WESTERN EXTENSION TO THE KEYSBROOK MINERAL SANDS PROJECT, SECTION 40AA, REFERRAL UNDER S.38 THE EP ACT

Prepared For:

KEYSBROOK LEUCOXENE PTY LTD

Report Number:

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DOCUMENT DETAILS

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TABLE OF CONTENTS

TABLES

1. INTRODUCTION

1.1. PURPOSE AND SCOPE

Keysbrook Leucoxene Pty Ltd (KLPL), a subsidiary of Doral Mineral Sands Pty Ltd (Doral), is proposing a significant amendment of an approved proposal under Section 40AA of the *Environmental Protection Act 1986* (EP Act). Specifically, KLPL are seeking to expand its current mining operation for the Keysbrook Mineral Sands Project, which operates under Ministerial Statement No. 810 and No. 1089, to include an additional 511.64ha of mining area located immediately to west of the current operations. The Proposal is a referred to as the 'Western Extension' to the Keysbrook Mineral Sands Mine.

In accordance with the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual* (EPA, 2021a), KLPL seek to refer this Proposal to the Environmental Protection Authority (EPA) under Section 38 of the EP Act for assessment of a significant amendment to an approved Proposal (S.40AA).

This Referral Document has been prepared as a Supplementary Report (Part B) to the Referral Form (Part A) and aims to provide sufficient information about the environmental impacts of the significant amendment in the context of the approved proposal and the proposed application of the mitigation hierarchy to avoid, minimise, rehabilitate (and offset, if appropriate) those impacts. KLPL considers that the existing implementation conditions are adequate to manage the combined and ongoing impacts of the amended Proposal to ensure the EPA's environmental factor objectives are achieved.

The Referral Document (Supplementary Report) has been prepared in accordance with *Referral of a proposal under section 38 of the Environmental Protection Act 1986 Instructions* (EPA, 2021b) and generally follows the *Instructions and Template: Environmental Review Document*.

1.2. PROPONENT

Keysbrook Leucoxene Pty Ltd (KLPL) is a 100% owned subsidiary of Doral Mineral Sands Pty Ltd, which itself is an unlisted public company owned by Iwatani International Corporation of Japan.

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1.3. OTHER APPROVALS AND REGULATIONS

1.3.1. ENVIRONMENTAL PROTECTION ACT 1986 (WA)

The Keysbrook Mineral Sands Mine (Proposal) was initially described in a Public Environmental Review document (MBS, 2006a). The Proposal comprised the excavation of a shallow, low grade mineral sands deposit on farmland near Keysbrook, 70km south of Perth, and initial ore processing to produce a heavy mineral concentrate then transported offsite for further processing. The mining area is predominantly

cleared grazing land with pockets of remnant native vegetation. Mined areas are backfilled with sand and clay tailings and rehabilitated to pasture or native vegetation.

The mine area falls in the Shire of Murray and the Shire of Serpentine Jarrahdale, with fixed ore processing infrastructure in the Shire of Murray. The duration of the Proposal was approximately 8 years, with mining extending over an originally approved footprint of 1,366ha.

During the course of the environmental impact assessment several areas of better-quality remnant native vegetation were excised from the mine footprint, as described in the EPA Report and Recommendations Bulletin 1269 (EPA, 2007).

Eleven appeals were received in response to the EPA Report and Recommendations Bulletin 1269, with concerns relating to, noise, dust, groundwater, nutrient mobilisation, acid sulphate soils, impacts to flora and fauna and the adequacy of community consultation (Office of the Appeals Convenor, 2009). A number of the appeals were upheld, resulting in changes to the implementation conditions that were recommended by the EPA.

Following determination of the appeals and further consultation as to the wording of implementation conditions, the Proposal was conditionally approved by the Minister for Environment on 19 October 2009 through MS810.

On 19 June 2011 Condition 15 of MS810 was amended to correct a clerical error under Section 46c of the EP Act.

A Section 45c request (MBS, 2012) was approved on 4 February 2013 that provided for the relocation of the Wet Concentrator Plant (MS810, Attachment 2) and increased the available land area, by inclusion of an area outside the proposal footprint, within which KLPL was to secure 75ha for the protection of native vegetation in perpetuity, as required under MS810 Condition 6. The relocation of the Wet Concentrator Plant and associated access road fell predominantly on cleared farmland.

On 16 October 2014, MS810 Condition 3 was amended through Ministerial Statement No. 984 under Section 46 to extend the period of authorisation for commencement. Adjustment to the definition of “Acid Sulphate Soils Management Plan” (Condition 16) was also made at this date.

On 8 February 2019 the Minister for Environment amended Condition 14 of MS810 through Ministerial Statement 1089 under Section 46 following an inquiry conducted by the EPA into the regulation and management of noise. The amended condition sets separation distances for mining and processing operations and provides for the distances to be varied by agreement with landowners and/or approval of a specific Noise Monitoring and Management Plan.

A Section 45C request to include Lots 101, 103, 104 and 105 Westcott Road was approved in September 2019, increasing the mine area by 153ha (to 1532ha). These Lots were referred to as the Block of four, as they were an island within the existing approved mine area.

A Section 45c request was submitted in August 2022 to include an additional 70ha of mine area (cleared pasture) located on Lot 56 Westcott Road within the original EPA Development Envelope, which increased the total mine area from 1,532ha to 1,602ha (~4.5% increase) and extends the life of mine by ~1 year (Doral, 2022).

An additional Section 45c request was submitted to the EPA on 4 May 2023 to include 142.3ha of mine area (mapped as cleared pasture) located within Lot 63 Hopeland Road, Keysbrook. This additional area is located

within the existing EPA Development Envelope and increased the total disturbance area to ~1,745ha and extend the life of mine by ~18 months.

The changes to date have been largely administrative, with only minor changes to the spatial extent or environmental risks associated with the Proposal.

Ministerial Statement No 810 and 1089 are provided as Appendix 1.

1.3.2. ENVIRONMENTAL PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (CTH)

In July 2005 the Keysbrook Mineral Sands Mine was determined to be a controlled action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Federal Minister granted approval for the Project, under the EPBC Act on 16 February 2010 (EPBC 2005/2016).

1.3.3. LOCAL GOVERNMENT ACT 1995 (WA)

The Shire of Serpentine Jarrahdale approved the initial application for an extractive industry licence for the project under the Shire of Serpentine Jarrahdale Extractive Industries Local Law 1999, through the powers conferred by the State Local Government Act 1995.

The Extractive Industry Licence and Development Approval for the initial stage of the project was granted on 15 March 2012. On 16 September 2019, the Development Approval for Stage 2 of the Project was granted and Stage 3 (inclusion of Lot 63 Hopeland Rd) was submitted in June 2023.

Development approval within the Shire is guided by the *Planning and Development Act 2005* and the Shire of Serpentine Jarrahdale Local Planning Scheme.

1.3.4. MINING ACT 1978 (WA)

The Proposal does not require approval under the State *Mining Act 1978* as the land titles pre-date 1 January 1899 and consequently ownership of all minerals (except gold, silver and platinum) is vested in the freehold title owner.

1.3.5. RIGHTS IN WATER AND IRRIGATION ACT 1914 (WA)

The Proposal is within the Serpentine Groundwater Management Area, which is a proclaimed area under the State *Rights in Water and Irrigation Act 1914*. Four Groundwater Well Licences (GWLs) have been granted by DWER for implementation of the project to date:

1. GWL 164007 – permits abstraction of up to 1,800,000kL per annum from the Lower Leederville aquifer (Murray Groundwater Area) for mining and mineral processing.
2. GWLs 177296, 176404 & 177336 – permit abstraction of up 200,000kL per annum from the Superficial Swan aquifer for mine pit dewatering.

1.3.6. DECISION-MAKING AUTHORITIES RELEVANT FOR THE PROPOSAL

TABLE 1-1: DMA'S RELEVANT FOR PROPOSAL

DECISION-MAKING AUTHORITY	RELEVANT LEGISLATION
Minister for Environment	*Environmental Protection Act 1986* *Biodiversity Conservation Act 2016*

DECISION-MAKING AUTHORITY	RELEVANT LEGISLATION
Commonwealth Minister for Environment	*Environment Protection and Biodiversity Act 1999*
Minister for Water	*Rights in Water and Irrigation Act 1914*
Minister for Aboriginal Affairs	*Aboriginal Heritage Act 1972*
Minister for Health	*Radiation Safety Act 1975*
Minister for Lands	*Land Administration Act 1997*
Department of Water and Environmental Regulation	Part V of the *Environmental Protection Act 1986* *Environmental Protection Regulations 1987*
Department of Mines, Industry Regulation and Safety	*Work Health and Safety Act 2020* *Work Health and Safety (Mines) Regulations 2022* *Dangerous Goods and Safety Act 2004*
Radiological Council of Western Australia	*Radiation Safety Act 1972*
Shire of Serpentine-Jarrahdale Shire of Murray	*Planning Development Act 2005*

1.4. COMPLIANCE

Compliance performance in the implementation of the Project may be characterised in two periods:

1.4.1. CONSTRUCTION, COMMISSIONING AND EARLY OPERATIONS PRIOR TO JUNE 2017

Project construction and transitioning to steady state operations presented a number of challenges as a new workforce became progressively familiar with site specific operational conditions and monitoring, management and compliance requirements. Instances of potential non-compliance with implementation conditions occurred with respect to operational noise emissions and the full implementation of several required environmental management plans.

Noise

The propagation of operational noise for the Project resulted with a number of complaints raised by surrounding residents in the early period of construction, commissioning and operation.

Under less favourable meteorological conditions during night time operations, operational noise emissions had the potential to exceed assigned levels set by the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) and consequently elements of Condition 14 (MS810). Elevated noise emissions were attributed to specific equipment and shortfalls in design and management. Night mining was suspended while a comprehensive programme to improve noise monitoring, reduce noise emissions and obtain additional agreements with residents was implemented.

KLPL reported problems with the calibration of its then principal noise monitoring device ('Barn Owl') that caused it to under record noise levels, to the Office of the Environmental Protection Authority (OEPA) in November 2016. In a letter dated 27 June 2017, the OEPA advised that these problems constitute a non-compliance with Condition 14-4 which were subsequently rectified by KLPL management actions. KLPL implemented appropriate calibration procedures and deployed a further 5 noise monitors in and around the Proposal area.

At the request of KLPL, the Minister for Environment initiated an inquiry in December 2016 into Condition 14 of MS810 to ensure noise from the Proposal is appropriately regulated and managed (EPA Assessment No 2110). After a period of extensive noise monitoring, modelling and analysis, the Minister for Environment published MS1089 on 8 February 2019 which amended Condition 14 of MS810. The history of noise management and background to the conditions recommended by the EPA, and adopted by the Minister in MS1089, is documented in EPA Report 1627 (December 2018).

The revised Condition 14 (MS1089) imposes significant separation distances (2km day time; 3.3 km night time) between the operations and noise sensitive premises to ensure compliance with assigned levels. The separation distances do not apply in respect to specific noise sensitive premises if an amenity agreement is executed between KLPL and the owner and occupier of the premise. In this event prescribed indoor noise limits apply (MS1089 Condition 14-2).

Through improved noise planning, monitoring and management, and the targeted replacement/attenuation of equipment, operational noise emissions were significantly reduced during 2017 and continued to be reduced in targeted areas during 2018. Coupled with additional amenity agreements this resulted in a corresponding reduction in the number of noise complaints from surrounding residents. The last formal complaint received by KLPL was logged in January 2018.

Implementation of Approved Management Plans

In a report submitted to the OEPA on 30 November 2016, KLPL reported potential non-compliance with the requirement to implement a number of approved management plans. Elements of the following plans were not implemented:

- Weed and Dieback Management Plan (MS810 Condition 9-2);
- Water Management Plan (MS810 condition 11-5);
- Acid Sulphate Soils Management Plan (MS810 Condition 12-2);
- Noise Monitoring Plan (MS810 Condition 14-4);
- Air Quality and Dust Management Plan (MS810 Condition 15-4).

The gaps in implementation were predominantly procedural, did not result in any environmental harm, compromise environmental objectives or impair site environmental performance (noise monitoring and management excepted, as discussed above).

In correspondence dated 27 June 2017, the OEPA advised a determination of non-compliance with the conditions listed above and requested further information and actions in order to return to compliance. KLPL provided a full response to the OEPA on 31 August 2017 and an annual Compliance Assessment Report on 26 October 2017. On 8 November 2017 the OEPA advised that sufficient information had been provided to demonstrate compliance with the relevant conditions.

1.4.2. OPERATIONS PHASE JUNE 2017 – PRESENT

The environmental performance at the Keysbrook Mine progressively improved through the course of 2017 and onwards. With one exception, described below, no material matters of non-compliance or potential non-compliance have been identified in the last 3 years. The improvement in performance is also attributed to the cessation of night mining activities (following ownership change from MZI to Doral in July 2019), tightened operational management and monitoring procedures and improved understanding of the local environment.

Vegetation Clearing

In May 2019, 0.26ha of native vegetation was inadvertently cleared beyond the approved mining area boundary on Lot 59 Westcott Road. The incident was reported to DWER on 27 May 2019, with a follow-up report provided on 1 August 2019. The clearing beyond the boundary resulted from trees felled within the approved mine area falling across and obscuring survey pegs demarcating the limit of clearing. The cleared area is within a paddock that will revert to cattle grazing post mining. KLPL sheeted the area using the cleared vegetation and undertook supplementary planting to promote revegetation of the area. An additional 1ha of native re-vegetation will be undertaken within areas more secure for long term retention as a natural area. Following investigation, internal clearing and demarcation procedures were revised to limit the risk of re-occurrence.

15,000L Diesel Spill

In July 2019, the loss of approximately 15,000L occurred at the sites designated fuel tank. While refueling the sites mobile machines service truck, the service truck operator left the vicinity with the handpiece activated and was not present when overfilling occurred. The automatic shut-off of filling nozzle failed, resulting in overfilling the truck.

Sand bunds were promptly constructed to contain diesel to a section of site drains which report to a sump fitted with an extraction pump which returns water to the sites Process Water Ponds. The pump was isolated to withhold diesel in the sump and additional containment bunds were constructed downstream as a contingency. There was no discharge offsite. Licensed waste carrier engaged to recover ponded water and diesel from the sump. Approximately 40,000L of water/diesel mix was removed from site by a licensed waste carrier. Absorbent booms and matting were deployed to collect any remnant diesel. Recovered sand material was stockpiled and sampled prior to disposal at a licensed waste facility.

