposal area at least 10 m from the boundary to prevent excess clearing and spread of weeds and pathogens. Lighting of fires is prohibited Clearing areas will be searched for native fauna with any fauna found appropriately relocated prior to commencing clearing. Pets are not allowed on site. There is no onsite disposal of municipal waste, it will be taken to an offsite disposal or recycling facility.
<u>Minimise</u>	
	<ul style="list-style-type: none"> Areas of Banksia Woodland TEC (which is also good quality Black Cockatoo habitat), which are designated to be cleared for construction purposes, will only be cleared if required. Minimise the risk of clearing of adjacent Black Cockatoo Habitat and potential breeding trees through implementation of a Land Clearing Procedure (refer to Table 5-5 for details).

Potential Impact	Mitigation measures
	<ul style="list-style-type: none"> • The site will be fenced (for the operational phase of the project) to prevent native fauna species gaining access to water storages on the site where they could become trapped. • Dust suppression application will be controlled to prevent overspray to adjacent Black Cockatoo habitat. • Vehicle speeds will be restricted to 25 km/hr within the site. • Native fauna injuries or mortalities will be recorded and reported internally and to appropriate regulatory agencies where required • Wherever practical land clearing will be undertaken on one front only in a direction which provides an opportunity for fauna to escape the clearing area to surrounding vegetation • Water storage facilities will have appropriate fauna egress to enable any fauna which may gain access to the water storage to escape from the facility. • The site induction will include education on the potential impacts to fauna and inform inductees of the following requirements: • Native fauna injured as a result of construction or operation of the project will be taken to a designated veterinary clinic or a DBCA nominated wildlife carer. <ul style="list-style-type: none"> – Stop works in the vicinity of any injured or shocked animals that are encountered to allow them to escape or be attended to if required. – Feeding of animals is prohibited on the site. • Signage will be placed within proximity to potential breeding trees with hollows to indicate Black Cockatoos may be present. • To prevent degradation of surrounding Black Cockatoo habitat a site Hygiene Procedure will be implemented. Further details are included in Table 4-12. • To prevent degradation of surrounding Black Cockatoo habitat weed control will be conducted if new weed infestations, attributable to the Proposal activities are identified. • Bushfire risk will be managed through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-specific emergency response plan • A Hot Work System will be implemented. • Degradation of habitat due to site runoff impacts will be prevented to the site drainage design. Site runoff will be captured via establishment of a topographic grade that directs runoff to perimeter drains which flow in an easterly direction to infiltration basins. • Feral animal control programs will be undertaken if required. • Municipal waste will be stored within covered/lidded bins to prevent scavenging by introduced fauna.
<u>Rehabilitate</u>	
	<ul style="list-style-type: none"> • The Project will be in place for at least 25 years.

Potential Impact	Mitigation measures
	<ul style="list-style-type: none"> At the end of Plant life agreement will be made with the landowner, LandCorp, whether the site will be rehabilitated. This will be dependant in whether the site will be required for another industrial use. The service corridor width will be reduced and excess areas rehabilitated when it is no longer required for access. Similarly, if construction areas as not required for the operation of the Plant they will be rehabilitated.
Threatened Orchids	
<u>Avoid</u>	
	<ul style="list-style-type: none"> Driving restrictions will be implemented to restrict driving to within the Proposal area or on designated tracks/roads only. The site runoff will be captured via establishment of a topographic grade that directs runoff to perimeter drains which flow in an easterly direction to infiltration basins. All vegetation and soil cleared from the Proposal area will be stockpiled within the Proposal area at least 10 m from the boundary to prevent excess clearing and spread of weeds and pathogens. An ASS investigation has been undertaken to identify ASS locations within the Proposal area. Lighting of fires is prohibited Process plant, reagent, hydrocarbon storage areas will be located at least 100 m from the Proposal area boundary to prevent any releases from impacting on surrounding vegetation including threatened orchids.
<u>Minimise</u>	
	<ul style="list-style-type: none"> The Project boundary will be fenced to minimise edge effects Dust suppression application will be controlled to prevent overspray which may impact on threatened orchid habitat. An ASSMP will be developed and implemented to minimise the likelihood of acid and metalliferous mobilisation from ASS. Speed limits will be restricted to 25 km/hr to minimise dust impacts to adjacent threatened orchid habitat. Dust generating materials will be stored within covered warehouses or silos A site hygiene procedure will be implemented. Further details are included in Table 4-12. Weed control will be conducted if new weed infestations, attributable to the Proposal activities are identified. Bushfire risk will be managed through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-specific emergency response plan A Hot Work System will be implemented.

Potential Impact	Mitigation measures
<ul style="list-style-type: none"> Albemarle will develop a Threatened Orchid Management Plan for the Project. Further details are in Table 4-12. The plan will be submitted for approval. <p><u>Rehabilitate</u></p> <ul style="list-style-type: none"> No rehabilitation of threatened orchids is planned. Orchids may be present within the proposed offset area. 	

8.5 Recovery Plans, Threat Abatement Plans and Conservation Advice

Recovery Plans, Threat Abatement Plans and Conservation Advice which is relevant to the MNES the Proposal may impact upon have been listed in Table 8-3. A discussion of how the Project conforms to the Advice or Plan requirements is included.

Table 8-3 Relevant Recovery Plans, Threat Abatement Plans and Conservation Advice for MNES

Plan/Conservation Advice	Albemarle Proposal
Approved Conservation Advice (incorporating listing advice) for the <i>Banksia Woodlands of the Swan Coastal Plain</i> Ecological Community (Commonwealth of Australia, 2016)	<p>Where possible, the management objectives of the Proposal have aimed to align with the conservation objectives outlined in section 5 'Priority Research and Conservation Actions' of the Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (Commonwealth of Australia 2016).</p> <p>According to Commonwealth of Australia (2016) the main ongoing threats to the Banksia dominated woodlands ecological community are listed and assessed as follows:</p> <p><u>Clearing and fragmentation:</u></p> <p>Considerable effort has been made to minimise the amount of clearing of native vegetation required for the proposal and avoid clearing of the Banksia Woodlands TEC, particularly areas in very good to excellent condition. Refer to section 4.6.1 for specific details.</p> <p><u>Dieback diseases:</u></p> <p><i>Phytophthora cinnamomi</i> management will be integrated with other hygiene management requirements such as weed and other pathogens (e.g. <i>Armillaria</i>) through implementation of a Hygiene Procedure which will require:</p> <ul style="list-style-type: none"> all vehicles and machinery entering the site to be cleaned before arrival and presented for inspection to confirm they are free from soil and vegetative material. No offsite driving unless on designated roads. No bringing of plant or soil material to site unless approved for a specific purpose.

Plan/Conservation Advice	Albemarle Proposal
	<ul style="list-style-type: none"> – No storage of cleared vegetation or soils outside the Proposal area. <p><u>Invasive species:</u></p> <p>Weed management will be integrated with other hygiene management requirements such as <i>P. cinnamomi</i> through implementation of a Hygiene Procedure which will require:</p> <ul style="list-style-type: none"> – all vehicles and machinery entering the site to be cleaned before arrival and presented for inspection to confirm they are free from soil and vegetative material. – No offsite driving unless on designated roads. – No bringing of plant or soil material to site unless approved for a specific purpose. – No storage of cleared vegetation or soils outside the Proposal area. <p><u>Fire regime change:</u></p> <p>Management of fire risk through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-specific emergency response plan as outlined in the EMP (GHD 2017).</p> <p>Lighting of fires is prohibited by staff and contractors is prohibited.</p> <p><u>Hydrological degradation:</u></p> <ul style="list-style-type: none"> • The stormwater management strategy for the Proposal is outlined in the Preliminary Water Management Plan (Appendix B). • The Proposal area will be graded to drain to the east using the natural topographic grade and slightly augmenting that hydraulic grade line where required to meet standard drainage requirements. • Any surface water flow generated within the Proposal area will be directed to the east and no stormwater or stormwater pathways will be directed to the <i>Banksia Woodlands</i> habitat to the west or south of the Proposal area. • The stormwater management strategy and preliminary drainage design has allowed for the construction of open drainage swales along the site's northern and southern boundaries. The site will be graded towards these open swales and surface water will then be graded east. • The surface water run-off regime within the development area will be altered, but the surface water regime of rainfall infiltration through the sandy

Plan/Conservation Advice	Albemarle Proposal
	<p data-bbox="778 221 1385 288">lithology, which is external to the Proposal area will remain unchanged.</p> <ul data-bbox="722 311 1430 748" style="list-style-type: none"> <li data-bbox="722 311 1430 495">• Therefore, no change to the surface water run-off regime within the <i>Banksia Woodlands</i> habitat is proposed. The proposed action will also not disturb the habitat and the natural nutrient cycling of growth and decline within the ecological community itself. <li data-bbox="722 517 1430 658">• There is no proposal to amend the surface water regime in this area and, as such, no changes to the groundwater elevation are likely and no associated mobilisation of ASS is anticipated. <li data-bbox="722 680 1430 748">• Further details on ASS management are within section 6.6. <p data-bbox="715 770 911 804"><u>Climate change:</u></p> <p data-bbox="715 826 1410 1039">The Proposal is considered unlikely to exacerbate this threat. It may indirectly reduce this threat as the product of the Plant (Lithium Hydroxide Product) will be used in the development of rechargeable batteries to power Electric Vehicles, Energy Storage systems and other rechargeable items.</p> <p data-bbox="715 1061 820 1095"><u>Grazing:</u></p> <p data-bbox="715 1117 1426 1375">The KSIA Industrial Core is currently subject to grazing. The Proposal area includes 25.04 ha of predominantly cleared land which is currently grazed. Removal of this area may lead to a slight increase in grazing pressure within the surrounding area which includes <i>Banksia</i> woodlands TEC although it is likely that cattle/sheep will avoid the area due to noise and vibration associated with the Plant operation.</p> <p data-bbox="715 1397 1294 1431"><u>Decline in pollinating and seed dispersing fauna:</u></p> <p data-bbox="715 1453 1418 1621">Loss of remnant vegetation within the Proposal area has the potential to result in a slight decline in pollinating and seed dispersing fauna however the Proposal area does not represent significant habitat for any fauna other than Black Cockatoos.</p> <p data-bbox="715 1644 1355 1722"><u>Loss of keystone <i>Banksia</i> species and fragmenting of nectar/pollen nutritional networks:</u></p> <p data-bbox="715 1744 1418 1845">There will be a loss of up to 6.37 ha of <i>Banksia</i> woodland TEC in which keystone species <i>Banksia ilicifolia</i> have been recorded (ELA 2017a, c) .</p> <p data-bbox="715 1868 1410 2013">Clearing of the <i>Banksia</i> woodland TEC within the Proposal area will occur along the edges of broader blocks of the TEC and is therefore not expected to fragment nectar/pollen nutritional networks.</p>

Plan/Conservation Advice	Albemarle Proposal
<p>Department of Environment and Conservation (2009). Glossy-leafed Hammer Orchid (<i>Drakaea elastica</i>) Recovery Plan. Department of Environment and Conservation, Western Australia.</p>	<p><u><i>Threat 1: Land Clearing</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Whilst vegetation will be cleared for the purpose of the Proposal it is expected that this will not exacerbate this threat as there are no known populations within the Proposal area.</p> <ul style="list-style-type: none"> The closest known locations of <i>Drakaea elastica</i> are approximately 45 m north and 500 m north west of the Proposal area (ELA 2013) (Figure 4.1).
	<p><u><i>Threat 2: Degradation and Fragmentation of Habitat</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Whilst vegetation will be cleared for the purpose of the Proposal it is expected that this will not exacerbate this threat as there is no known habitat within the Proposal area.</p> <ul style="list-style-type: none"> All orchid species recorded within the KSIA occur within 'sand patch' habitats that are relatively undisturbed and have not yet been subject to ground disturbances in the long term (AECOM 2012, ELA 2013). Sand patches within the Proposal area have been subject to grazing by livestock and now contain a range of annual weed species, in which orchids are not expected to occur (ELA 2017c).
	<p><u><i>Threat 3: Edge Effects</i></u></p> <p>The Proposal may exacerbate this threat, however impacts will be managed through the implementation of a CEMP and EMP.</p> <p>During construction phase there will be:</p> <ul style="list-style-type: none"> Clear demarcation of all clearing boundaries. Checks to confirm clearing boundaries are demarcated and are correct prior to undertaking clearing. Daily inspection of cleared areas to confirm clearing has occurred within the designated clearing boundary. Survey of cleared areas post clearing to confirm boundaries have been adhered to. Adherence to the site hygiene procedure to prevent weed and <i>Phytophthora cinnamomi</i> introduction or spread.

Plan/Conservation Advice	Albemarle Proposal
	<ul style="list-style-type: none"> • Demarcation of an exclusion area (40 m) around the known DRF location (with physical barriers between the site boundary and the DRF location if necessary). • A spotter will be used when clearing in proximity of the DRF to ensure the exclusion boundary is maintained. • Stockpiling of all soil and vegetative materials from clearing will be within the Proposal area extents to avoid impacting areas outside the Proposal area boundary • Restrictions will also be in place to limit vehicles to driving on designated tracks or within the Proposal area to avoid impacts to vegetation outside the boundary. • Site drainage design which directs runoff to perimeter drains to the north and south which flow in an easterly direction to two infiltration ponds. • Dust suppression applied as required and monitoring <p>During the operational phase:</p> <ul style="list-style-type: none"> • Edge effects such as weeds and fire break maintenance will be managed through implementation of the ongoing EMP. Signage will be established to identify an exclusion area where the known populations are located and site inductions will discuss avoidance of these populations. • Site drainage design which directs runoff to perimeter drains to the north and south which flow in an easterly direction to two infiltration ponds. <p>It is not expected that dust generated during the operational phase will impact on surrounding vegetation as dust will be minimised through:</p> <ul style="list-style-type: none"> • Storage of dust producing materials within warehouses or covered sheds • Application of dust suppression when required. <p><u><i>Threat 4: Increased Density of Ground-level Vegetation</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>It is not proposed to disturb soil and vegetation surrounding the Proposal area, either during or post construction phase, therefore the density of ground-level vegetation surrounding</p>