Four groundwater monitoring wells were installed to aid in a groundwater investigation to determine if the diesel spill had impacted groundwater. Monitoring to date has indicated that the diesel spill did not impact the groundwater, with multiple rounds of monitoring not detecting hydrocarbons in groundwater at or downstream of the spill site.

Environmental Performance

KLPL's current environmental performance of the approved Project is provided in the most recent Annual Compliance Assessment Report (CAR) (Appendix 2).

2. PROPOSAL

2.1. PROPOSAL CONTENT

Keysbrook Leucoxene Pty Ltd (KLPL), a subsidiary of Doral Mineral Sands Pty Ltd (Doral), is proposing a significant amendment of an approved proposal under Section 40AA of the *Environmental Protection Act 1986* (EP Act). Specifically, KLPL are seeking to expand its current mining operation for the Keysbrook Mineral Sands Project, which operates under MS810 and MS1089, to include an additional 511.64ha of mining area located immediately to west of the current operations (i.e., the Western Extension).

The Proposal is to extend the mine area of the Keysbrook Mineral Sands Mine, located in the Shire of Serpentine Jarrahdale and Shire of Murray 70 km south of Perth (Figure 2-1). The Keysbrook Mine consists of a shallow, low grade ore deposit. The Mine operates 24 hours a day, 7 days a week, however during evening and night time periods (7pm-7am) all mining earthworks activities cease and only the feed prep screening plant fed by a front-end loader and wet Concentrator plant remain in operation.

Specifically, the significant amendment under Section 40AA is to include an additional 511.64ha of mine area located to the west of the currently approved Proposal, which would increase the total mine area from approximately 1,745ha to 2,257ha (~22.5% increase). The additional disturbance area includes 21.04ha of native vegetation, with the remainder comprising cleared pasture and some planted non-native vegetation. The proposed Development Envelope for the Proposal is shown in Figure 2-2. It is noted that the majority of the Proposal area is located within the existing EPA Development Envelope, however a minor extension to include part Lot 64, Lot 507 and Lot 20 has been included.

Ore from the deposit (proposed amendment area) will be mined progressively via a series of shallow open-cut pits using dry mining techniques to a maximum depth of ~5-6mbgl. The average depth of mining however for the proposed amendment area is ~1-2mbgl. Dewatering of groundwater inflows into the pit will be required to enable dry mining to occur during wetter times of the year. Mining will be staged in order to minimise the area of disturbance (at any one time) with the aim of achieving focused and effective management of the environmental factors at each pit location, prior to moving onto the next pit location.

Processing of ore will commence in-pit and then slurry will be pumped from the feed preparation plant to the existing wet concentration plant for further processing. Waste clay and sand materials from processing of this ore will be combined and backfilled into the mine voids using co-flocculation (co-disposal system) where possible. The mined area will be rehabilitated back to pasture, consistent with the post-mine land use requirements.

HMC produced at the wet Concentrator plant will be stockpiled on site prior to transport to Doral's Picton Dry Separation Plant, located ~120km south of the mine, for separation using magnetic and electrostatic processes. The Picton Dry Separation Plant has a licence to process HMC sourced from Doral's Mines. Processing of HMC into products of zircon, ilmenite, and leucoxene has occurred since the Picton Dry Separation Plant was approved by MS484 in 1998. Once processed, HMC products are hauled by truck to either the Bunbury Port or Fremantle Port for export. Processing activities at the Picton Dry Separation Plant and exporting of product remain unaffected by this proposal and thus are not part of this request under Section 38.

Mining within the Western Extension is proposed to operate for 65 months (i.e. 5.5 years), commencing in the first quarter (Q1) of 2026 (i.e. January 2026) and finishing in Q2 of 2031 (i.e. May 2031). The total extent

of mining (disturbance area) during this time is shown in Figure 2-2. A summary of the Proposed Mining Schedule – Western Extension is presented in the following Table.

TABLE 2-1: SUMMARY OF PROPOSED MINING SCHEDULE – WESTERN EXTENSION

MINING SECTION	MINING LOTS	MINING BLOCK NUMBERS	MINING PERIOD
Section 1	201, 507 and 508	403-473	January 2026 to February 2028
Section 2	64	332-400	February 2028 to December 2029
Section 3	63	273, 277, 309, 319, 320, 321, 328, 329	December 2029 to May 2030, & May 2031
Section 4	62 and 20	211-269	May 2030 to April 2031

A Proposal Content Document has been prepared in accordance with *How to identify the Content of a Proposal, Instruction and template* (EPA, 2021c) and is provided as Appendix 3.

2.2. JUSTIFICATION

KLPL as a subsidiary of Doral is a global supplier of the products of mineral sands mining (ilmenite, leucoxene, rutile and zircon). Continuation of mining is core to KLPL's business and crucial to continue to deliver to a global market.

KLPL commenced mining the Keysbrook Mineral Sands Mine in 2015, in accordance with MS810 and MS1089. Mining of the currently approved mine area is due to be completed by January 2024, however at the time of compilation of this application, KLPL is awaiting a 45c Approval for Lot 63 Hopelands Road. Upon the successful approval of this 45c application, the mine life will extend to December 2024.

Doral have been operating in the southwest region of Western Australia since 2002, predominantly at the Dardanup Mine which extracted ore from the Dardanup and Burekup Mineral Sands Deposits, located approximately 20km east of Bunbury. Operations ceased at the Dardanup Mine in December 2015 and the Site has been rehabilitated back to the agreed end land use and mining tenements relinquished.

Doral commenced mining the Yoongarillup Mineral Sands Deposit (Yoongarillup Mine), located 17km southeast of Busselton, in January 2017. Mining operations were completed in 2020, with the Site now fully rehabilitated in accordance with the Site's Mine Closure Plan and is soon to undergo an application for relinquishment.

Doral commenced mining the Yalyalup Mineral Sands Deposit in November 2021 in accordance with MS1168.

Doral also operates a Dry Separation Plant at Picton, 10km east of Bunbury, which receives HMC from Doral's Yalyalup Mine and KLPL's Keysbrook Mine.

Employing approximately 100 staff and contractors, KLPL's business is a source of employment locally and provides business for suppliers, distributors and local services (e.g., mechanics, contractors, consultants). KLPL contributes financial support to local schools, sporting groups, various volunteer groups, and annual local festivals and is considered a valuable member of the local community.

Current mining ore reserves at the Keysbrook Mine inclusive of the 45c request for Lot 63, are anticipated to be completed by the end of 2024. An alternative additional ore source is therefore required to continue

to meet global demand and to ensure the continued employment of KLPL's employees and contractors. Continuation of mining operations at the Keysbrook Mineral Sands Project will enable KLPL to continue operating in the Peel Region of Western Australia and ensure employees and contractors are retained in the region and local support to communities continues.

2.3. PROPOSAL ALTERNATIVES

KLPL have analysed the alternatives to mining the Western Extension to the Keysbrook Mineral Sands Project. A discussion of the alternatives is provided as follows.

IS THIS PROPOSAL NEEDED

KLPL is a global supplier of the products of mineral sands mining (ilmenite, leucoxene, rutile and zircon). Continuation of mining is core to KLPL's business and crucial to continue to deliver to a global market.

Ilmenite, rutile, leucoxene (an alteration product of ilmenite) and HITI (which is a blend of ilmenite and leucoxene) are mainly used to make pure white, highly light refractive and ultra-violet light absorbing, Titanium Dioxide pigment for use in protective house and car paints; paper; plastics; ink; rubber; textiles; cosmetics; sun screens; leather and ceramics. Because titanium dioxide is non-toxic and biologically inert, it can be safely used in foodstuffs and pharmaceuticals. Super strong, lightweight and corrosion resistant titanium metals are also used in the construction of aircraft, spacecraft and motor vehicles, and for medical implants. Again, its non-reactive properties make titanium one of the few materials the human body will not reject; consequently, it is widely used in such medical operations as hip replacements and the installation of heart pacemakers. This super metal is also being increasingly used in the manufacture of strong, lightweight sports equipment, jewellery and other advanced engineering applications.

Zircon is used in ceramics, specialty castings and various refractory applications, where its resistance to high temperature and abrasion make it extremely valuable in the manufacturing processes as well as ceramics such as glazes for tiles and sanitary wear. In industry, it is mainly used as a raw material in making refractory bricks, furnace linings and producing pigments in the ceramic industry; where its opacity and hardness gives a whiteness and durability to tiles, sanitary ware and tableware. It is also utilized in a range of other high-tech industrial and chemical applications.

KLPL's operations meet a global need for ilmenite, rutile and zircon and provide the West Australian community with employment. It is noted that Ilmenite Rare Earths and Zircon are listed as Critical Minerals on Federal Dept Industry website (https://www.industry.gov.au/publications/australias-critical-minerals-list). KLPL currently abstracts ore to produce these products from its Keysbrook Mine, however the ore reserves within the approved mine area are due to be exhausted by 2024. An alternative ore source is required to continue to meet global demand and to ensure the continued employment of KLPL's employees.

OTHER TECHNOLOGIES OR OPTIONS

Open cut mining of mineral sands is a well-established practice in Western Australia due to the shallow nature of the deposits, which generally occur between the surface to 10m deep in the region. Deposits are usually strand-like and occur at the location of ancient shorelines. Disturbance occurs only on the surface layers and not at depth compared to other forms of mining (e.g., iron ore mining can have pit depths of greater than 100-200m deep). The use of alternative technologies can be more expensive (e.g., horizontal drilling) and have their own associated impacts and may not result in fewer disturbances to the environment.

LOCATION OPTIONS

KLPL are constrained spatially, as the location of mineral sands deposits are the targeted location, and in the Peel Region these are largely associated from the foothills of the Darling Scarp to the coast. The grade of HMC discovered through exploration drilling largely determines the areas that are viable and can be extracted for sale. In this case KLPL have conducted extensive exploration drilling, and the results of aircore testing indicates the Western Extension area contains viable mineral. The location of the Western Extension is immediately adjacent to the current mine area, which enables the existing processing infrastructure to remain operational in its current location. Doral hold other tenements in the southwest, however economic resources have yet to be defined for these. As such limited environmental or technical studies have been undertaken on these tenements.

OPTIMISATION OF PROPOSAL TO MINIMISE ENVIRONMENTAL IMPACTS

The design of the Proposal and placement of mine pits is continually evaluated through stages of exploration drilling. Exploration drilling has been occurring in the subject area since approximately 2007 and since that time KLPL have designed a series of mine pit configurations, resulting in the layout presented in this Referral Document.

The following design optimisations have been incorporated into the design and layout of the Proposal to minimise environmental impacts:

- Areas containing native vegetation have been avoided where possible to minimise the need to clear vegetation;
- Utilisation of the existing mine infrastructure located on the adjacent approved Keysbrook Mine site to reduce the total area disturbed;
- Location of processing equipment in-pit (e.g., hopper) to minimise noise emissions to sensitive receptors;
- Incorporation of noise bunds to minimise potential noise impacts under certain wind conditions on nearby residences;
- Incorporation of several options for emergency discharge of water in the event of extended periods of heavy rainfall.

2.4. LOCAL AND REGIONAL CONTEXT

2.4.1. LOCATION

The Proposal is located in the Shire of Serpentine Jarrahdale and Shire of Murray approximately:

- 55km south of the Perth Central Business District;
- 35km south of the Armadale Regional Centre;
- 25km south east of the Rockingham Regional Centre;
- 23km north east of the Mandurah Regional Centre;
- 7.5km north west of the North Dandalup Town Site;
- 2.5km west of the Keysbrook Town Site.

2.4.2. LAND TENURE

The legal description of the Proposal area is detailed in the following table, with a copy of the Certificate of Title included in Appendix 4.

TABLE 2-2: LEGAL DESCRIPTION OF PROPOSAL

LOT	ADDRESS	PLAN / DIAGRAM	VOLUME	FOLIO	OWNERSHIP
20	1491 Hopeland Rd, Keysbrook	41621	2567	177	Private/KLPL
62 Comprises:					
31	NA	408493	2932	228	Private/KLPL
32	NA	408493	2932	229	
33	NA	408493	2932	230	
34	1391 Hopeland Rd, North Dandalup	408493	2932	231	
63	1265 Hopeland Rd, Keysbrook	739	1049	169	Private/KLPL
64	603 Elliott Rd, Keysbrook	739	1667	630	Private
201	580 Elliott Rd, Keysbrook	68316	2765	289	Private/KLPL
508	630 Elliott Rd, Keysbrook	91207	2115	24	Private
507	Elliot Road, Keysbrook	91207	2115	23	Private

2.4.3. LANDUSE

The Proposal area currently accommodates agricultural land use comprising annual pasture, cattle grazing and horse agistment. Limited remnant native vegetation occurs within the Proposal Area, with the exception of some small areas of generally degraded overstorey vegetation.

3. STAKEHOLDER ENGAGEMENT

3.1. KEY STAKEHOLDERS

Doral is committed to undertaking a proactive engagement program with its stakeholders, government and the broader community as part of its community engagement program for the Proposal. Key stakeholders for the Proposal have been identified as having an influence and/or interest throughout the life of the Project and who are impacted by the Proposal's operations.

Doral (previously MZI Resources Pty Ltd) has proactively engaged with its stakeholders from 2012 onwards with the commencement of the Keysbrook mineral sands operation in 2015. Stakeholder engagement and communications are managed by a dedicated Community Relations Manager who has been in this role since 2012. A community consultative group, the Keysbrook CCG, has been operational since 2012 and is comprised of local Councillors and community members. The CCG has been meeting every 6 weeks since 2012 and for the last few years, meeting quarterly at the Keysbrook Hall.

A regular Keysbrook site community update is sent to all neighbours on a 6 – 12-week basis in addition to an annual / bi-annual newsletter.

The key stakeholders for the Proposal identified to date include the following as identified in Table 3-1.

TABLE 3-1: KEY STAKEHOLDERS

KEY STAKEHOLDER GROUP	
Landowners	• Landowners within the development envelope • Near neighbours
Local Government Authorities	• Shire of Murray • Shire of Serpentine Jarrahdale
State Government Departments and Agencies	• Department of Water and Environmental Regulation (DWER)
Members of Parliament	• Local member for Darling Range, Hugh Jones MLA • Local member for Murray, Robyn Clarke MLA • Federal member for Canning Andrew Hastie
Non-Government Organisations, including special interest groups	• Keysbrook Volunteer Bushfire Brigade • North Dandalup Volunteer Bushfire Brigade • Landcare SJ • Peel Harvey Catchment Council

3.2. STAKEHOLDER ENGAGEMENT PROCESS

The objective of Doral's stakeholder engagement program is to provide timely information to ensure key issues and concerns have been identified and can be managed effectively throughout the life of the project.