Plan/Conservation Advice	Albemarle Proposal
	<p>the Proposal area is expected to remain relatively unchanged.</p> <p><u><i>Threat 5: Grazing</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>The majority of the Proposal area is currently disturbed by cattle grazing, weed invasion, unauthorised access (e.g. unplanned tracks, rubbish dumping, motorbikes) and clearing/logging.</p> <p>It is not proposed to disturb soil and vegetation surrounding the Proposal area, either during or post construction phase, therefore the level of grazing in the surrounding vegetation is expected to remain relatively unchanged or less if livestock move further away once the plant is operational.</p> <p><u><i>Threat 6: Rabbits, Kangaroos and Livestock</i></u></p> <p>The KSIA Industrial Core is currently subject to grazing. The Proposal area includes 25.04 ha of predominantly cleared land which is grazed. Removal of this area may lead to a slight increase in grazing pressure within the surrounding area which includes Banksia woodlands TEC although it is likely that cattle/sheep will avoid the area due to noise and vibration associated with the Plant operation.</p> <p><u><i>Threat 7: Construction</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Whilst vegetation will be cleared for the purpose of the Proposal it is expected that this will not exacerbate this threat as there are no known populations within the Proposal area.</p> <ul style="list-style-type: none"> • The closest known locations of <i>Drakaea elastica</i> are approximately 45 m north and 500 m north west of the Proposal area (ELA 2013) (Figure 4.1). <p>Construction impacts will be managed through the implementation of a CEMP and EMP.</p> <p><u><i>Threat 8: Powerline, Gas Pipeline, Firebreak and Road Maintenance</i></u></p> <p>The Proposal may exacerbate this threat, however impacts will be managed through the implementation of an ongoing EMP.</p> <p>During the operational phase impact from roads, weeds and fire break maintenance will be managed in the EMP. Signage will be established to identify an exclusion area where the known populations are located and site inductions will discuss avoidance of these populations.</p>

Plan/Conservation Advice	Albemarle Proposal
	<p data-bbox="715 226 1046 259"><u>Threat 9: Rubbish Dumping</u></p> <p data-bbox="715 280 1238 313">The Proposal will not exacerbate this threat.</p> <p data-bbox="715 333 1406 443">The majority of the Proposal area is currently disturbed by activities such as unauthorised access (e.g. unplanned tracks, rubbish dumping).</p> <p data-bbox="715 463 1430 607">It is considered that the level of rubbish dumping in the local area may be reduced once construction and operational phases commence due to increased surveillance in the area.</p> <p data-bbox="715 627 1414 696">All municipal and industrial waste from the Proposal will be removed to licensed offsite landfill or recycling facilities.</p> <p data-bbox="715 728 932 761"><u>Threat 10: Weeds</u></p> <p data-bbox="715 781 1430 851">The Proposal may exacerbate this threat, although only at a localised scale.</p> <p data-bbox="715 871 1422 981">The Proposal area has been subject to grazing by livestock and now contains a range of annual weed species (ELA 2017c).</p> <p data-bbox="715 1001 1425 1209">Spread of weeds could potentially occur if hygiene and land clearing controls are not implemented. A Hygiene Procedure and Land Clearing Procedure will be implemented to minimise the risk of weed introduction and spread to surrounding areas where the species is known to occur.</p> <p data-bbox="715 1229 944 1263"><u>Threat 11: Disease</u></p> <p data-bbox="715 1283 1430 1491"><i>Phytophthora cinnamomi</i> is known to be present within the surrounding area with a record of occurrence to the south of the Proposal area. Management of this threat will be integrated with other hygiene management requirements such as weed and other pathogens (e.g. <i>Armillaria</i>) through implementation of a Hygiene Procedure which will require:</p> <ul data-bbox="778 1512 1422 1872" style="list-style-type: none"> – all vehicles and machinery entering the site to be cleaned before arrival and presented for inspection to confirm they are free from soil and vegetative material. – No offsite driving unless on designated roads. – No bringing of plant or soil material to site unless approved for a specific purpose. – No storage of cleared vegetation or soils outside the Proposal area. <p data-bbox="715 1892 1171 1926"><u>Threat 12: Inappropriate Fire Regimes</u></p> <p data-bbox="715 1946 1238 1980">The Proposal will not exacerbate this threat.</p> <p data-bbox="715 2000 1430 2069">Management of fire risk through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-</p>

Plan/Conservation Advice	Albemarle Proposal
	<p>specific emergency response plan as outlined in the EMP (GHD 2017).</p> <p><u><i>Threat 13: Poor Recruitment</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>All orchid species recorded within the KSIA occur within 'sand patch' habitats that are relatively undisturbed and have not yet been subject to ground disturbances in the long term (AECOM 2012, ELA 2013).</p> <p>Sand patches within the Proposal area have been subject to grazing by livestock and now contain a range of annual weed species, in which orchids are not expected to occur (ELA 2017c).</p> <p>Soil and vegetation surrounding the Proposal area will not be disturbed, either during or post construction phase therefore the level of recruitment in the surrounding vegetation is expected to remain relatively unchanged.</p> <p><u><i>Threat 14: Recreational Use</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>The majority of the Proposal area is currently disturbed by activities such as unauthorised access (e.g. unplanned tracks, rubbish dumping, motorbikes).</p> <p>It is considered that the level of unauthorised access for recreational use in the local area may be reduced once construction and operational phases commence due to increased surveillance in the area.</p> <p><u><i>Threat 15: Sand Extraction</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Sand extraction is not applicable to this site.</p> <p><u><i>Threat 16: Rising Saline Water Table</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>The area of land clearing is considered to be small and localised, and has previously been cleared. The Proposal is therefore unlikely to result in any significant risk in the water table.</p>
<p>Department of the Environment, Water, Heritage and the Arts (2008). Approved Conservation Advice for <i>Diuris micrantha</i> (Dwarf Bee-orchid). Canberra: Department of the</p>	<p><u><i>Threat 1: Habitat Loss, Disturbance and Modification</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No known habitat will be lost within the Proposal area.</p> <ul style="list-style-type: none"> The closest known location of <i>Diuris micrantha</i> is approximately 2.3 km north-east of the Proposal area (ELA 2013).

Plan/Conservation Advice	Albemarle Proposal
<p>Environment, Water, Heritage and the Arts.</p>	<p><u><i>Threat 2: Invasive Weeds</i></u></p> <p>The Proposal may exacerbate this threat, although only at a localised scale.</p> <p>The Proposal area has been subject to grazing by livestock and now contains a range of annual weed species (ELA 2017c).</p> <p>Spread of weeds could potentially occur if hygiene and land clearing controls are not implemented. A Hygiene Procedure and Land Clearing Procedure will be implemented to minimise the risk of weed introduction and spread to surrounding areas where the species is known to occur.</p> <p><u><i>Threat 3: Trampling, Browsing or Grazing</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>The majority of the Proposal area is currently disturbed by cattle grazing, weed invasion, unauthorised access (e.g. unplanned tracks, rubbish dumping, motorbikes) and clearing/logging.</p> <p>Soil and vegetation surrounding the Proposal area will not be disturbed, either during or post construction phase, therefore the level of trampling, browsing or grazing in the surrounding vegetation is expected to remain relatively unchanged or less if livestock move further away once the plant is operational.</p> <p><u><i>Threat 4: Fire</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Fire risk will be managed through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-specific emergency response plan as outlined in the EMP (GHD 2017).</p>
<p>Department of the Environment, Water, Heritage and the Arts (2008). Approved Conservation Advice for <i>Drakaea micrantha</i> (Dwarf Hammer-orchid). Canberra: Department of the Environment, Water, Heritage and the Arts.</p>	<p><u><i>Threat 1: Habitat Loss, Disturbance and Modification</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No known habitat will be lost within the Proposal area.</p> <ul style="list-style-type: none"> • The closest suspected location of <i>Drakaea micrantha</i> is approximately 735 m north of the Proposal area (ELA 2013) (Figure 4.1). • The closest known locations of <i>Drakaea micrantha</i> are approximately 1 km south-east (ELA 2013).