Doral's approach to implementing the engagement strategy and ongoing consultation includes:

- Identification of key stakeholders, documenting interests and concerns in relation to the project;
- Communicate clearly the purpose of the consultation and provide information in a timely manner;
- Implement communications to effectively manage ongoing engagement activities over the life of the project, whilst allowing for meaningful input into the project design through the expression of concerns;
- Document and record stakeholder interactions through its Consultation Manager software program;
- Implement the Stakeholder Interaction Policy and Procedure to ensure stakeholder concerns or grievances are appropriately documented and managed;
- A dedicated community mobile is provided and promoted amongst near neighbours for any queries or concerns outside of normal business hours.

The following table provides a summary of Doral's Stakeholder Engagement Process.

TABLE 3-2: STAKEHOLDER ENGAGEMENT PROCESS

KEY STAKEHOLDER GROUP	TIMING	ENGAGEMENT METHOD
Landowners	• Quarterly or as required	• One-On-One meetings • Correspondence /Project Updates • Newsletters /Fact Sheet
Local Government Authorities	• Annually	• Project briefing • Newsletter / Fact Sheet
State Government Departments and Agencies	• Ongoing / as required	• Meetings • Correspondence /Project Updates
Members of Parliament	• Annually	• Meetings • Project updates • Newsletter / Fact Sheet
Non-Government Organisations, including special interest groups	• Annually	• Meetings • Project updates • Newsletter / Fact Sheet

Ongoing Stakeholder Consultation

The implementation of Doral's Stakeholder Engagement Plan will ensure the delivery of timely and regular communication activities based around key milestone dates and events that is relevant to key stakeholders.

Ongoing consultation activities will include:

- One on one meetings with landholders;
- Community update letter to landholders and near neighbours;

- Project Newsletter to the broader community;
- Project fact sheets;
- Provision of 24-hour contact cards to nearest neighbours for any issue or concern;
- Briefings and presentations to local government, community groups and key stakeholders;
- Mine site tour for interested parties;
- Continued appointment of Corporate Affairs / Community Relations Manager.

3.3. STAKEHOLDER CONSULTATION

A summary of Stakeholder consultation undertaken to date is provided in the following table.

TABLE 3-3: STAKEHOLDER CONSULTATION UNDERTAKEN

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
DWER (OEPA) – Aidan Walsh, Helen Butterworth	15/03/23	Presentation of foreseeable end of Keysbrook approved mine reserves, proposal to submit 45c application for 45c amendment to allow time for larger Western Extension approvals to be processed	45c application (for Lot 56) needs to be low risk (and was subsequently submitted in October 2022). The larger Western Extension project would need to be referred as a Section 40AA significant amendment to approved project.
DWER (OEPA) – Samara Rogers	03/03/23	Pre-referral meeting to discuss the future of the Keysbrook project including proposed stages of extension and subsequent requests for approvals including the submission of this section 40AA.	EPA services is very busy, prioritise the most critical approval to the top of the list. Therefore, the submission of this 40AA was postponed from April pending the approval of proposed 45c to Lots 56 and 63.
LANDOWNERS (require approvals and/or agreements)			
Doral owned property Lot 63 – Hopelands Road	Leaseholder receives regular site update letters, various meetings held. Extension update 4/4/23, 14/4/23, 23/8/23 and various discussions with Mine Manager	Under agreement. Doral purchased in 2022, subject to lease arrangement. Ongoing engagement. Property included in western extension.	Seek alternative grazing pasture when mining commences.
Lot 507	Receives regular site update letters.	Discussions ongoing in regard to extension proposal.	Amenity agreement discussion in progress, commitment to keep in

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
Lot 1 – Hopelands Road	Extension update 4/4/23, 14/4/23, 23/8/23 Phone conversation with family 10/07/23		informed in regard to project milestones.
Lot 508 – Elliott Road	Receives regular site update letters, various meetings held. Extension update 4/4/23, 14/4/23, 23/8/23	Under Mining Agreement, regular engagement on various matters in relation to mining agreement. Property included in western extension.	Supportive of project, timing around commencement of mining is highest concern, seeking early mining commencement.
Lot 64 – Elliott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held on 15/08/2023	Under Agreement, ongoing engagement, primary concerns are noise and dust. Property is included in extension, no mining agreement secured.	Continue to work with landholder in regard to management of these matters. Proactive actions remain being avoidance of topsoil removal in high winds, water cart usage on roads, predictive noise modelling to manage mine activities based on weather. Keep informed of timing associated with Lot 63. Continued discussion with Mine Manager on operational matters.
Doral Owned property Lot 212 – Elliott Road	Doral purchased in August 2023. Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call with tenant 22 /08/23	Doral owned, tenant under Agreement. Property included in extension.	Ongoing engagement with tenant, new lease agreement in progress.
Doral owned property Lot 20 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 22/08/23	Under agreement. Ongoing engagement. Tenant informed of extension and timelines.	Query in regard to length of tenancy in relation to western extension, extended stay permitted subject to approvals. Commitment to keep informed.
Doral owned property	Ongoing engagement	Under Agreement. Tenanted, informed of extension and timelines.	Keep informed in regard to approval developments for Lot 63 and broader western extension.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
Lot 211 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23		
Lot 212 – Hopelands Road	Ongoing engagement, receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting 9/06/23	Under agreement. Tenanted, various conversations with owner, receives community updates.	Keep informed in regard to approval developments for Lot 63 and broader western extension.
Lot 11 – Hopeland Road	Regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	No residence.	Keep informed in regard to approval developments for Lot 63 and broader western extension.
Lot 12 – Readheads Road 2 residences	Ongoing engagement Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 16/08/23	Advised had noticed water table had dropped, no other issues raised.	Advised we had community bore monitoring program and could be included on this. Will revert if any issues, will also pass on message to neighbour. Keep informed in regard to approval developments for Lot 63 and broader western extension. Meeting to be requested in regard to amenity agreement discussion.
Lot 101/ 102 – Readheads Road	Ongoing engagement Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting 23/08/23	At meeting discussed proposed mine plan and timings. Queried if exploration had been completed on property.	Meeting in progress to provide information on exploration data. Keep informed in regard to approval developments for Lot 63 and broader western extension. Meeting to be requested in regard to amenity agreement discussion.
Lot 5 – Readheads Road	Ongoing engagement Receives regular site update letters.	Deceased estate, unaware of new owner details.	In progress to ascertain new owner details. Correspondence has been sent to same address as previously.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Extension update 4/4/23, 14/4/23, 23/8/23 16/08/23 – phone call attempt, no answer.		
Lot 506 – St Blaise Grove	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 16/08/23	No issues. Receives all site community update letters, issued quarterly.	Will keep informed of any developments.
Lot 3 – Hopeland Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone conversation 14/08/23	No issues, mining not a problem in previously mined areas.	Commitment to keep informed in regard to approvals and the western extension, meeting to be requested in regard to amenity agreement discussion.
Lot 309 and 310 – Hopeland Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	No feedback received in regard to extension letters.	Keep informed in regard to approval developments for Lot 63 and broader western extension. Meeting to be requested in regard to amenity agreement discussion.
Lot 700 – Hopeland Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call and text 23 /08/23	Under agreement, house is tenanted, no issues	No concerns, commitment to provide updates when available. Will continue to keep informed.
Lot 701 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held 15/7/23	Under agreement. Ongoing engagement. Concerns raised as to proximity of mining to residence, noise and dust.	Advised same mitigation measures will be implemented and commitment to further discussion and collaborative approach when mining relocates closer to residence.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Phone call 21 /08/23		
Lot 12 – Hopelands Road (2 residences)	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting 3/5/23 Text on 21 /08/23	Under agreement, two houses. Discussions held around western extension.	No specific concerns, advised same mitigation measures will be implemented and commitment to further discussion and collaborative approach. Continue to keep informed, will contact when available for further meeting in relation to Lot 63.
Lot 503 – Elliott Road	Phone call 25/07/23. Copy of letter dated 4/4/23 and 24/08/23 sent via email.	No issues, house not tenanted. Land managed by caretaker / farm manager, owner resides overseas, no intention to rent. Western extension letter sent to Farm Manager to forward on to owner. Farm manager advised no issues with the proposal and will seek feedback from owner.	Will keep informed of any developments.
Lot 500 – Elliott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone conversation 7/08/23	Property is Under Offer, has been on market for significant time. Various conversations around Iluka tenement. Email received from Owner on 7/10/21 providing approval to EPA for Doral to mine Lot 64. No issues in regard to current western extension.	Was not willing to sign amenity agreement whilst property remains for sale. Doral requested when property is sold, to advise who the new owners are to arrange a meeting.
Lot 20 – Elliott Road	Receives regular site update letters. Meeting 3/8/21 Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held 15/08/23, site tour on 23/08/23	Under agreement. No major issues, noted on some occasions can hear site on still nights, clearing of native vegetation.	Toured site on 23/08/23, will keep informed of any developments.
Lot 1, 2, 67 – Hopelands Road (2 residences)	Receives regular site update letters.	Various discussions, amenity agreement previously presented.	Environment Manager detailed mitigation and preventative measures to be implemented to address concerns

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held 23/08/23	Issues include: noise can be heard at night on occasions, dust is a significant concern and especially in regard to the race horses, clearing of native vegetation.	raised. Advised further meeting beneficial to run through finalised environmental plans. Advised will follow up in the new year in regard to amenity agreement. Offered site tour.
Lot 2 – Hopelands Road	Obtained details from owner of Lot 1,2,67	Meeting request in progress.	
Lot 501 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting held 23/08/23	No issues, has worked with Doral (previously MZI Resources previously).	Follow up meeting in progress in regard to amenity agreement. Will keep informed of any developments.
Lot 500 – Hopelands Road		In progress to ascertain contact details.	
Lot 70 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 21/08/23	No residence Phone conversation, provided update on Lot 63 and the western extension.	Will keep informed of any developments.
Lot 71 – Hopelands Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23	No residence. Discussions have been around exploration access for neighbouring property.	Will keep informed of any developments.
Lot 56 – Westcott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Various meetings. Phone call 23/08/23	Under Agreement, ongoing engagement. Concerns raised in regard to Doral owned Lot 212 and existing lease arrangement as currently leases from previous owner.	Continue to work with landholder in regard to lease arrangement.
Lot 4 – Westcott Road	Receives regular site update letters.	Under agreement for proposed mining for Lot 56. Ongoing engagement. Concerns raised in	Advised same mitigation measures for current operations will be implemented

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
	Extension update 4/4/23, 14/4/23, 23/8/23 Various meetings.	regard to dust and noise in regard to mining on Lot 56.	and commitment to further discussion and collaborative approach. Further discussion required for amenity agreement for western extension
Residents south of Readheads Road	Contact details to be obtained and is in progress.		Intention is to have those within close proximity to be under agreement, consultation in progress.
NEAR NEIGHBOURS			
Lot 1 – Elliott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Meeting in April 2023 with Environment Manager Phone call 14/08/23	Receives all site update letters, involved in site native revegetation program and in contact with Doral team. Dust and operational impact on water table is primary concern.	Various meetings to run through annual water monitoring data. Participates in the community bore monitoring program, bore is tested every quarter. Advised noise not an issue.
Lot 501 – Elliott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 16/08/23	Receives all site community update letters, issued quarterly. Primarily noise, can sometimes hear loader at night, not constant. Concerns around clearing of native vegetation.	Feedback noted. Aware of sites native revegetation program.
Lot 508 – St Blaise Grove	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call 16/08/23, received text	No issues. Receives all site community update letters, issued quarterly.	Will keep informed of any developments.
Lot 13 and 14 – Westcott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone call and email, 16/08/23	No issues. Receives all site community update letters, issued quarterly. Have met previously through discussions regarding mine access to Lot 56.	Will keep informed of any developments.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
Lot 54 – Westcott Road	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Phone conversation 7/08/23	No issues. Receives all site community update letters, issued quarterly. Various meetings over the years. Advised mining for Lot 56 is delayed and advised plans for Western Extension.	No issues in regard to Western Extension. Advised we would keep them informed as to any plans in regard to Lot 56, which is closer to their residence than the Western Extension.
OTHER STAKEHOLDERS			
Local MP Robyn Clarke MLA	Receives regular site update letters. Extension update 4/4/23, 14/4/23, 23/8/23 Email: 21/08/23	No issues, supportive of Company's community funding program.	Annual meeting requested for late 2023.
Local MP Hugh Jones MLA	Receives regular site update letters. Extension update 4/4/23, 14/4/23 23/8/23 Email: 21/08/23	No issues, supportive of Company's community funding program.	Annual meeting requested for late 2023.
CY O'Connor Research Facility	26 July 2023	Presentation to Group on western extension. Questions in regard to mine life, water allocation, rehabilitation techniques.	Advised of monthly water monitoring and reporting process and rehabilitation commitments. Offered site tour for those interested.
North Dandalup and Keysbrook Volunteer Bushfire Brigades	Annually, every October	An annual site visit by the Groups to ensure members are provided with the latest information in regard to its operations and identify and confirm the site's ability to respond to emergency situations.	Any corrective actions or suggestions will be implemented as identified.
COMMUNICATIONS			
Western Extension letter, sent to closest neighbours for western extension.	Dated 4 April 2023. Sent to 44 neighbours.	Detailed letter outlining environmental measures and operating details associated with the Western Extension.	No phone calls or feedback received on receipt of letter.

STAKEHOLDER	DATE	ISSUES/TOPICS RAISED	PROPONENT RESPONSE/OUTCOME
Keysbrook site updates, sent to all on community database.	Dated 14 April 2023. Sent to 85 neighbours, close and interested neighbours.	Western Extension update. Community update letters are sent approximately every 8 – 12 weeks and have been sent to nearest neighbours since 2012.	No phone calls or feedback received on receipt of letter.
Keysbrook site updates, sent to all on community database.	Dated 23 August 2023. Sent to 85 neighbours, close and interested neighbours.	Western Extension update. Community update letters are sent approximately every 8 – 12 weeks and have been sent to nearest neighbours since 2012.	No phone calls or feedback received on receipt of letter.
Keysbrook Community Consultative Group (CCG), meeting since 2012	2 May 2023 2 August 2023 Next: 1 November 2023	Both meetings focused on the western extension and current timings, community consultation, approvals process. Queries were based on mine life, future deposits, ongoing employment and crossing of Elliott Road.	Continue to keep informed of developments, timings and any community concerns raised during the consultation period. Minutes are made available on the Doral website.
Annual Newsletter	Planned for October 2023	To include details of western extension.	

Doral is committed to ensuring that all stakeholder feedback is documented and considered as part of the Proposal. Stakeholder engagement remains an ongoing activity for the Mine, which includes regular and timely information provided to all key stakeholders regarding the environmental approvals process and subsequent updates as the mine plan layout and timings progress.

4. OBJECT AND PRINCIPLES OF THE EP ACT

4.1. PRINCIPLES

The EP Act sets out five principles by which protection of the environment is to be achieved in Western Australia. These principles, and the manner in which KLPL has sought to apply them in the design and planned implementation of the Proposal, are outlined in Table 4-1.

TABLE 4-1: EP ACT PRINCIPLES

PRINCIPLE	CONSIDERATION
1. Precautionary Principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: • Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; • An assessment of the risk weighted consequences of various options.	KLPL have used existing environmental data and commissioned site-specific investigations and assessments to assess risk to relevant environmental values during the design of the Proposal. Environmental management and monitoring plans have been prepared to avoid or minimise impacts on identified environmental values. Doral have maintained engagement with relevant government agencies (see Table 3-3) to minimise any uncertainty surrounding the environmental impact of the Proposal.
2. Intergenerational Equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	KLPL recognises the importance of intergenerational equity and throughout the management measures sections of this Referral Document, measures to appropriately manage potential impacts to ensure health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations are presented.
3. Conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integrity should be a fundamental consideration.	KLPL recognise the values of native vegetation, fauna habitat and ecological linkages for maintaining diversity and ecosystem function within the Development Envelope and have designed the Proposal to avoid clearing vegetation as far as practicable.
4. Improved valuation, pricing and incentives mechanisms i. Environmental factors should be included in the valuation of assets and services. ii. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement.	KLPL have factored in the costs of implementing environmental management measures into annual budgets for the Proposal. The following valuation, pricing and incentive mechanisms have been considered: • Include costs of environmental management and monitoring into annual budgets;

PRINCIPLE	CONSIDERATION
iii. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes. iv. Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentives structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	• Include estimated costs for closure and rehabilitation; • Minimisation of native vegetation clearing which provides costs savings associated with earthworks, rehabilitation and provision of offsets; • Improve efficiencies with water consumption and water recycling; • Minimise the use of consumables where possible and identify opportunities for reuse and recycling of materials.
5. Waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge.	KLPL's Environmental Management System (EMS) includes waste management plans, waste management procedures and incident reporting procedures which will be communicated to staff in inductions and regular meetings to ensure best practise management of wastes is implemented for the Proposal. KLPL commits to minimising waste as far as practicable during construction, operation and closure by adopting the waste controls hierarchy; avoid, reduce, reuse, recycle and safe disposal.

4.2. IDENTIFICATION OF ENVIRONMENTAL FACTORS

The EPA's *Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual* (EPA, 2021a) defines a number of environmental factors, organised into five themes: Sea, Land, Water, Air and People that are utilised by the EPA to conduct an Environmental Impact Assessment (EIA).

To assist in determining the Key Environmental Factors for the Proposal, KLPL has assessed all information available, including existing information from the approved Keysbrook Mine, as well as new site-specific information obtained from surveys, investigations and assessments for the Proposal. The following Key Environmental Factors have been identified:

- Flora and Vegetation;
- Terrestrial Fauna;
- Inland Waters;
- Social Surroundings (noise);
- Air Quality.

Information relating to these environment factors, including regional context, baseline data, potential impacts and mitigation measures are discussed in detail in Sections 5, 6, 7, 8 and 9.

Additional Environmental factors considered relevant to the Proposal but not determined to be key environmental factors include:

- Greenhouse Gas Emissions.

This Environmental Factor is discussed in Section 10.

5. ENVIRONMENTAL FACTORS – FLORA AND VEGETATION

5.1. EPA OBJECTIVE

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

5.2. POLICY AND GUIDANCE

- *Statement of Environmental principles, Factors and Objectives* (EPA, 2021d)
- *Environmental Factor Guideline – Flora and Vegetation* (EPA, 2016a).
- *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016b).
- *Instructions on how to Prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (EPA, 2016c).
- *Environmental Offsets Policy, Perth, Western Australia (Government of Western Australia, 2011).*
- *Environmental Offsets Guidelines, Perth, Western Australia (Government of Western Australia, 2014).*

<u>Other Policy and Guidance</u>

- Matters of National Environmental Significance. Significant Impact Guidelines 1.1. *Environmental Protection and Biodiversity Conservation Act 1999* (DoE, 2013).
- *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a).
- *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi. Canberra, ACT: Commonwealth of Australia (DoE, 2014).*

5.3. ORIGINAL PROPOSAL

The majority of land within the original Project area is cleared pasture and used for beef or dairy cattle grazing. Remnant native vegetation occurs in pockets and as scattered trees over pasture due to extensive clearing for agriculture. Long term grazing has resulted in removal of the understorey in the remnant areas within the approved mining footprint and consequently the vegetation condition within the mine footprint was predominantly degraded.

The vegetation complexes, as defined by (Heddle, Loneragan, & Havel, 1980) within the mine area include Bassendean Central and South, Guidlford and Southern River complexes. The original Project required disturbance of up to 1,366ha, which allowed for up to 182ha of native vegetation clearing comprising stands of mature trees mainly subject to permanent or intermittent grazing by cattle, and having minimal or no understorey.

The remnant vegetation within the mine area was mapped as Marri (*Corymbia calophylla*) woodland (MBS, 2006a), comprising nine vegetation units as identified by (Bennett Environmental Consulting, 2006). Floristic analyses stemming from these surveys indicated two potential Threatened Ecological Communities (FCT3a and FCT3b) in the survey area that were degraded to completely degraded and consequently not worthy of conservation (Bennett Environmental Consulting, 2006).

No Declared Rare Flora or Priority Listed Flora were located within the Project area during these surveys (MBS, 2006a) (Bennett Environmental Consulting, 2006). Furthermore, a Detailed and Targeted Flora and Vegetation Survey conducted in 2020, identified the following:

- No Threatened or Priority flora or other flora of conservation significance;
- No Declared Pest Plants or Weeds of National Significance were found; and,
- None of the vegetation units on site were regarded as occurrences of Threatened Ecological Communities.

Bennett Environmental Consulting (2006) also identified the presence of 34 weed species, of which 28 were considered invasive. Weeds of particular concern due to their ability to invade natural bushland and change the structure, composition and function of ecosystems included *Bromus diandrus* (Great brome*), Ehrharta calycina* (Perennial veldt grass), *Leptospermum laevigatum* (Victorian teatree) and *Romulea rosea* (Guildford grass). *Phytophthora cinnamomi* (dieback) was also identified to be present in some upland vegetation on the eastern patch of remnant native vegetation on Lot 59.

A 2006 baseline survey identified *Phytophthora cinnamomi* in the Project area (MBS, 2006a). Additional surveys undertaken in 2013 and 2016 confirmed the presence of the pathogen in an area of highly disturbed remnant vegetation (Terratree, 2013; 2017a). The cleared, grazing areas that formed the majority of the 2013 and 2016 survey areas were determined to be unmappable (uninterpretable) given the absence of indicator species. Remnant vegetation in the area surveyed is classified as degraded, with few indicator species remaining. A Dieback risk assessment determined that these areas must be assumed to be infested and managed accordingly (Terratree, 2017a). This determination can be applied to much of the project area given intensive and unrestricted livestock movement between areas of infested and excluded vegetation and periods of seasonal inundation across the lower areas. Similarly, the risk assessment concluded it is likely *P. cinnamomi* is present in the drainage lines and tributaries in the surrounding areas and hence the areas should be managed as if designated infested.

Subsequent changes to the Original Project following the 45c approval for land located in the centre of the existing operation (Block of 4) in 2019 (MS 810, Attachment 3) increased the disturbance area to 1,532ha.

Potential indirect environmental impacts on native vegetation outside of the approved mining footprint associated with implementation of the Project (as reported in Bulletin 1269) included a decline in condition or mortality as a result of:

- Reduced water availability caused by groundwater abstraction;
- Excessive dust deposition;
- The spread of invasive weed species or Dieback (*Phytophthora cinnamomi*).

5.4. RECEIVING ENVIRONMENT

5.4.1. SURVEYS

Three separate Flora and Vegetation surveys have been conducted for the Proposal as shown on Figure 5-1.

These include:

- Survey 1 – Detailed, Reconnaissance and Targeted Flora and Vegetation Survey, Lot 64 Elliot Road Keysbrook, WA (Ecoedge, 2021).

  - The survey was undertaken on 27 October 2020, 10 November 2020 and 18 August 2021 in accordance with the (EPA, 2016b).

- Survey 2 – Detailed, Reconnaissance and Targeted Flora and Vegetation Survey, Lot 57, 508, 201 Elliot Road and Part Lot 56 Westcott Road Keysbrook, WA (Ecoedge, 2022).
  - The survey was undertaken on 9 and 20 August, and 22 and 23 September 2021 in accordance with the (EPA, 2016b).
- Survey 3 – Detailed, Reconnaissance and Targeted Flora and Vegetation Survey, Lots 20, 62, 63 and 211, Keysbrook, WA (Ecoedge, 2023).
  - The survey was undertaken on 12 and 13 July, 18 August, 16 September and 10 November 2022 in accordance with the (EPA, 2016b).

All reports are included as Appendix 5.

5.4.2. SOIL LANDSCAPE SYSTEMS

The Proposal area occurs across the Bassendean land system (212_Bs) and the Pinjarra land system (213_Pj). The Bassendean land system is comprised predominantly of sand dunes and sand plains of deep, pale grey, siliceous sand intervened with sandy and clayey swamps with some black, peaty soils (van Gool 1990). The Pinjarra land system is predominantly poorly drained coastal plain, characterised by semi-wet soils that can range from grey deep sandy duplexes to brown loamy earths, pale sands and clays (van Gool, 1990). These systems have been divided into soil phases based on local soil conditions, with the soil phases found in the Proposal area described in the following table and shown on Figure 5-2.

TABLE 5-1: SOIL LANDSCAPE SYSTEMS

SYSTEM	SUBSYSTEM	DESCRIPTION
Bassendean (212_Bs)	212Bs_B1	Extremely low to very low relief dunes, undulating sandplain, and discrete sand rises with deep bleached grey sands, sometimes with a pale-yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2m; banksia dominant.
	212Bs_B2	Flat to very gently undulating well drained sandplain of the surface. Deep bleached grey sands with a pale-yellow B horizon or a weak iron-organic hardpan 1-2m.
	212Bs_B4	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5m by clay or less frequently a strong iron-organic hardpan.
	212Bs_B6	Imperfectly drained sandplain and broad extremely low rises. Deep or very deep grey siliceous sands.
Pinjarra (213_Pj)	213Pj_B2	Well to moderately well drained flat to very gently undulating sandplain. Deep bleached grey sands with a pale-yellow B horizon or a weak iron-organic hardpan 1-2m.

SYSTEM	SUBSYSTEM	DESCRIPTION
	213Pj_P11	Shallow brown loamy soils or less commonly, very shallow sands over ironstone pavement which is a clear barrier to drainage.
	213Pj_P1b	Flat to very gently undulating plain. Imperfectly drained and moderately susceptible to salinity in limited areas. Deep acidic mottled yellow duplex (or 'effective duplex') soils. Moderately deep pale sand to loamy sand over clay.
	213Pj_P2	Flat to very gently undulating plain. Poor to imperfectly drained. Deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam over clay.
	213Pj_P7	Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and grey duplex soils.
	213Pj_P8	Broad poorly drained flats and poorly defined stream channels. Moderately deep to deep sands over mottled clays. These may be acidic or less commonly alkaline grey and yellow duplex soils to uniform bleached or pale brown sands over clay.

5.4.3. VEGETATION COMPLEXES

Three Vegetation complexes on the Swan Coastal Plain occur within the Proposal area as per (Webb, Kinloch, Keighery, & Pitt, 2016) and shown on Figure 5-3. All of these of complexes, and particularly the Guildford Complex (5.09%) are below the desired 30% pre-European retention target.

TABLE 5-2: VEGETATION COMPLEXES

VEGETATION COMPLEX	DESCRIPTION
Bassendean Complex – Central and South (44)	Vegetation ranges from woodland of *Eucalyptus marginata* (Jarrah) - *Allocasuarina fraseriana* (Sheoak) - Banksia species to low woodland of Melaleuca species and sedge lands on the moister sites. This area includes the transition of *Eucalyptus marginata* (Jarrah) to *Eucalyptus todtiana* (Pricklybark) in the vicinity of Perth.
Guildford Complex (32)	A mixture of open forest to tall open forest of Corymbia calophylla (Marri) - Eucalyptus wandoo (Wandoo) - Eucalyptus marginata (Jarrah) and woodland of Eucalyptus wandoo (Wandoo) (with rare occurrences of Eucalyptus lane-poolei (Salmon White Gum)). Minor components include Eucalyptus rudis (Flooded Gum) - Melaleuca rhaphiophylla (Swamp Paperbark).
Southern River Complex (42)	Open woodland of *Corymbia calophylla* (Marri) - *Eucalyptus marginata* (Jarrah) - Banksia species with fringing woodland of *Eucalyptus rudis* (Flooded Gum) - *Melaleuca rhaphiophylla* (Swamp Paperbark) along creek beds.

5.4.4. VEGETATION ASSOCIATION

The Proposal area comprises only one Beard Vegetation Association: Association 968 'Medium woodland; jarrah, marri wandoo'.

5.4.5. VEGETATION UNITS

The following table combines the vegetation units mapped by Ecoedge during the three Surveys that occur within the proposed disturbance areas. Vegetation Units are shown on Figure 5-4.