Plan/Conservation Advice	Albemarle Proposal
	<p data-bbox="715 226 1023 259"><u>Threat 2: Invasive Weeds</u></p> <p data-bbox="715 280 1430 349">The Proposal may exacerbate this threat, although only at a localised scale.</p> <p data-bbox="715 369 1422 477">The Proposal area has been subject to grazing by livestock and now contains a range of annual weed species (ELA 2017c).</p> <p data-bbox="715 495 1425 705">Spread of weeds could potentially occur if hygiene and land clearing controls are not implemented. A Hygiene Procedure and Land Clearing Procedure will be implemented to minimise the risk of weed introduction and spread to surrounding areas where the species is known to occur.</p> <p data-bbox="715 725 879 759"><u>Threat 3: Fire</u></p> <p data-bbox="715 779 1238 813">The Proposal will not exacerbate this threat.</p> <p data-bbox="715 831 1385 974">Fire risk will be managed through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-specific emergency response plan as outlined in the EMP (GHD 2017).</p> <p data-bbox="715 1005 1018 1039"><u>Conservation Information</u></p> <p data-bbox="715 1059 1366 1167">The site induction will include education on threatened species potentially impacted by the Proposal including <i>Drakaea micrantha</i>.</p> <p data-bbox="715 1198 1385 1232"><u>Enable Recovery of Additional Sites and/ or Populations</u></p> <p data-bbox="715 1252 1422 1543">A proposed offset area has been identified which has areas of relatively undisturbed Banksia woodland TEC vegetation which has 'sand patch' habitats potentially suitable for <i>Drakaea micrantha</i>. There are currently no recorded locations of the species or any other threatened orchids within the proposed offset area however targeted surveys have not been undertaken within this location to the knowledge of Albemarle.</p>
<p data-bbox="316 1579 683 1832">Australian Government Department of the Environment (2014), Threat abatement plan for disease in natural ecosystems caused by <i>Phytophthora cinnamomi</i>. Canberra, ACT.</p>	<p data-bbox="715 1579 1422 1686"><u>Objective 1: Identify and prioritise for protection biodiversity assets that are, or may be, impacted by <i>Phytophthora cinnamomi</i></u></p> <p data-bbox="715 1704 1425 1881">The Proposal is considered consistent with this objective as flora, fauna and ecological communities at risk of dieback caused by <i>P. cinnamomi</i> have been prioritised in terms of preventing further spread of dieback to the area surrounding the Proposal.</p>

Plan/Conservation Advice	Albemarle Proposal
	<p><u>Objective 2: Protect priority biodiversity assets through reducing the spread and mitigating the impacts of <i>Phytophthora cinnamomi</i></u></p> <p>The Proposal is considered consistent with this objective.</p> <p>A Hygiene Procedure will be implemented for the Proposal.</p> <p><i>P. cinnamomi</i> management will be integrated with other hygiene management procedures such as weed and other pathogens (e.g. Armillaria).</p> <p><u>Objective 3. Communication and training</u></p> <p>The Proposal is considered consistent with this objective.</p> <p>Prior to entering the site, all staff and contractors will receive inductions for hygiene procedure requirements. Further details on communication and training/induction are in the Albemarle Kemerton Plant EMP (GHD 2017a)</p>
<p>Australian Government Department of the Environment and Energy (2016). Threat abatement plan for competition and land degradation by rabbits. Canberra, ACT.</p>	<p><u>Objective 1: Strategically manage rabbits at the landscape scale and suppress rabbit populations to densities below threshold levels in identified priority areas.</u></p> <p>The Proposal will not impede on this objective.</p> <p><u>Objective 2: Improve knowledge and understanding of the impact of rabbits and their interactions with other species and ecological processes.</u></p> <p>The Proposal will not impede on this objective.</p> <p><u>Objective 3: Improve the effectiveness of rabbit control programs.</u></p> <p>The Proposal will not impede on this objective.</p> <p><u>Objective 4: Increase engagement of, and awareness by, the community of the impacts caused by rabbits, and the need for integrated control.</u></p> <p>The Proposal will not impede on this objective.</p>
<p>Western Australian Department of Parks and Wildlife (2013), Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) Recovery Plan.</p>	<p><u>Known and Potential Threats 1: Loss of Breeding habitat</u></p> <p>The Proposal will not exacerbate this threat.</p> <p>There is no known breeding habitat within the Proposal area.</p> <p><u>Known and Potential Threats 2: Loss of Non-breeding, Foraging and Night roosting Habitat</u></p>

Plan/Conservation Advice	Albemarle Proposal
	<p>The Proposal may exacerbate this threat however the project area has been selected to minimise potential loss of non-breeding, foraging and night roosting habitat;</p> <ul style="list-style-type: none"> • The total area of the site is 89.25 ha most of which has previously been cleared with only 6.58 ha of remanent native vegetation remaining in good or better condition, • The remainder of the site consists of pine plantation, partially cleared pine plantation and previously cleared paddocks with scattered remnant / regrowth vegetation, • However of the 89.25 ha, 45.73 ha (adjusted from 62.63 based on canopy assessment, refer to Chapter 7) of suitable foraging habitat and 14.45 ha of potential breeding habitat (of varying vegetation conditions) is present, • Of the 45.73 ha most is comprised of pine plantation and small patchy areas of regrowth able to be utilised for Black Cockatoo foraging. Only 6.58 ha is in good or better condition. <p>Refer to Section 5.6.1 for further details.</p> <p><u><i>Known and Potential Threats 3: Tree Health</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No known premature decline syndromes are known from the area.</p> <p>A Hygiene Procedure will be implemented for the Proposal.</p> <p><i>P. cinnamomi</i> management will be integrated with other hygiene management such as weed and other pathogen (e.g. Armillaria) control in the CEMP.</p> <p><u><i>Known and Potential Threats 4: Mining and Extraction Activities</i></u></p> <p>Not relevant to this project.</p> <p><u><i>Known and Potential Threats 5: Illegal Shooting</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No firearms will be allowed on site.</p> <p><u><i>Known and Potential Threats 6: Illegal Taking</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No traps are allowed on site. During inductions staff will be educated not to interfere with wildlife.</p> <p><u><i>Known and Potential Threats 7: Climate Change</i></u></p>