TABLE 5-3: COMBINED VEGETATION UNITS

SURVEY	VEG UNIT	DESCRIPTION	AREA TO BE DISTURBED (HA)
Survey 1	A1	Low woodland/open woodland of *Banksia attenuata*, *B. menziesii*, *B. ilicifolia*, *Nuytsia floribunda*, *Xylomelum occidentale* with isolated mid-height *Allocasuarina fraseriana* and *Eucalyptus marginata* trees over sparse mid-height shrubland of *Xanthorrhoea brunonis* (sometimes with patches of tall shrubland of *Kunzea glabrescens*) over grassland of *Austrostipa flavescens*, **Briza maxima*, *B. minor*, **Ehrharta calycina*, *Microlaena stipoides* and forbland of **Arctotheca calendula*, **Hypochaeris glabra* and **Ornithopus pinnatus* on grey sand. [In some places, *B. attenuata* and *B. menziesii* are missing from this subunit].	0.13
Survey 1	A2	Mid-height open woodland of *Corymbia calophylla* and *Allocasuarina fraseriana* over open low woodland of *Banksia attenuata* and *Xylomelum occidentale* over grassland of **Briza maxima*, *B. minor*, **Ehrharta calycina*, *Microlaena stipoides* and forbland of **Arctotheca calendula*, **Hypochaeris glabra* and **Ornithopus pinnatus* on grey sand.	0.00
Survey 2	A3	*Eucalyptus marginata*, *Corymbia calophylla*, (*Allocasuarina fraseriana*) medium open forest over *Banksia attenuata*, *B. menziesii*, *Xylomelum occidentale* low woodland over *Xanthorrhoea brunonis* medium very open shrubland over *Dasypogon bromeliifolius*, *Hibbertia hypericoides* low very open shrubland over *Caladenia flava*, *Dampiera linearis*, *Drosera erythrorhiza*, **Hypochaeris glabra*, *Lagenophora huegelii*, *Lomandra* spp., **Romulea rosea*, **Ursinia anthemoides* open forbland, **Briza maxima*, *Microlaena stipoides* scattered grasses and *Mesomelaena tetragona* scattered sedges on grey sand on low rises.	0.00
Survey 3	A4	Mid-height open forest or woodland of *Corymbia calophylla* (occasionally with *Allocasuarina fraseriana*, *Eucalyptus marginata*, *Melaleuca preissiana* or *Nuytsia floribunda*) over scattered *Kingia australis* tall shrubs over forbland including **Arctotheca calendula*, **Lolium* spp., **Lotus subbiflorus*, **Rumex* spp., **Trifolium repens* on grey loamy sand.	1.10
Survey 2	A5	*Corymbia calophylla, Eucalyptus marginata*, *Allocasuarina fraseriana* medium open forest over (*Banksia attenuata*, *B. menziesii*), *B.*	12.32

SURVEY	VEG UNIT	DESCRIPTION	AREA TO BE DISTURBED (HA)
		grandis, *Xylomelum occidentale* low woodland over *Hibbertia hypericoides*, *Xanthorrhoea brunonis* medium open shrubland over **Briza maxima*, *Microlaena stipoides* scattered grasses and *Drosera erythrorhiza*, **Hypochaeris glabra*, *Lagenophora huegelii*, *Pyrorchis nigricans*, **Ursinia anthemoides* very open forbland on grey sand/ sandy loam on lower slopes (transitional between EmCcBaBmOF and CcEmXpOF).	
Survey 3	A6	Mid-height open forest or woodland of *Eucalyptus marginata* and *Allocasuarina fraseriana* over scattered Xylomelum occidentale low trees over forbland including **Arctotheca calendula*, **Lolium* spp., **Lotus subbiflorus*, **Rumex* spp., **Trifolium repens* on grey sand.	0.97
Survey 1	B1	Mid-height open forest of *Corymbia calophylla* and *Eucalyptus marginata* over *Melaleuca preissiana* open low woodland over low open shrubland of *Banksia dallanneyi*, *Dasypogon bromeliifolius* and *Xanthorrhoea brunonis* over sparse forbland of *Burchardia multiflora*, *Desmocladus fascicularis* and *Microtis media*, very open sedgeland of *Cyathochaeta avenacea* and open grassland of **Briza maxima* and **B. minor* on grey sand.	0.00
Survey 1	B2	Mid-height open forest or woodland of *Corymbia calophylla* (occasionally with *Allocasuarina fraseriana* and *Xylomelum occidentale*) over pasture species including **Arctotheca calendula*, **Lolium* spp., **Lotus subbiflorus*, **Rumex* spp., **Trifolium repens* on grey loamy sand or sand.	2.31
Survey 2	B4	*Corymbia calophylla* (*Eucalyptus marginata*) medium open forest over *Hibbertia hypericoides*, *Xanthorrhoea preissii* (*X. brunonis*) medium open shrubland over *Cyathochaeta avenacea*, *Mesomelaena stygia*, *M. tetragona* open sedgeland, *Conostylis aculeata*, *Desmocladus fasciculatus*, **Hypochaeris glabra*, *Trachymene pilosa* very open forbland on grey-brown loamy sand.	0.00
Survey 2	B5	*Corymbia calophylla* (*Eucalyptus marginata*) medium open forest over *Hibbertia hypericoides*, *Xanthorrhoea preissii* (*X. brunonis*) medium open shrubland over *Cyathochaeta avenacea*, *Mesomelaena stygia*, *M. tetragona* open sedgeland, *Conostylis aculeata*, *Desmocladus fasciculatus*, **Hypochaeris glabra*, *Trachymene pilosa* very open forbland on grey-brown loamy sand.	1.73
Survey 1	C1	Mid-height shrubland of *Astartea scoparia*, *Kunzea recurva* and *Xanthorrhoea preissii*, with emergent mid-height *Corymbia calophylla* and *Melaleuca preissiana* low trees, over low open shrubland of *Boronia spathulata* and *Hypocalymma angustifolium*, over open sedgeland of *Cyathochaeta avenacea* and *Lepidosperma longitudinale*, forbland of **Arctotheca calendula*, **Hypochaeris*	0.00

SURVEY	VEG UNIT	DESCRIPTION	AREA TO BE DISTURBED (HA)
		glabra, **Ornithopus pinnatus* and grassland of **Cynodon dactylon* and *Lolium multiflorum* on grey-brown loamy sand.	
Survey 1	C2	Low woodland of *Melaleuca preissiana* with fringing mid-height *Corymbia calophylla* trees over sedgeland of *Lepidosperma longitudinale* over forbland of **Hypochaeris glabra*, **Lotus subbiflorus* and **Ursinia anthemoides* and grassland of **Briza maxima*, **B. minor*, **Ehrharta longiflora*, **Lolium multiflorum* on grey-brown sand. [The ground-layer of *L. longitudinale* is missing from most areas].	0.00
Survey 1	C3	Low woodland to open woodland of Melaleuca preissiana over pasture species including *Arctotheca calendula*, **Lolium* spp., **Lotus subbiflorus*, **Rumex* spp., **Trifolium repens* on grey loamy sand or sandy clay-loam.	0.53
Survey 2	D	*Eucalyptus rudis* medium woodland over *Melaleuca rhaphiophylla* low woodland over **Arctotheca calendula*, **Hypochaeris glabra* open forbland, **Briza maxima*, **Ehrharta longiflora* grassland and **Juncus gregiflorus*, **J. subsecundus* open rushland on grey-yellow sandy loam on alluvial flats	1.14
Survey 3	E1	Low woodland of *Melaleuca preissiana* or *M. rhaphiophylla* with isolated *Eucalyptus rudis*, **Eucalyptus mannifera* medium trees over forbland of **Arctotheca calendula*, **Hypochaeris glabra*, **Lotus subbiflorus* and **Ursinia anthemoides* and grassland of **Briza maxima*, **B. minor* **Ehrharta longiflora*, **Lolium multiflorum* on grey-brown sandy loam.	0.43
Survey 3	E2	Low woodland of *Melaleuca preissiana* or *M. rhaphiophylla* over forbland of **Arctotheca calendula*, **Hypochaeris glabra*, **Lotus subbiflorus* and grassland of **Briza maxima*, **B. minor* **Lolium multiflorum* (and *Cotula coronopifolia* in damper areas) on grey-brown loam.	0.24
Survey 3	F	Sedgeland of *Juncus pallidus*, with scattered emergent **Eucalyptus globulus* or *Melaleuca preissiana* or *M. rhaphiophylla* low/medium trees over forbland of **Arctotheca calendula*, **Romulea rosea*, **Rumex conglomeratus* and open grassland of **Avena barbata*, **Cenchrus clandestinus*, **Eragrostis curvula* on grey sandy loam.	0.25
Survey 3	G	Tall shrubland of *Acacia saligna*, *Jacksonia sternbergiana*, *Kunzea glabrescens* and *Regelia ciliata* on grey sand. [Mainly plantings].	0.00
Survey 1, 2, 3	P	Amenity plantings of eucalyptus species, including **Eucalyptus camaldulensis*, **E. mannifera*.	4.66
Survey 1, 2, 3	Cleared Pasture	Cleared Pasture	485.81

SURVEY	VEG UNIT	DESCRIPTION	AREA TO BE DISTURBED (HA)
TOTAL DISTURBANCE AREA			511.64

5.4.6. VEGETATION CONDITION

Almost all vegetation within the Development Envelope was mapped by Ecoedge (2021, 2022 and 2023) as Completely Degraded mainly due to historic physical disturbance (clearing) followed by long periods of livestock grazing. It is also likely that *Phytophthora* dieback disease has played a role in vegetation degradation as well. There is only one small patch of vegetation, on the western boundary of Lot 62, that was mapped as Good condition, however this is an area of revegetation undertaken by KLPL. Vegetation condition is shown in Figure 5-5.

5.4.7. CONSERVATION SIGNIFICANT VEGETATION

No conservation significant vegetation is present within the Proposal area.

It is noted that three of the vegetation units mapped by (Ecoedge, 2022) within Lot 56 (not part of this Proposal), were assigned to the State and Federally listed SCP FCT3c, following multi-variate analysis. These are however located outside and upgradient of the Proposal (and Development Envelope).

5.4.8. FLORA

Survey 1

Ninety-eight species of vascular flora were identified within the survey area, of which 32 (33%) were introduced taxa.

Survey 2

One hundred and nineteen species of vascular flora were identified within the survey area, of which 25 (21%) were introduced non-native taxa.

Survey 3

Forty-nine species of vascular flora were identified within the survey area, of which 27 (55%) were introduced non-native taxa. There were another six taxa that were amenity plantings.

5.4.9. FLORA OF CONSERVATION SIGNIFICANCE

There were no threatened or priority flora or other species of conservation significance recorded within the Proposal area. Targeted surveys were carried out for the threatened orchids *Drakaea elastica* and *D. micrantha* on 18 August and 16 September 2022 as part of Survey 3, however they were not identified. (Ecoedge, 2023) considered that to have residual likelihood post-survey of 'Unlikely '.

5.4.10. WEEDS AND DIEBACK

Three introduced species, Cape tulip (**Moraea flaccida*), Arum Lily (**Zantedeschia aethiopica)* and Cotton Bush (**Gomphocarpus fruiticosus*) are Declared Pest plants in Western Australia under the *Biosecurity and Agriculture Management Act 2007* (Figure 5-6).

The location of the Arum Lily is within the northeast portion of Lot 64 and is outside of the proposed disturbance area.

The location of the Cape Tulip is within the southern portion of the Proposal area within Lot 20 and Lot 211 and are outside of the proposed disturbance areas.

The location of Cotton Bush is within the southern portion of the Proposal area within Lot 62 and is within areas proposed for disturbance.

Phytophthora Dieback surveys were conducted by BARK Environmental (2021a; 2021b; 2023) to assess for the potential presence of *Phytophthora* Dieback within the Proposal area (Appendix 6).

Results from the assessments show that the Site vegetation composition and structure is so severely altered by historic disturbance activities that assessment was not possible and as such all Lots were assigned a Dieback Occurrence Category of 'Excluded'.

As such, all of the proposed disturbance area for the Proposal was mapped as 'Excluded' given it is mostly cleared pasture with little to no vegetation or indicator species.

5.4.11. WETLANDS

Survey 1

According to the latest SCP Geomorphic wetland data set (DBCA 2020f in Ecoedge 2021), a system of wetlands is mapped across and adjacent to low lying portions of the survey area. This system occurs as expressions of predominantly seasonally inundated sumplands and seasonally waterlogged damplands with a small seasonally waterlogged palusplain wetland. The sumpland and dampland components are mapped as Resource Enhancement (RE) wetlands, and the palusplain wetland is mapped as a Multiple Use wetland. However, this wetland is mapped as being predominately in Cleared or Completely Degraded condition. (Ecoedge, 2021) notes that applying to DBCA to downgrade this wetland management category to Multiple Use Wetland should be considered. Most of the wetland area would be regarded as scoring poorly on both natural and human use attributes due to the predominantly Completely Degraded to Degraded Condition of its vegetation.

There are no Conservation Category wetlands (CCW) within Lot 64.

Survey 2

The vegetation Unit G (ErMrW) is recognised as having habitat representative of a wetland or watercourse. This unit occurs along much of the creekline in the northern part of the Proposal area (northern portions of Lot 507, 508 and Lot 201) and is mostly in a Completely Degraded condition with some small areas in a Degraded condition. *Melaleuca preissiana*, which is a typical small tree of wetlands may occur in areas mapped as Unit B5 CcOF where it abuts the creekline in the northern part of the Proposal area. However, unit CcOF B5 is not considered to be wetland vegetation.

Portions of vegetation unit B5 occur within mapped occurrences of the CCW and RE wetlands.

Survey 3

Most of these wetlands have been categorised as Multiple Use with smaller areas scattered within the survey area categorised as Resource Enhancement. One Conservation Category wetland (UFI 14870), which is 0.775ha in size, occurs in the western boundary of Lot 63. Site assessment of this CCW determined no presence of wetland vegetation at the site and that the terrestrial vegetation is in a completely degraded condition (Rockwater, 2022b). It has been recommended that a request to modify the management category of the CCW should be submitted to DBCA.

The locations of CCW's relevant to the Proposal are shown on Figure 5-7.

5.5. POTENTIAL IMPACTS

The following aspects of the Proposal may affect flora and vegetation values:

Direct Impacts

- Clearing of 21.04ha of native vegetation will reduce the extent of soil-landscape systems, vegetation complexes and vegetation units.

Indirect Impacts

- Reduced water availability to CCW's caused by groundwater abstraction;
- Mining activities and vehicle movement have the potential to spread weeds and dieback within and adjacent to the Development Envelope;
- Mining activities and vehicle movement has the potential to deposit dust on vegetation within and adjacent to the Development envelope.

5.5.1. CLEARING OF NATIVE VEGETATION

The Proposal has been designed to avoid clearing native vegetation as far as practicable in order to reduce direct impacts to flora and vegetation values. This has resulted in the avoidance of ~99ha of native vegetation within the Proposal's Development Envelope. The Proposal will however require clearing of 21.04ha of completely degraded to degraded native vegetation to facilitate the development of mine areas. This will reduce the regional and local extent of soil-landscape systems, vegetation complexes and vegetation units. No Threatened or Priority ecological communities or flora species will be directly impacted (cleared) by the Proposal.

Soil Landscape Mapping

The Proposal will require disturbance of 511.64 ha, that occurs within the Bassendean land system (212_Bs) and Pinjarra land system (213_Pj). Table 5-4 shows the potential impact to the soil mapping units for the Proposal.

TABLE 5-4: DIRECT IMPACTS TO SOIL-LANDSCAPE SYSTEMS AND MAPPING UNITS

SOIL MAPPING UNIT	TOTAL EXTENT OF SOIL MAPPING UNIT (HA)	AREA OF SOIL MAPPING UNIT AFFECTED BY PROPOSAL (HA)	PERCENTAGE OF SOIL MAPPING UNIT AFFECTED BY PROPOSAL (%)
Bassendean Soil-Landscape System	28,242	441.4	1.56
Pinjarra Soil-Landscape System	49,455	70.24	0.14

Vegetation Complexes

Utilising the vegetation complex mapping within the Swan Coastal Plain (Webb, et al., 2016), clearing of native vegetation for the Proposal will occur within the Bassendean Complex - Central and South, Southern River Complex and Guildford Complex.

As shown in the following table, the area of native vegetation to be cleared represents only very minor percentages of the remaining vegetation complex areas and therefore does not significantly reduce their extent.

In 2001, the Commonwealth of Australia stated National Targets and Objectives for Biodiversity Conservation, which recognised that the retention of 30% or more, of the pre-European vegetation of each ecological community was necessary if Australia's biological diversity were to be protected (Environment Australia, 2001). This level of recognition is in keeping with the targets set in the EPA's Position Statement No. 2 (EPA, 2000), with particular reference to the agricultural area. With regard to conservation status, the EPA has set a target of 15% of pre-European extent for each community to be protected in a comprehensive, adequate and representative reserve system (EPA, 2006).

Currently only 5.09% of the pre-European extent of the Guildford vegetation complex is remaining, which is below the Commonwealth's 30% target and the EPA's 15% target. Only 0.32% of the Guildford vegetation complex is in DBCA managed lands. Both the Bassendean – Central and South and the Southern River complexes are below the Commonwealth target of 30%.

The red, orange and yellow shading in the tables indicates the status of the Commonwealth 30% retention target.

Status of the commonwealth retention target	>30%	<30%	<10%

TABLE 5-5: VEGETATION COMPLEXES IMPACTED BY PROPOSED AMENDMENT

Vegetation Complex	Pre-European (ha)	Current Extent (ha)	% Remaining	% Remaining in DBCA Reserves	Area of within Proposal	% of Vegetation to be Cleared for Amendment
Bassendean Complex - Central and South (44)						
Swan Coastal Plain	87,476.25	23,508.66	26.87	5.0	11.60	0.05
Southern River Complex (42)						
Swan Coastal Plain	58,781.48	10,832.18	18.43	1.60	7.84	0.07
Guildford Complex (32)						
Swan Coastal Plain	90,513.13	4,607.91	5.09	0.32	1.60	0.03

Vegetation Units

Clearing for the Proposal will affect the following vegetation units as shown in the following table.

TABLE 5-6: VEGETATION UNITS TO BE CLEARED FOR THE PROPOSAL

VEGETATION UNIT	AREA TO BE CLEARED FOR AMENDMENT
A1	0.13
A4	1.10
A5	12.32

VEGETATION UNIT	AREA TO BE CLEARED FOR AMENDMENT
A6	0.97
B2	2.31
B5	1.73
C3	0.53
D	1.14
E1	0.43
E2	0.24
F	0.25
Planted	4.66
Cleared Pasture	485.81
Total	**511.64**

All vegetation to be cleared for the Proposal has been mapped as Completely Degraded and Degraded.

5.5.2. REDUCED WATER AVAILABILITY

Groundwater modelling completed by (AQ2, 2023a) shows the following in relation to reduced water availability to sensitive receptors:

- The magnitude of drawdowns along the CCW adjacent to the Western Extension vary depending upon the proximity of the active mining pits (refer to Figures 21 to 29; AQ2, 2023a).
- Groundwater modelling suggests that there will be drawdowns of generally less than 0.5m around the CCWs. However, there are two CCWs (ID 14850 – Section 1 and ID 14870 – Section 3), where maximum drawdowns of up to 2.5m are predicted, due to their close proximity to the proposed mining areas. However, all drawdowns will be localised and temporary. It should be noted that at CCW ID 14870 water levels are predicted to recover from dewatering already simulated for Part Lot 63 in 2025.
- As stated in (Rockwater, 2007):
    - The identified CCWs are not considered to be groundwater dependent, but rather surface water dependent.
    - The wetlands are generally recharged during the wet season (winter) and sporadically during the rest of the year as a result of storm runoff and direct rainfall.
    - The wetlands probably represent a source of recharge to the shallow groundwater system, rather than the reverse.
- Long-term monitoring of the health of vegetation near to Keysbrook mine (Rockwater, 2022a) indicates no changes in water regime that have the potential to impact the health of groundwater dependent vegetation. Additionally, the CCWs close to the mine site are in a Degraded to Completely Degraded Condition.

5.5.3. SPREAD OF WEEDS AND DIEBACK

Three Declared plants or Weeds of National Significance were identified within the Proposal area during the surveys (Ecoedge, 2021; 2022; 2023). The majority of these are however located outside of proposed disturbance areas in Lot 20 and Lot 64. Two locations of Cape Tulip are within proposed disturbance areas within Lot 62 and will be managed in accordance with the Weed and Dieback Management Plan (MS810 Condition 9).

Phytophthora Dieback surveys conducted by BARK Environmental (2021a; 2021b; 2023), assessed for the potential presence of *Phytophthora* Dieback within the Proposal area. All of the proposed disturbance area within the Proposal was mapped as Excluded given it is mostly cleared pasture with little to no vegetation or indicator species. Dieback will continue to be managed as per the Weed and Dieback Management Plan (MS810 Condition 9) and is therefore unlikely to pose any risk of spread or introduction into other areas of vegetation as a result of mining activities.

5.5.4. DUST DEPOSITION

An extensive dust monitoring program is already in place at the Keysbrook Mine. Dust emissions are within limits set under Condition 15 of MS810. Elevated dust levels are recorded on occasions, particularly under seasonally dry soil conditions and sustained strong winds. Dust deposition is generally not evident on remnant vegetation and there has been no decline in vegetation condition within or around the mine site, based on visual assessment and wetland vegetation condition monitoring. Inclusion of the proposed amendment area is unlikely to increase the risk of dust deposition on native vegetation, and KLPL will continue to implement the Air Quality and Dust Management Plan as per Condition 15 of MS810.

5.6. MITIGATION

In order to protect flora and vegetation values so that biological diversity and ecological integrity are maintained during the implementation of the Proposal, KLPL has applied the mitigation hierarchy to avoid, mitigate and rehabilitate potential impacts to flora and vegetation values.

5.6.1. AVOID

KLPL's primary mitigation strategy to protect flora and vegetation values, is to design the Proposal to avoid clearing of native vegetation, as far as practicable and maximise the use of existing cleared areas. This has resulted in the avoidance of ~99ha of native vegetation from disturbance.

A 100m buffer will also be established to avoid direct impacts to CCWs present within the Development Envelope as per MS810 Condition 7b.

5.6.2. MINIMISE

In accordance with MS810, KLPL will continue to implement the following key management measures to minimise impacts to flora and vegetation values:

- MS810 Condition 6 - Protection of Native Vegetation.
    - 6-3 The proponent shall not clear any native vegetation within the Proposal area unless the land to be cleared is required for the extraction of mineral ore within 6 months of the date of clearing.
- MS810 Condition 7 - Protection of Watercourses and wetlands.

    - 7-1 The proponent shall not clear vegetation or undertake mining activities:
        a. Within 20m of the banks of watercourses shown in Fig 9 of the PER document.
        b. Within 100m of the boundary of a conservation category wetland.

- MS810 Condition 9 - Weed and Dieback Management Plan (Appendix 6)
    - Key measures in the Rehabilitation Management Plan relevant to flora and vegetation include:
        a. Identify location of Declared or priority weed species at the Site.
        b. Control Declared or priority weed species identified at the Site.
        c. Prevent the introduction and spread of weeds by plant and equipment.
        d. Prevent the introduction and spread of *Phytophthora* dieback.

5.6.3. REHABILITATE

KLPL will continue to rehabilitate the Site in accordance with:

- MS810 Condition 8 – Conservation and Rehabilitation Management Plan (Appendix 7)
    - Key measures in the Conservation and Rehabilitation Management Plan relevant to flora and vegetation include:
        a. Condition 8-2a. Re-establish self-sustaining local provenance native vegetation cleared in the implementation of the proposal, at a ratio of not less than 1.4:1 (1.4ha of revegetation per 1ha of vegetation cleared).

KLPL will commit to revegetating ~30ha to counterbalance the direct impact of clearing 21.04ha.

5.7. ASSESSMENT AND SIGNIFICANCE OF RESIDUAL IMPACTS

Direct Impacts

Native Vegetation Clearing

As documented in the EPA Report and Recommendations (EPA Bulletin 1269) the original Project involved clearing of up to 182ha of semi-intact stands of native vegetation and other scattered remnant vegetation, including isolated paddock trees. A further 1,184ha of cleared pasture was approved for mining/disturbance, bringing the total disturbance area for the Project to 1,366ha. Subsequent changes to the Project (see MS810) have resulted in an increase to the total disturbance area to 1,745ha (includes the recent S45C applications, under assessment).

To manage direct impacts to native vegetation for the Original Project, MS810 Condition 6, required KLPL to ensure a minimum of 75ha of native vegetation (refer to Figure 3 of MS810) is protected in perpetuity. To meet this condition, KLPL secured two of the better tracts of remnant native vegetation with 75ha protected in perpetuity by conservation covenants executed under the *Soil and Land Conservation Act 1945*. The areas, 25ha on Lot 34 (formerly Lot 62) Hopelands Road and 50ha on Lot 202 Elliott Road have been fenced to exclude stock and surveyed by consultant botanists (Onshore Environmental, 2019) to assist in developing a program for revegetation. Weed control has been implemented at both areas. Native seed was sown on clear areas within the Lot 34 conservation area in 2017 and supplemental seedlings planted in 2019 and 2020. In 2018, 200 grass trees (*Kingia australis*), were transplanted to the conservation area on Lot 202.

Following a further upgrade in fencing on Lot 202 to minimise kangaroo and rabbit damage, approximately 10ha of the cleared areas of the property was planted with native species in June 2019. A further 7ha was planted with native species in July 2020. Planting was undertaken by the Serpentine Jarrahdale Landcare group (SJ Landcare).

In addition to the protection of 75ha of native vegetation, MS810 Condition 8 requires the re-establishment of self-sustaining local provenance native vegetation at a ratio of not less than 1.4:1 (1.4ha of revegetation per 1ha of vegetation clearing).

Disturbance for the Proposal has been designed as far as practicable to utilise existing cleared areas, in order to reduce direct impacts to flora and vegetation values. This has resulted in the avoidance of ~99ha of native vegetation within the Proposal's Development Envelope, with the generally larger areas/patches of native vegetation, being avoided. The Proposal will however require direct disturbance of 21.04ha of completely degraded to degraded native vegetation (and 490.47ha of cleared pasture and planted species) to facilitate the development of mine areas. This vegetation has been assessed as low-quality with no conservation significance. No Threatened or Priority Ecological Communities or Threatened or Priority listed flora species occur within the Proposal area and therefore will not be directly impacted.

As per MS810 Condition 7-1(b) a buffer of 100m from the edge of the CCW (UFI 14850) located on the northern boundary, will be established and as such no mining or disturbance activities will occur within 100m of this CCW. A 100m buffer from CCW UFI14870 is already in place as part of previous approvals for mining within Lot 63. This buffer will remain in place for the Proposal.

A 20m buffer shall also be established on either side of the following watercourses which traverses through (or nearby) to the Proposal area, as required by MS810 7-1(a), which states no vegetation clearing or mining activities shall not occur within 20m of the banks of a watercourse:

- Dirk Brook Tributary (northeast of Lot 201 disturbance area);
- Nambeelup Brook North Tributary (within Lot 64 disturbance area and Lot 63);
- Balgobin Brook South (within Lot 62 disturbance area).

The Proposal will increase the total disturbance area by an additional 511.64ha, to a total area of ~2,257ha, which is an increase of 22.6% of the currently approved disturbance area, as per MS810 (includes the S45C amendments).

The additional disturbance area will be rehabilitated in accordance with the requirements of MS810 Condition 8, Rehabilitation Management Plan, which requires revegetation at the rate of 1.4ha for every 1ha of native vegetation cleared. As such a total of ~30ha will be revegetated for the Proposal. The Rehabilitation Management Plan, has been updated to include the Proposal area.

Indirect Impacts

Potential indirect environmental impacts on native vegetation outside of the approved mining footprint associated with the Original Proposal (as reported in Bulletin 1269) included a decline in condition or mortality as a result of:

- Reduced water availability caused by groundwater abstraction;
- Excessive dust deposition; and
- The spread of invasive weed species or Dieback (*Phytophthora cinnamomi*).

Reduced Water Availability

Potential groundwater dependent vegetation occurs in association with a number of CCWs south of the original Project (mining) area (Figure 5-7). The wetlands are subject to periodic saturation as a result of localised runoff and seasonal peaks in the upper, unconfined aquifer (Superficial aquifer). Implementation of the Project to date has not affected groundwater levels in the Superficial aquifer beyond the boundary of the approved mining area. Abstraction from the deeper, confined Lower Leederville aquifer has not induced any detectable impact on groundwater levels in the Superficial aquifer, and the localised interception of groundwater in the course of mining has not impacted on groundwater levels in the Superficial aquifer at the site boundary. Overall, there has been a net recharge of the Superficial aquifer associated with water infiltration from sand and clay tailings backfilled to the mine void (GRM, 2021).

A Wetland Vegetation Monitoring Program has been implemented on a six-monthly basis at the Site since 2015 as part of approval conditions to monitor the condition of vegetation at the CCWs immediately south of the main mining area. Conclusions provided in the most recent report (Spring 2021) have not identified any adverse trends related to mining and groundwater drawdown (Rockwater, 2022a) (Appendix 8). Furthermore, the potential impact to the CCW's from the original approved mining area was assessed using groundwater flow modelling (Rockwater, 2007). This assessment concluded that the CCWs are not considered groundwater dependent, instead being surface water dependent.

Groundwater modelling for the Proposal suggests that there will be drawdowns of generally less than 0.5m around the CCWs near to the Proposal area. However, there are two CCWs (UFI 14850 – Section 1 and UFI 14870 – Section 3), where maximum drawdowns of up to 2m are predicted, due to their close proximity to the proposed mining areas. However, all drawdowns will be localised and temporary and the CCW's are likely to be resilient to cope with the propose changes given long-term hydrogeological and environmental monitoring data (Rockwater, 2022a) suggests that mining activities for the Project to date have not resulted in changes to the water regime that have impacted the health of wetland monitoring sites.