Plan/Conservation Advice	Albemarle Proposal
	<p>The Proposal is considered unlikely to exacerbate this threat.</p> <p>It may indirectly reduce this threat as the product of the Plant (Lithium Hydroxide Product) will be used in the development of rechargeable batteries to power Electric Vehicles, Energy Storage systems and other rechargeable items.</p>
	<p><u><i>Known and Potential Threats 8: Collisions with Motor Vehicles</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Vehicle speeds will be reduced to 25 km/hr on access to the project. This will be conveyed to staff via the induction process and signage placed on roads and around plant. All fauna strikes are to be reported and assessed.</p>
	<p><u><i>Known and Potential Threats 9: Disease (Biological Threats)</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No practices/operations undertaken for the project will increase the potential for disease. No pets are allowed on site.</p>
<p>Western Australian Department of Environment and Conservation (2008), Forest Black Cockatoo (Baudin's Cockatoo <i>Calyptorhynchus baudinii</i> and Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksii naso</i>) Recovery Plan.</p>	<p><u><i>Threat 1: Killing by Illegal Shooting</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No firearms are allowed on site.</p>
	<p><u><i>Threat 2: Feral Honeybees</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No trees with hollows will be cleared for this project. One tree with a DBH >500 mm will be removed however no hollow is present. Honey Bees are known in the region to occupy tree hollows.</p>
	<p>The Proposal may exacerbate this threat however the project area has been selected to minimise potential loss of non-breeding, foraging and night roosting habitat;</p> <ul style="list-style-type: none"> • The total area of the site is 89.25 ha most of which has previously been cleared with only 6.58 ha of remanent native vegetation remaining in good or better condition, • The remainder of the site consists of pine plantation, partially cleared pine plantation and previously cleared paddocks with scattered remnant / regrowth vegetation,

Plan/Conservation Advice	Albemarle Proposal
	<ul style="list-style-type: none"> • However of the 89.25 ha, 45.73 ha (adjusted from 62.63 based on canopy assessment, refer to Chapter 7) of suitable foraging habitat and 14.45 ha of potential breeding habitat (of varying vegetation conditions) is present, • Of the 45.73 ha most is comprised of pine plantation and small patchy areas of regrowth able to be utilised for Black Cockatoo foraging. Only 6.58 ha is in good or better condition. <p>Refer to Section 5.6.1 for further details.</p> <p><u><i>Threat 3: Nest Hollow Shortage</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No trees with hollows will be cleared for this project. One tree with a DBH >500 mm will be removed however no hollow is present.</p> <p><u><i>Threat 4: Nest Hollow Competition</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No trees with hollows will be cleared for this project. One tree with a DBH >500 mm will be removed however no hollow is present.</p>
<p>Department of the Environment, Water, Heritage and the Arts (2009). Approved Conservation Advice for <i>Calyptrorhynchus banksii naso</i> (Forest Red-tailed Black Cockatoo). Canberra: Department of the Environment, Water, Heritage and the Arts.</p>	<p><u><i>Threat 1: Illegal Shooting</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No firearms are allowed on site.</p> <p><u><i>Threat 2: Habitat Loss</i></u></p> <p>The Proposal may exacerbate this threat however the project area has been selected to minimise potential loss of non-breeding, foraging and night roosting habitat;</p> <ul style="list-style-type: none"> • The total area of the site is 89.25 ha most of which has previously been cleared with only 6.58 ha of remanent native vegetation remaining in good or better condition, • The remainder of the site consists of pine plantation, partially cleared pine plantation and previously cleared paddocks with scattered remnant / regrowth vegetation, • However of the 89.25 ha, 45.73 ha (adjust from 62.63 based on canopy assessment, refer to Chapter 7) of suitable foraging habitat and 14.45 ha of potential breeding habitat (of varying vegetation conditions) is present,

Plan/Conservation Advice	Albemarle Proposal
	<ul style="list-style-type: none"> Of the 45.73 ha most is comprised of pine plantation and small patchy areas of regrowth able to be utilised for Black Cockatoo foraging. Only 6.58 ha is in good or better condition. <p>Refer to Section 5.6.1 for further details.</p> <p><u><i>Threat 3: Nest Hollow Shortage</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No trees with hollows will be cleared for this project. One tree with a DBH >500 mm will be removed however no hollow is present.</p> <p><u><i>Threat 4: Competition from other Species</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No trees with hollows will be cleared for this project. One tree with a DBH >500 mm will be removed however no hollow is present.</p> <p><u><i>Threat 5: Injury or death from Apis mellifera (European Honeybees)</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No trees with hollows will be cleared for this project. One tree with a DBH >500 mm will be removed however no hollow is present. Honey Bees are known in the region to occupy tree hollows</p>
<p>Threatened Species Scientific Committee (2018). Conservation Advice <i>Calyptrorhynchus baudinii</i> Baudin's cockatoo. Canberra: Department of the Environment and Energy.</p>	<p><u><i>Threat 1: Land clearing and tree harvesting for agriculture, forestry and mining</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Very few trees will be cleared for this project. Historically much of the site was previously cleared with only 6.58 ha of remnant vegetation remaining within the project area. One tree with a DBH >500 mm will be removed however no hollow is present.</p> <p><u><i>Threat 2: Destruction of nesting and foraging trees from fire events</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Fire risk will be managed through implementation of the KSIA Bushfire Management Plan (RUIC Fire 2016) and site-specific emergency response plan as outlined in the EMP (GHD 2017).</p> <p><u><i>Threat 3: Loss of hollows from European honey bees (Apis mellifera)</i></u></p> <p>The Proposal will not exacerbate this threat.</p>

Plan/Conservation Advice	Albemarle Proposal
	<p>No trees with hollows will be cleared for this project. One tree with a DBH >500 mm will be removed however no hollow is present. Honey Bees are known in the region to occupy tree hollows</p> <p><u><i>Threat 4: Nest hollow shortage due to competition with native bird species</i></u></p> <p>The Proposal will not exacerbate this threat. No trees with hollows will be cleared for this project. One tree with a DBH >500 mm will be removed however no hollow is present.</p> <p><u><i>Threat 5: Illegal shooting</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No firearms are allowed on site.</p> <p><u><i>Threat 6: Phytopathogens (Dieback)</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>No known premature decline syndromes are known from the area.</p> <p>A Hygiene Procedure will be implemented for the Proposal.</p> <p><i>P. cinnamomi</i> management will be integrated with other hygiene management such as weed and other pathogen (e.g. Armillaria) control in the CEMP.</p> <p><u><i>Threat 7: Infestation of bullseye borer (Phoracantha acanthocera)</i></u></p> <p>The Proposal will not exacerbate this threat.</p> <p>Typically infestations of the Bullseye Borer have been observed in the southwest corner of WA and on Karri or Jarrah and Marri in association to Karri. No infestations have been recorded in the Kemerton area.</p> <p><u><i>Threat 8: Climate change</i></u></p> <p>The Proposal is considered unlikely to exacerbate this threat.</p> <p>It may indirectly reduce this threat as the product of the Plant (Lithium Hydroxide Product) will be used in the development of rechargeable batteries to power Electric Vehicles, Energy Storage systems and other rechargeable items.</p>

8.6 Significance assessment

An assessment of the significance of the Proposal in accordance with the Department of Environment, Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (2013) was undertaken for the referral of the Proposal under the EPBC Act (GHD 2017c). The assessment did not include impacts on Threatened Orchids in proximity to the Proposal area. An updated version of the assessment including Threatened Orchids is included in Table 8-4.