Dust Deposition

An extensive dust monitoring program is already in place at the Keysbrook Mine. Dust emissions are within limits set under Condition 15 of MS810. Elevated dust levels are recorded on occasions, particularly under seasonally dry soil conditions and sustained strong winds. Dust deposition is generally not evident on remnant vegetation and there has been no decline in vegetation condition within or around the mine site, based on visual assessment and wetland vegetation condition monitoring. Inclusion of the Proposal is unlikely to increase the risk of dust deposition on native vegetation, and KLPL will continue to implement the Air Quality and Dust Management Plan as per Condition 15 of MS810.

Weeds and Dieback

Historically, 34 weed species were recorded within the original Proposal area, of which 28 species are considered invasive (Bennett Environmental Consulting, 2006). These weeds occur throughout the locality and KLPL implement an ongoing weed program within and around the Project area with the primary objectives of controlling/eliminating declared species and reducing the weed burden in target native revegetation areas.

Three Declared plants or Weeds of National Significance were identified within the Proposal area during the surveys (Ecoedge, 2021; 2022; 2023). The majority of these are however located outside of proposed disturbance areas in Lot 20 and Lot 64. Two locations of Cape Tulip are within proposed disturbance areas

within Lot 62 and will be managed in accordance with the Weed and Dieback Management Plan (MS810 Condition 9).

A *Phytopthora* Dieback assessment completed in 2017 (Terratree, 2017a) reiterated earlier conclusions (Terratree, 2013) that, due to the historical disturbance and lack of indicator species the majority of the Project area could not be mapped for the presence/absence of *Phytopthora* and is classified as 'excluded'. Under *Dieback Interpreter Guidelines* (DPaW, 2015), excluded areas are assumed to be infested and managed accordingly.

Phytophthora Dieback surveys conducted by BARK Environmental (2021a; 2021b; 2023), mapped the Proposal area as 'Excluded' given the Proposal area generally comprises cleared pasture and areas of remnant vegetation are in degraded to completely degraded condition due to significant grazing and clearing disturbances. Dieback will continue to be managed as per the Weed and Dieback Management Plan (MS810 Condition 9) and is therefore unlikely to pose any risk of spread or introduction into other areas of vegetation as a result of mining activities.

5.8. ENVIRONMENTAL OUTCOMES

With the inclusion of the Proposal to the approved mine areas for the Keysbrook Mine as per MS810, the additional cumulative impacts to native vegetation is not considered significant and the EPA's objective *to protect flora and vegetation so that biological diversity and ecological integrity are maintained* will continue to be achieved through existing management measures (particularly the creation of new native vegetation) and the Conditions provided in MS810 that relate to flora and vegetation.

6. ENVIRONMENTAL FACTOR – TERRESTRIAL FAUNA

6.1. EPA OBJECTIVE

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

6.2. POLICY AND GUIDANCE

EPA Policy and Guidance

- *Statement of Environmental principles, Factors and Objectives* (EPA, 2021d)
- *Instructions on how to Prepare Environmental Protection Act 1986 Part IV Environmental Management Plans* (EPA, 2016c).
- *Technical Guidance – Terrestrial Fauna Surveys* (EPA, 2016d).
- *Environmental Offsets Policy, Perth, Western Australia (Government of Western Australia, 2011).*
- *Environmental Offsets Guidelines, Perth, Western Australia (Government of Western Australia, 2014).*

Other Policy and Guidance

- Matters of National Environmental Significance. Significant Impact Guidelines 1.1. *Environmental Protection and Biodiversity Conservation Act 1999* (DoE, 2013).
- *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a).
- *EPBC Act Referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable) Calyptorhynchus baudinii, Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso* (DSEWPaC, 2012b).
- *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black cockatoo. Department of Agriculture, Water and the Environment, Canberra, February 2022* (DAWE, 2022).
- *Survey guidelines for Australia's threatened birds. Guidelines for detecting birds listed as threatened under the EPBC Act*. (DEWHA, 2010).
- *Approved Conservation Advice for Calyptorhynchus banksii naso (Forest Red-tailed Black Cockatoo). Canberra: Department of the Environment, Water, Heritage and the Arts* (DEWHA, 2009).
- *Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo Calyptorhynchus banksii naso) Recovery Plan. Department of Environment and Conservation, Western Australia* (Chapman, 2008).
- *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan. Department of Parks and Wildlife, Perth, Western Australia* (DPaW, 2013).

6.3. ORIGINAL PROPOSAL

Baseline fauna investigations identified four conservation significant fauna species that were known or had the potential to utilise remnant vegetation within the Original approved mining area. These include the following, which have been updated to reflect their current name and status:

- Rainbow Bee-eater (*Merops ornatus*) now listed as Migratory under the Biodiversity Conservation Act 2016 (BC Act);
- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso)* – listed as Vulnerable under the *BC Act* and *EPBC Act;*
- Carnaby`s Black-Cockatoo *Zanda latirostris* – listed as Endangered under the *BC Act* and *EPBC Act;*
- Quenda (*Isoodon obesulus fusciventer*) listed as Priority 4 by Department of Biodiversity, Conservation and Attractions (DBCA).

Western Wildlife conducted a survey of remnant vegetation in Lots 56, 59, 300 and 3 (now Lots 201 & 202 Elliott Rd) in October 2005 for nesting and feeding activity by Black Cockatoos and concluded that the vegetation was likely to provide foraging habitat and may provide nesting habitat for three Black Cockatoo species (Carnaby's Black Cockatoo, Forest Red-tailed Black Cockatoo and Baudin's Black Cockatoo) (Wilcox, 2005).

The EPA Report and Recommendations (Bulletin 1269) considered that the Original Project has the potential to impact on fauna through the loss of habitat from vegetation clearing, fragmentation of habitat and noise from mining and transport.

These impacts were not considered to be significant in the event the following was undertaken:

- Protection of native vegetation through excision of a minimum of 75ha of native vegetation from Lots 59 and/or Lot 62 (as per MS810 Condition 6);
- Implementation of measures to protect conservation areas from grazing;
- Implementation of management measures (including but not limited to weed and disease control, revegetation and monitoring) to conservation areas to achieve a functioning and self-sustaining vegetation community (i.e., MS810 Conditions 8 and 9).

6.4. RECEIVING ENVIRONMENT

6.4.1. SURVEYS

The Proposal is predominantly cleared pasture used for stock grazing but there are some remnant bushland patches, large paddock trees and established gardens around farm buildings. The degraded nature of the vegetation, presence of stock and absence of any understorey within native vegetation areas are considered to be of limited value to ground dwelling fauna.

Three threatened Black-Cockatoo species however occur in the area, with their conservation significance under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and WA *Biodiversity Conservation Act 2016* (BC Act) presented below:

- Carnaby's Black-Cockatoo (*Zanda latirostris*) – listed as Endangered under the *BC Act* and *EPBC Act*.
- Baudin's Black-Cockatoo (*Zanda baudinii*) – listed as Endangered under the *BC Act* and *EPBC Act.*

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – listed as Vulnerable under the *BC Act* and *EPBC Act.*

Two separate Black Cockatoo Habitat assessments have been conducted for the Proposal (Appendix 9).

These include:

- Survey 1 – Assessment of the nesting and foraging values of three Lots (508, 201 and 64) near Keysbrook for Doral Mineral Sands Pty Ltd, Keysbrook Mineral Sands Mine (BCE, 2021).
    - The survey was undertaken on 3 and 9 December 2020 and 5 July 2021 in accordance with *EPBC Act Referral guidelines for three threatened black cockatoo species (DSEWPaC, 2012b)* and the revised draft guidelines (DEE, 2017) (current guidance at the time of assessment).
- Survey 2 – Assessment of Nesting, Foraging and Roosting Values for Three Species of Black-Cockatoo in Lots 62, 63, 20 and 507 near Keysbrook, Western Australia (BCE, 2022).
    - The survey was undertaken on 2 and 3 of July 2022 in accordance with the *EPBC Act Referral guidelines for three threatened black cockatoo species* (DAWE, 2022).

In addition to the above surveys, additional targeted assessment of potential nesting trees (identified by BCE) were undertaken by Australian Black-Cockatoo Specialists (ABCS, 2023a; 2023b) (Appendix 9).

6.4.2. POTENTIAL NESTING HABITAT

The Proposal area's suitability for potential nesting habitat was assessed by checking for large, potentially hollow-bearing trees that may facilitate breeding by Black-Cockatoos, and assigning trees a rank using a system developed by Bamford Consulting Ecologists (BCE). DSEWPaC (2012) and DAWE (2022) considers trees that meet the basic criterion of having a DBH >500mm (or >300mm for Wandoo) as being potential Black-Cockatoo breeding trees. The BCE ranking system allows trees that meet this criterion to be assessed as to the likelihood of a tree actually being used for nesting (BCE, 2021; 2022). Trees with a rank of 4 or 5 are extremely unlikely to contain hollows that could be used for breeding, although could eventually develop hollows of suitable size. Trees ranked from 1 to 3 are either being used (rank of 1), have been recently used based on chew marks around a suitable hollow entrance (rank of 2), or have potentially suitable hollows that have not been recently used (rank of 3).

All trees within the Proposal area (including areas excluded from disturbance) were therefore inspected and those that met the basic DBH criterion of DSEWPaC (2012) and DAWE (2022) were numbered and co-ordinates taken with a hand-held GPS, Diameter at Breast Height (DBH) recorded, species and live status recorded, and they were assigned a rank as to their potential for breeding (as outlined in Appendix 1 of both surveys).

The two surveys documented a total of 1,123 meeting the basic criterion of DBH >500mm within the survey area. The majority of trees within the survey area were Marri *Corymbia calophylla* (552) and Jarrah *Eucalyptus marginata* (235), with small numbers of Blackbutt *E. patens* (9), Tuart *E. gomphocephala* (7), Flooded Gum *E. rudis* (9), Pricklybark *E. todtiana* (24).

A total of 179 introduced eucalypts had been planted along the main driveway and around homesteads in the survey area. These trees often get to a large size but generally do not form hollows and therefore are unlikely to be suitable for nesting for Black-Cockatoos.

There was also a significant number (157) of large dead trees (referred to as stags), with the majority located in paddocks. The length of time as a nesting tree is often less for a stag compared with a living tree but suitable hollows do often form in the large branches and trunks of dead trees.

The majority of trees recorded were ranked 5 (730) or 4 (170), which identify large trees without suitable black-cockatoo nesting potential at this current time.

A total of 221 trees contained hollows that were deemed initially to have potential for nesting with a rank of 3 and two trees were recorded with a BCE rank of 2.

TABLE 6-1: BCE RANKING FOR NESTING SUITABILITY BY SPECIES AND STATUS

Score	Marri	Jarrah	Unknown Euc. sp.	Blackbutt	Pricklybark	Flooded Gum	Tuart	Introd Euc. sp.	Live	Dead	TOTAL
1	0	0	0	0	0	0	0	0	0	0	**0**
2	2	0	0	0	0	0	0	0	1	1	**2**
3	64	87	66	0	3	1	0	0	85	136	**221**
4	80	51	30	0	6	0	1	2	109	61	**170**
5	406	99	10	9	15	8	6	177	685	45	**730**
TOTAL	**552**	**237**	**106**	**9**	**24**	**9**	**7**	**179**	**880**	**243**	**1123**

A review of the survey information indicated that of the 221 (rank 3) and 2 (rank 2) trees, only 39 actually contained some type of hollow and that further review was warranted to determine if they are likely to be considered potentially suitable for a Black-Cockatoo. It is noted that 11 of the 39 trees were located with the Lot 63 S45C area which not part of this amendment.

The Australian Black-Cockatoo Specialists (2023a; 2023b) subsequently completed a close visual inspection of hollows within the 39 identified trees using a camera pole, drone and/or ladder. Any evidence of nesting/suitability of the hollow was then photographed and details or any use (including non-target species) was also recorded.

Results of the inspections (ABCS, 2023a)(ABCS, 2023b) indicated that only one tree contained hollows that are potentially suitable for a Black Cockatoo to use within the Proposal area (Figure 6-1). This tree is a large very unstable burnt stag, with three hollows identified by BCE. The upper and lower hollows are too small and not deep enough for Black-Cockatoos, but the middle hollow is shallow and as it goes back into the branch it is considered suitable for a Black-Cockatoo. It was noted there was faeces and compaction consistent with nesting, most likely a Galah or Owl, and there were no signs of use by Black-Cockatoos. The hollow was therefore rated as 'potential', however unlikely to be used by Black-Cockatoos due to its size. The main trunk of the tree has been burnt through from the bottom, and up out of the main fork, it is unstable and will most likely fall over in very high winds. An additional tree containing hollows considered to be potentially suitable for use by a Black-Cockatoo was identified within the Lot 63 S45C area (Figure 6-1), which was avoided as part of that request. Both of the identified trees have been avoided from disturbance.

6.4.3. FORAGING HABITAT

Foraging habitat and value for Black-Cockatoos was assessed by inspecting the vegetation and reviewing vegetation descriptions in the Flora and Vegetation survey reports. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area, and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed in Appendix 2 of BCE (2021; 2022) assessment. These three components are drawn from the DCCEEW offset calculator but with the scoring approach developed by BCE:

- A score out of six for the vegetation composition, condition and structure;
- A score out of three for the context of the site;
- A score out of one for species density.

Foraging value can thus be assigned a score out of six, based upon site vegetation characteristics, or a score out of 10 if context and species density are also considered. The score out of 10 is calculated only for vegetation of at least Low to Moderate foraging value (vegetation characteristics score of ≥ 3). Vegetation with No, Negligible or Low foraging value is effectively assigned context and species density scores of '0' because the context and species density are of little relevance if the vegetation does not support regular foraging by the birds. Foraging value scores are calculated differently for the three black-cockatoo species (Appendix 2 of BCE, 2021 and BEC, 2022) depending upon the vegetation present.

The following foraging habitat assessment is provided based on the two Black Cockatoo surveys.