Table 8-4 Significance assessment for MNES

Significance assessment for MNES
Black Cockatoos - Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>), Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) and Baudin's Cockatoo (<i>Calyptorhynchus baudinii</i>)
Significant Impact Guidelines
<p>An assessment of impacts on Black Cockatoos was undertaken against the Significant Impact Guidelines as presented below.</p> <p><u>Lead to a long-term decrease in the size of an important population of a species</u></p> <p>The Proposal will result in the removal of up to 45.73 ha of suitable foraging habitat (note this is adjusted from the original value of 62.63 ha based on a canopy assessment of the former pine plantation, refer to section 5.5 for further details), 14.45 ha of potential breeding habitat and one potential breeding tree.</p> <p>Black Cockatoo habitat is well represented within the locality. The estimated area of suitable foraging habitat available within the Shire of Harvey (based on current extent of Beard (1979) vegetation associations) is estimated to be 87,007.51 ha (GoWA 2016). The Proposal may reduce the overall area of habitat by less than 0.06% within the Shire of Harvey as a result of direct loss of habitat from clearing. The vegetation considered to be suitable foraging habitat is largely contained in DBCA-managed land (approximately 76%).</p> <p>The proposed action, without the implementation of species specific mitigation measures, is unlikely to result in a long-term decrease in the size of a population of this species as it is unlikely to substantially:</p> <ul style="list-style-type: none">• reduce the overall area of available habitat to the population• reduce the overall area of occupancy of the population• exacerbate existing barrier effects or create new barrier effects• disrupt the breeding cycle of part of the population. <p>Therefore, it is considered that clearance of up to 45.73 ha of suitable foraging habitat, 14.45 ha of potential breeding habitat and one potential breeding tree are unlikely to lead to a long-term decrease in the size of the local population of the Carnaby's Black Cockatoo, Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo.</p> <p><u>Reduce the area of occupancy of an important population</u></p> <p>The Proposal is unlikely to substantially reduce the area of occupancy of the population of Carnaby's Black Cockatoo, Baudin's Cockatoo or Forest Red-tailed Black Cockatoo within the local area or region. The species is known to occur throughout the greater south-west region and Swan Coastal Plain bioregion.</p> <p>The estimated area of suitable foraging habitat available within the Shire of Harvey (based on current extent of Beard (1979) vegetation associations) is estimated to be 87,007.51 ha</p>

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(GoWA 2016). The Proposal may reduce the overall area of habitat by less than 0.06% within the Shire of Harvey as a result of direct loss of habitat from clearing. The vegetation considered to be suitable foraging habitat is largely contained in DBCA-managed land (approximately 76%). There are large blocks of suitable foraging habitat immediately adjacent to the Proposal area.

The removal of 45.73 ha of habitat within the Proposal area is not considered to be substantial for the species in a regional context, due to the extent of the known habitat adjacent to the Proposal area as well as the availability of known and modelled suitable habitat within the locality and region.

Fragment an existing important population into two or more populations

The Proposal is unlikely to fragment the population into two or more populations. Much of the Proposal area has previously been cleared and is predominantly in a Degraded to Completely Degraded condition. The Proposal is unlikely to substantially fragment the habitat or impose a physical barrier to the movement of Black Cockatoos between the habitat within the Proposal area and surrounding habitat areas. Large, contiguous areas of native vegetation of better condition is available adjacent to the Proposal area which currently provide important habitat linkages to surrounding areas. Clearing for the Proposal is unlikely to significantly fragment the habitat available in the local area and/or regional area. Based on the mobility of the species and the availability of suitable habitat adjacent to the Proposal area, fragmentation of potential populations is considered unlikely.

Adversely affect habitat critical to the survival of a species

The Proposal is unlikely to affect habitat critical to the survival of the species. Up to 45.73 ha of suitable foraging, 14.45 ha of potential breeding habitat and one potential breeding tree will be cleared for the Proposal. The habitat located within the Proposal area consists of habitat described by the recovery plan as critical for the survival of Black Cockatoos (DEC 2008; DPAW 2013).

Although the Proposal area includes habitat for the Black Cockatoos, it is highly modified. The quality of the vegetation was assessed by ELA (2017 a, b, c) and GHD (2017) and of the foraging / potential breeding habitat 56.17 ha (89.68 %) was assigned a condition rating of Completely Degraded. The remaining 6.46 ha (10.32 %) was rated as Good or better.

Given the habitat is highly modified, and well represented adjacent to the Proposal area and in the greater locality, the impacts of the clearing are not considered significant.

Disrupt the breeding cycle of an important population

There is 14.45 ha of potential breeding habitat within the Proposal area and one potential breeding tree present. Given the extent of remaining habitat in the region, the Proposal is considered unlikely to disrupt the breeding cycle of an important population of this species.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

The works associated with the Proposal, may modify and destroy a small proportion of potential habitat for this species, but unlikely to the point that this species would decline significantly. The Project may reduce the overall area of habitat by up to 45.73 ha as a direct loss of habitat from construction. The small scale of this habitat loss within a regional context (i.e. less than 0.06% within the Shire of Harvey) is considered unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitats to the extent that the species is likely to decline.

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Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

The Proposal may potentially exacerbate existing invasive species (such as weeds and introduced predators) that already occur within the Proposal area. However, the potential incremental change is considered to be minor and unlikely to significantly impact the value of the Black Cockatoo habitat adjacent to the Proposal area or Black Cockatoo individuals.

The Proposal is unlikely to result in an invasive species becoming established in the Proposal area to the extent that Black Cockatoos are substantially impacted.

Introduce disease that may cause the species to decline

There is potential that the introduction/spread of Dieback could reduce the flora species diversity and density, and potentially impact on the habitat quality for Black Cockatoos. A Hygiene Procedure will be developed for the Project.

The Proposal is unlikely to introduce a disease (e.g. beak and feather disease virus) that may cause the species to decline. There are no known diseases that may be introduced to the area that may cause the Black Cockatoo population to decline and it is unlikely that any disease already exists in the Proposal area that may be spread by the activities of the Proposal.

Interfere substantially with the recovery of the species

Carnaby's Black Cockatoo:

The Proposal is unlikely to interfere substantially with the recovery of Carnaby's Black Cockatoo as it is unlikely to interfere with the recovery actions outlined in the Carnaby's cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (DPAW 2013) for this species that is managed by DBCA. Actions in the Recovery Plan include:

- protect and manage important habitat
- conduct research to inform management
- undertake regular monitoring
- manage other impacts
- undertake information and communication activities
- engage with the broader community.

Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo:

The Proposal is unlikely to interfere substantially with the recovery of the Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo as it is unlikely to interfere with the recovery actions outlined in the Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Redtailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan (DEC 2008). The Recovery Plan is managed by DBCA. Actions in the Recovery Plan include::

- seek the funding required to implement future recovery actions
- determine and promote non-lethal means of mitigating fruit damage by Baudin's Black Cockatoo in orchards
- eliminate illegal shooting

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- develop and implement strategies to allow for the use of noise emitting devices in orchards
- determine and implement ways to remove feral Honeybees from nesting hollows
- identify factors affecting the number of breeding attempts and breeding success and manage nest hollows to increase recruitment
- determine and implement ways to minimise the effects of mining and urban development on habitat loss
- determine and implement ways to manage forests for the conservation of Forest Black Cockatoos
- identify and manage important sites and protect from threatening processes
- map feeding and breeding habitat critical to survival and important populations, and prepare management guidelines for these habitats
- monitor populations numbers and distribution
- determine the patterns and significance of movement
- maintain the Cockatoo care program and use other opportunities to promote the recovery of Forest Black Cockatoos.

Detailed consideration of the recovery actions outline in the listed recovery plans is included in section 8.5.

Banksia woodlands of the Swan Coastal Plain ecological community

Remnant vegetation remaining within the Proposal area has been identified as representative of the EPBC listed Threatened Ecological Community (TEC) 'Banksia Woodlands of the Swan Coastal Plain' (Banksia Woodland).

The Proposal will result in the clearing of up to 6.37 ha of Banksia Woodland in Good condition.

Significant Impact Guidelines

An assessment of impacts on the Banksia Woodland TEC was undertaken against the Significant Impact Guidelines as presented below.

An action is likely to have a significant impact on a Critically Endangered or Endangered Ecological Community if there is a real chance or possibility that it will:

Reduce the extent of an ecological community

The proposal will result in the permanent clearing of 6.37 ha of Banksia Woodland. The condition of this vegetation has been assessed to be in Excellent (0.09 ha), Good (6.18 ha) and Completely Degraded (0.1 ha) condition. The remnant vegetation within the Proposal area which is representative of the Banksia Woodland TEC, occurs on the edge, and is part of, a larger contiguous area of remnant vegetation that is representative of the Banksia Woodland TEC.

Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines

The proposed clearing is confined to an 87.7 ha area within a 257 ha lease option area within Lot 510 Wellesley Road. 6.37 ha of the proposed vegetation clearing area is mapped as the Banksia Woodland TEC. Approximately 82 ha of vegetation mapped as the Banksia

Significance assessment for MNES

Woodland TEC occurs within the lease option area that will not be impacted by the Proposal. The proposed clearing will reduce the presence of the Banksia Woodland TEC within the lease option area by approximately 7.8% and will not significantly reduce connectivity of remaining remnant vegetation areas.

Adversely affect habitat critical to the survival of an Ecological Community

This TEC is well represented in the surrounding area and much of it is protected within DBCA lands. 6.18 ha of remnant vegetation representative of the TEC which will be cleared occurs along the western boundary of the Proposal area. The area directly east of this, within the Proposal area, consists of previously cleared paddocks (with some regrowth of remnant vegetation) and partially cleared pine plantations. Located along the boundary of previously cleared land (paddocks), is considered unlikely to impact the survival of the TEC.

0.42 ha of remnant vegetation representative of the TEC will be cleared from the boundary of an area referred to as the Banksia Block which is remnant vegetation representative of the TEC in very good to excellent condition. The Banksia Block is approximately 12 ha and is south of an area of previously cleared paddocks. Only 3.5% of this area will be cleared and is considered unlikely to impact the survival of the TEC.

The clearing of 6.37 ha (in total) of this TEC, located along the boundary of previously cleared land (paddocks), is considered unlikely to impact the survival of the TEC.

Modify or destroy abiotic (nonliving) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns

The topography within the Proposal area slopes from west to east, and site drainage will be designed to flow towards north and south perimeter drains which be graded to flow easterly toward two infiltration ponds at the east boundary of the Proposal area. Due to the Proposal area's low topography and deep, well-drained sands, there is limited natural surface water flow within the Proposal area. There is no permanent surface water within the Proposal area however a large portion is mapped as geomorphic wetlands. Areas mapped as wetland have been historically modified through clearing and establishment of pine plantations. The hydrology is currently altered through an existing agricultural drain. The wetland area is almost entirely in Completely Degraded condition and offers little to no ecological value (ELA 2017a).

The vegetation representing the Banksia Woodland TEC is located on the more elevated areas along the western boundary. Surface water flows in an easterly direct. The clearing of the Proposal area is unlikely to result in changes to downstream surface water flows or groundwater levels. The clearing activity is considered unlikely to have any impacts on abiotic factors outside the clearing area and thus impacts on the TEC will be limited.

Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting

No activities likely to cause a change in species composition are proposed. The small scale of clearing of the TEC within the Proposal area is unlikely to cause a substantial change in species composition of the TEC given the relatively large extent of the Banksia Woodland vegetation occurring in the wider area. Furthermore, disturbance associated with the proposed action will be managed and monitored to ensure no impacts occur outside of the Proposal boundary.

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Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:

- Assisting invasive species, that are harmful to the listed ecological community, to become established, or
- Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.

A large proportion of the site is already considered to be disturbed as a result of historical clearing, agriculture and pine plantations. A number of weed species have been observed in the area during previous flora and vegetation surveys.

Disturbances associated with the Proposal will be managed and monitored in accordance with a land clearing procedure (refer to section 4.6.1 for further details) to ensure no disturbance outside of the approved development footprint. Management plans will be prepared and implemented as part of the construction and development stages, including a hygiene procedure for the prevention of spread of weeds and dieback.

It is considered unlikely that the Proposal will cause a substantial change in the quality or integrity of an occurrence of an ecological community.

Interfere with the recovery of an ecological community

The proposed action is unlikely to interfere with the recovery of the Banksia Woodland TEC, given the occurrence of the TEC within the site as a relatively narrow band along the western boundary situated adjacent to previously cleared, highly disturbed land which covers the majority of the Proposal area.

More intact and larger occurrences of the TEC occur to the west, north and south of the Proposal area in the wider locality, much of which is protected within DBCA lands. The proposed clearing area does not represent a key linkage to other remnant vegetation as a large proportion is previously cleared or highly disturbed.

The Proposal is also unlikely to interfere substantially with the recovery of the Banksia Woodland TEC as it is unlikely to interfere with the recovery actions outlined in the

Threatened Orchids (Dwarf Bee-orchid (*Diuris micrantha*), Glossy-leafed Hammer Orchid (*Drakaea elastica*) and Dwarf Hammer-orchid (*Drakaea micrantha*))

Significant Impact Guidelines

An assessment of impacts on *Drakaea elastica*, *Drakaea micrantha* and *Diuris micrantha* was undertaken against the Significant Impact Guidelines as presented below.

Lead to a long-term decrease in the size of an important population of a species

- Clearing of the Proposal area will not lead to a long term decrease in the size of an important population of these species. No individual plants or populations of *Drakaea elastica*, *Drakaea micrantha* or *Diuris micrantha* have been recorded within the Proposal area. The closest recorded location is two individual *Drakaea elastica* plants identified approximately 45 m north of the Proposal area (ELA 2013, AECOM 2012).
- Indirect impacts such as such as dieback spread, weeds, accidental clearing, sedimentation could potentially lead to a decrease in the size of the recorded

Significance assessment for MNES

population of two individuals of *Drakaea elastica*, recorded approximately 45 m north of the Proposal area.

- Effective mitigation measures for clearing, vehicle hygiene and drainage will reduce the risk of indirect impacts occurring (see section 8.4).

Reduce the area of occupancy of the species

- There are no populations recorded within Proposal area
- All orchid species recorded within the KSIA occur within 'sand patch' habitats that are relatively undisturbed and have not yet been subject to ground disturbances in the long term (AECOM 2012, ELA 2013). Sand patches within the Proposal area have been subject to grazing by livestock and now contain a range of annual weed species, in which orchids are not expected to occur (ELA 2017c).
- It is highly unlikely the habitat within project area is suitable for these orchid species given the above.

Fragment an existing population into two or more populations

- There are no populations within Proposal area.
- There is only one recorded population in proximity to the Proposal area approximately 45 m north west.
- The Proposal will not fragment this recorded from another recorded population as recorded populations within the Park are well spread apart.
- The area where the population occurs is linked to other relatively undisturbed habitat considered suitable for the orchid species that is not linked to the Proposal area.

Adversely affect habitat critical to the survival of a species

- The Proposal is considered unlikely to adversely affect habitat critical to the survival of the threatened orchid species.
- The habitat within the Proposal area is not considered suitable for these species due to its level of disturbance and degradation. All orchid species recorded within the KSIA occur within 'sand patch' habitats that are relatively undisturbed and have not yet been subject to ground disturbances in the long term (AECOM 2012, ELA 2013).
- Habitat in proximity to the Proposal area, particularly to the north, is considered to be a suitable 'sand patch' type habitats in which these species are likely to be found.
- Suitable habitat is well represented in the KSIA as there are more than 1,431 ha of DBCA managed lands within the KSIA Buffer Zone. Much of this is relatively undisturbed and provides more suitable habitat for the orchid species.
- Indirect impacts from Proposal activities such as dieback and weed spread, accidental clearing and sedimentation or flooding could potentially occur within the orchid habitat.
- Controls will be in place to prevent indirect impacts occurring within the surrounding suitable habitat include a hygiene procedure, land clearing procedure, and restrictions of offsite activities which will be communicated via the site induction.
- Natural surface water run-off is considered very low, considering the porous nature of the soils present within and surrounding the Proposal area (Bassendean sands). The topographic grade of the area, which will be maintain through development of the Proposal area, is also toward the east therefore if any runoff occurs it will flow away from the orchid habitat.
- Site drainage will also be established which will capture surface water from the Proposal area preventing flooding or sedimentation outside the area. The drainage will direct uncontaminated surface water via the site topographic grade to the

northern or southern perimeter drains which flow from west to east into two infiltration basins.

Disrupt the breeding cycle of a population

- Fire is a significant identified threat to all three threatened orchid species which can affect breeding by removing entire populations.
- The Proposal is expected to increase the risk of fire during the clearing of the Proposal area however once the site has been cleared this risk is expected to reduce as activities will occur within a cleared area.
- The Proposal will implement the requirements of the KSIA Bushfire Management Plan (RUIC Fire 2016) in order to manage the risk of fire.

The works associated with the Proposal, may modify and destroy a small proportion of potential habitat for this species, but unlikely to the point that this species would decline significantly. The Project may reduce the overall area of habitat by up to 45.73 ha as a direct loss of habitat from construction. The small scale of this habitat loss within a regional context (i.e. less than 0.06% within the Shire of Harvey) is considered unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitats to the extent that the species is likely to decline.

Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- A targeted orchid survey (AECOM 2012) only resulted in two recorded locations of *Drakaea elastica* within proximity of the Proposal area, that could be considered to be at risk of indirect impact from the Proposal.
- The Proposal may indirectly impact on the two recorded locations if indirect impacts to the habitat are not effectively controlled.
- The indirect impacts are only likely to modify, remove, destroy or decrease the habitat associated with these two *Drakaea elastica* which is unlikely to cause a the species.
- There is no known habitat of *Drakaea micrantha* or *Diuris micrantha* within proximity of the Proposal area that could be indirectly impacted by the Proposal.

Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered/vulnerable species' habitat

- The Proposal area has a high population and range of weeds (74 species have been identified) as a result of past clearing and grazing activity.
- There have been no weeds of national significance recorded in the Proposal area however one of the species (**Zantedeschia aethiopica*, Arum Lily), listed as a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act), has been recorded.
- Weeds could potentially spread to the area of suitable threatened orchid habitat to the north west as a result of Proposal activities.
- Weed spread is mostly likely to occur as a result of poor hygiene practices when vehicles enter the Proposal Area or if they drive in areas outside the Proposal area, or if cleared soils are not contained within the Proposal area.
- Control of these key risks through a hygiene procedure, land clearing procedure, weed monitoring, weed control program and site rules will reduce the risk of weed spread occurring.

Introduce disease that may cause the species to decline.

- The Proposal occurs in an area at risk of *Phytophthora cinnamomi*.
- Soil on the southern side of Marriott Road has been tested positive for *Phytophthora cinnamomi* and areas of vegetation within the Proposal area are uninterpretable for Dieback presence
- There is potential that Proposal activities could lead to spread of dieback if it is present within, or introduced to, the Proposal area
- A hygiene procedure and land clearing procedure, will be implemented to minimise the risk of introduction or spread of dieback.

Interfere with the recovery of the species.

The Proposal is unlikely to interfere substantially with the recovery of Dwarf Bee-orchid (*Diuris micrantha*), Glossy-leafed Hammer Orchid (*Drakaea elastica*) and Dwarf Hammer-orchid (*Drakaea micrantha*) as it is unlikely to interfere significantly with the recovery actions outlined in the following recovery plan:

- Department of Environment and Conservation (2009). Glossy-leafed Hammer Orchid (*Drakaea elastica*) Recovery Plan. Department of Environment and Conservation, Western Australia.

Detailed consideration of the recovery actions outline in the recovery plans is included in section 8.5.

The Proposal is also unlikely to interfere with the recovery of these threatened orchid species as it is unlikely to significantly exacerbate the threats identified in the following Approved Conservation advice.

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- Department of the Environment, Water, Heritage and the Arts (2008). Approved Conservation Advice for *Drakaea micrantha* (Dwarf Hammer-orchid). Canberra: Department of the Environment, Water, Heritage and the Arts.

Detailed consideration of the threats is outlined in the listed recovery plans is included in section 8.5.

8.7 Predicted outcome

The Proposal will have the following residual impact on MNES.

- Approximately 6.37 ha of native vegetation associated with the 'Banksia Woodlands of the Swan Coastal Plain' TEC will be removed by the Proposal. This vegetation is mostly in Good condition.
- Up to 45.73 ha of suitable foraging habitat for threatened Black Cockatoo species and one potential breeding tree (Jarrah) which is > 500 mm DBH, with no observed hollows will be removed by the Proposal.

The offset described in Chapter 7 is proposed to counter balance this residual impact. A potential offset site has been identified within the KSIA Buffer area (Part Lot 509) which Albemarle plans to acquire and vest in the conservation estate.

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Appendices

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