Foraging Assessment - Lots 62, 63, 20 and 507 (BCE, 2022)

The majority of the Proposal area, comprising Lots 62, 63, 20 and 507, provides minimal foraging value for Black-Cockatoos (BCE, 2022). The majority of the vegetation within these Lots are limited to paddocks with isolated scattered trees. There are no areas of native bushland, and the highest quality habitat were clumps of natives with a weedy understorey. Five vegetation types were recognised by (BCE, 2022):

- Creekline. There were minor drainage lines surrounded by pasture with remnant Flooded Gum, Marri, Melaleuca. Rows of introduced Eucalypts have become established along the creeklines in Lot 62; particularly the northern creekline.
- Introduced Eucalypts. Introduced eucalypts were mostly planted along creeklines, driveways and surrounding homesteads. Forest Red-tailed Black-Cockatoos were seen foraging on introduced eucalypts during the earlier Black Cockatoo survey (BCE, 2021); however, no Forest Red-tailed Black-Cockatoos were observed during the (BCE, 2022) survey within Lots 62, 63, 20 and 507.
- Wetland. Intermittent flooding occurs with low-lying areas becoming inundated during the winter months. A 100m buffer surrounding wetlands is excluded from proposed development areas. These low-lying areas were in paddocks with scattered trees and were classed as 'cleared with sparse trees' for the assessment of foraging habitat.
- Pine. A single stand of pine trees is located in the southern section of Lot 62.
- Cleared with sparse trees. This vegetation type consisted of mostly isolated paddock trees with some small clusters of Marri and Melaleuca. Marri represented the most common species followed by Melaleuca with a few Jarrah, Flooded Gum and Tuart trees. There were occasional Sheoak and Woody Pear trees present. In Lot 63 there were large areas where trees were absent.

The above descriptions were used to assess the quality of foraging habitat for Black-Cockatoos based on the BCE scoring tool, with foraging values based upon vegetation characteristics, context and species density provided for each species in tables 6-2 to 6-4. For the purpose of this foraging value assessment, seasonally inundated areas and creeklines were included in 'cleared with sparse trees', as they were small in area and with similar vegetation characteristics.

Cleared with sparse trees was assigned vegetation characteristics score of 2 (out of 6) for each species. This value was based on the low density of forage trees (mostly Marri) and with paddocks having some foraging value from the seed of weeds. It is influenced by the presence of some clusters of Marri.

Introduced eucalypts were assigned differing values based on vegetation characteristics, as Carnaby's and Baudin's Black-Cockatoos appear to make less use of introduced eucalypts than the Forest Red-tailed Black-Cockatoo. Likewise, pines had differing foraging values, with a high score (4) for Carnaby's and a score of just 1 for the other two species.

Context score is based upon the proportion of regional foraging habitat represented within a project area, the vegetation characteristics score and the presence (or absence) of breeding nearby. As outlined in Appendix 2 of (BCE, 2022), a context score of 0 may be assigned where the vegetation characteristics score is <3, but a low context score can be given where vegetation with a low characteristic's score has some ecological function. This is the case for Lots 62, 63, 20 and 507 due to extensive clearing, where low quality vegetation is a large proportion of what is left. Therefore, a context score of 1 was assigned to all vegetation types for all species except for pines. Pines were assigned a context score of 2 for Carnaby's Black-Cockatoo, as pines are a valuable food source for this species, and they were assigned a context score of 0 for the Forest Red-tailed Black-Cockatoo, which rarely if ever forages on pines.

Appendix 2 of (BCE, 2022) recommends a species density score of 0 where the score for vegetation characteristics is <3, irrespective of the presence or absence of records of the birds. No Black-Cockatoos were observed during the site inspection, and there was only one tree where recent evidence of foraging by Red-tailed Black-Cockatoos was observed. In previous studies for the other areas of the Proposal (BCE, 2021) at least the Forest Red-tailed Black-Cockatoo was regularly observed. Assigning an overall species density value of 0 appeared to most accurately reflect the abundance of birds and the vegetation characteristics in the area (BCE, 2022).

TABLE 6-2: CARNABY'S BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Cleared with sparse trees	2	1	0	**3**
Introduced Eucalypts	1	1	0	**2**
Pines	4	2	0	**6**

TABLE 6-3: BAUDIN'S BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Cleared with sparse trees	2	1	0	**3**
Introduced Eucalypts	1	1	0	**2**
Pines	1	1	0	**2**

TABLE 6-4: FOREST RED-TAILED BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Cleared with sparse trees	2	1	0	**3**
Introduced Eucalypts	2	1	0	**3**
Pines	1	0	0	**1**

Foraging Assessment – Lots 64, 201 and 508 (BCE, 2021)

Lots 64, 201 and 508 contains foraging vegetation that is suitable for all three Black-Cockatoo species (BCE, 2021). There are several different vegetation types, as documented in the (MBS, 2004) assessment, most of which displayed a variable density of eucalypt canopy cover and distinctive mid and lower strata floristics. These are discussed below (BCE, 2021):

Native vegetation in the north-east corner of Lot 64 (vegetation type Bank_Sheo_Mar) consisted of an open canopy of Marri and Jarrah over Slender Banksia *Banksia attenuata,* Firewood Banksia *B. menziesii* and Sheoak *Allocasuarina fraseriana*. Marri and Jarrah provide a foraging resource for all three species, while proteaceous trees (Banksia) will benefit Carnaby's Black-Cockatoo, and Sheoak fruit will provide a resource for Forest Red-tailed and Baudin's Black-Cockatoos. The eastern section of this remnant patch included an intact shrub and ground layer, which was rare across the survey area (BCE, 2021). Further west transitioned to seasonal wetlands.

The remnant native vegetation in the north-western corner of Lot 64 (vegetation type Kunz_Jar_Bank) is of lesser value as it is mostly dominated by dense thickets of Spearwood *Kunzea glabrescens,* however it does contain an open overstory of Jarrah, Holly-leafed Banksia *B. ilicifolia*, Sheoak and the occasional Firewood Banksia.

The bushland remnant in the central eastern section of Lot 201 (vegetation type Jar_Bank_Xant) is a low closed forest of Jarrah, Slender Banksia with scattered Firewood Banksia over Grass trees *Xanthorrhoea sp.* and a weedy understorey.

The largest remnant in Lot 508 (vegetation type Mar_Jar_Xylo) contains an open woodland of Marri and Jarrah over the occasional Banksia and Woody pear *Xylomelum occidentale.*

Throughout the Proposal area there were small stands of Jarrah and Marri with little to no mid-strata and a grazed ground cover of weeds (vegetation type Jar_Mar_graze). Almost all paddock trees are eucalypts and are included in this vegetation type.

Throughout the site visit (BCE, 2021), small flocks (approximately 2 to 10 individuals) of Forest Red-tailed Black-Cockatoos were encountered. They were observed actively feeding on all three days on site, mostly in Marri. Foraging evidence on Marri fruit was abundant throughout the three Lots.

The remaining category consists of a mixed assemblage of native but mostly introduced plants of many varieties (vegetation type Mixed Veg). These may provide foraging value for black-cockatoos but the precise value is unknown and not included in the assessment.

The above descriptions were used by BCE (2021) to assess the vegetation characteristics value in Tables 6-5 to 6-7. Using the BCE scoring system, the site context value was calculated with a value of 2 for all three species. This value was determined by the prospect that Black-Cockatoos were likely to use the local area for breeding and that 1 to 5% of the existing vegetation in the local area remained. Both Carnaby's and Forest Red-tailed Black-Cockatoo are abundant in the area, therefore they are allocated a score of 1 for species density, whereas Baudin's Black-Cockatoo is more likely to remain further east on the Darling Scarp, therefore obtaining a score of 0. Note that in accordance with the BCE scoring system if the vegetation characteristics score for a vegetation type is less than 3, then the context and species density score automatically obtains a value of zero.

TABLE 6-5: CARNABY'S BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Jar_Mar_graze	3	2	1	6
Mar_Jar_Xylo	4	2	1	7
Jar_Bank_Xant	5	2	1	8
Kunz_Jar_Bank	3	2	1	6
Bank_Sheo_Mar	4	2	1	7
Int. Eucs	1	0	0	1

TABLE 6-6: BAUDIN'S BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Jar_Mar_graze	3	2	0	5
Mar_Jar_Xylo	4	2	0	6
Jar_Bank_Xant	3	2	0	5
Kunz_Jar_Bank	2	0	0	2

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Bank_Sheo_Mar	4	2	0	6
Int. Eucs	1	0	0	1

TABLE 6-7: FOREST RED-TAILED BLACK-COCKATOO FORAGING ASSESSMENT

VEGETATION TYPE	VEGETATION CHARACTERISTICS (6)	CONTEXT (3)	SPECIES DENSITY (1)	TOTAL (10)
Jar_Mar_graze	3	2	1	6
Mar_Jar_Xylo	4	2	1	7
Jar_Bank_Xant	3	2	1	6
Kunz_Jar_Bank	2			2
Bank_Sheo_Mar	4	2	1	7
Int. Eucs	3	2	1	6

6.5. POTENTIAL IMPACTS

The Proposal may result in the following impacts to fauna and fauna habitats:

- Direct clearing of 21.04ha of Black Cockatoo foraging habitat resulting in the loss of fauna habitat.

6.5.1. CLEARING OF BLACK COCKATOO HABITAT

The Proposal area provides value for all three Black-Cockatoo species for foraging and to a lesser degree potential nesting. A total area of ~120ha of native vegetation/foraging habitat is present within the Proposal's Development Envelope, which although assessed as low-quality foraging habitat includes some patches that are at least of moderate foraging quality for all three species. The presence of feeding Forest Red-tailed Black-Cockatoos during the site visits in Survey 1 (BCE, 2021) confirmed the importance of the general Site area for foraging for that species.

KLPL have designed disturbance areas for the Proposal to utilise existing areas of cleared pasture (i.e. 485.81ha) and avoid clearing native vegetation as far as practicable in order to reduce direct impacts to Black Cockatoo foraging and potential nesting habitat. This has resulted in the avoidance of ~99ha of native vegetation within the Proposal's Development Envelope, with the generally larger areas/patches of native vegetation, being avoided. The Proposal will however require direct disturbance of 21.04 ha of completely degraded to degraded native vegetation to facilitate the development of mine areas. This vegetation has been assessed as generally low-quality foraging habitat for Black-Cockatoos.

BCE (2021; 2022) identified 39 trees displaying hollows that appeared to be suitable for nesting by a Black-Cockatoo. However, upon closer inspection by Australian Black-Cockatoo Specialists (ABCS) (2023a; 2023b) only one tree containing three hollows was considered to be potentially suitable in the Proposal area. The

upper and lower hollows were deemed too small and not deep enough for Black-Cockatoos, whilst the middle hollow was shallow, however as it goes back into the branch it is considered suitable for a Black-Cockatoo. No signs of use by a Black-Cockatoo were identified. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. This tree has been avoided from disturbance as part of the Proposal. An additional potential nesting tree was identified in Lot 63 as part of the previous Section 45C request (ABCS, 2023a), which has also been avoided from disturbance.

No disturbance to known roost trees (i.e., four located outside of Proposal area) will occur as a result of implementing the Proposal.

6.6. MITIGATION

6.6.1. AVOID

The Proposal has been designed to utilise existing cleared pasture areas (i.e., 485.81ha) and avoid the need for clearing native vegetation/foraging habitat as far as practicable. This has resulted in ~99ha of native vegetation being successfully avoided from disturbance. In addition, the one tree containing potentially suitable hollows will be avoided from disturbance.

6.6.2. MINIMISE

In accordance with MS810, KLPL will continue to implement the following key management measures to minimise impacts to terrestrial fauna values:

- MS810 Condition 6 - Protection of Native Vegetation.
    - 6-3 The proponent shall not clear any native vegetation within the Proposal area unless the land to be cleared is required for the extraction of mineral ore within 6 months of the date of clearing.
- MS810 Condition 7 - Protection of Watercourses and wetlands.
    - 7-1 The proponent shall not clear vegetation or undertake mining activities:
        a. Within 20m of the banks of watercourses shown in Fig 9 of the PER document.
        b. Within 100m of the boundary of a conservation category wetland.

6.6.3. REHABILITATE

Clearing of 21.04 ha of Black-Cockatoo potential nesting and low-quality foraging habitat for the Proposal, will be revegetated in accordance with the requirements of the approved Rehabilitation Management Plan (MS810 Condition 8) (Appendix 7). This will include revegetation of at ~30ha of local native provenance species (i.e., at a ratio of 1.4ha:1ha) within the Proposal area. The revegetation will be undertaken with the objective of contributing to enhanced natural ecosystem function in the local area (e.g., such as by extending/establishing a native vegetation corridor) and providing additional Black Cockatoo foraging habitat.

6.7. ASSESSMENT AND SIGNIFICANCE OF RESIDUAL IMPACTS

As documented in the EPA Report and Recommendations (EPA Bulletin 1269) the original approved Proposal involved the clearing of 182ha of semi-intact stands of native vegetation and other scattered remnant vegetation, including isolated paddock trees.

To manage direct impacts to native vegetation for the Original Proposal, MS810 Condition 6, required KLPL to ensure a minimum of 75ha of native vegetation is protected in perpetuity. To meet this condition, KLPL secured two of the better tracts of remnant native vegetation with 75ha protected in perpetuity by conservation covenants executed under the *Soil and Land Conservation Act 1945*. The areas, 25ha on Lot 34 (formerly Lot 62) Hopelands Road and 50ha on Lot 202 Elliott Road have been fenced to exclude stock and surveyed by consultant botanists (Onshore Environmental, 2019) to assist in developing a program for revegetation.

Revegetation related works implemented on these properties to date includes:

- Botanical surveys completed in 2018 to document values and formulate appropriate rehabilitation actions (Onshore Environmental 2019);
- Installed fencing to exclude stock and in a select area on Lot 202 and Lot 34, additional fencing measures undertaken to exclude kangaroos and rabbits;
- Weed control to reduce competition in planted /seeded areas and placement of mulched native vegetation;
- Targeted seeding and planting with native species;
- Transplant of grass trees to Lot 202.

The revegetation works on the conservation areas are ongoing.

In accordance with a Rehabilitation Management Plan (MS810 Condition 8) that has been agreed with the owner of Lots 59 and 300, vegetation cleared in the course of mining will be replaced to a design that creates native vegetation corridors along existing degraded ephemeral watercourses. The first plantings were completed in June 2019 along select watercourse margins and in the southern area of Lot 59. In other areas, degraded topsoil adjacent to the watercourses has been replaced with better quality topsoil from mined vegetated areas, the areas covered with mulched vegetation and coarse cleared vegetation and appropriate native seedlings planted. A further 3.7ha along the frontage of Hopeland Road was planted with native vegetation in 2018. In 2020, further native revegetation plantings occurred with the focus on in filling on Lot 300 and the commencement of a direct seeding trial on Lot 59.

Through a series of surveys in 2004, 2005, and 2017, 22 potential Black Cockatoo nesting hollows were identified on Lot 59 and Lot 300, of which four were outside the approved mine area and nine were occupied by feral bees. This compares to 71 potential nesting hollows mapped locally outside of the approved mine area with 18 of these recorded in the conservation areas (two occupied by bees), and a further 25 (six occupied by bees) in native vegetation areas withdrawn from the proposal during the course of the initial environmental assessment (on Lot 56). To date, in collaboration with the SJ Landcare 30 artificial hollows have been installed in the conservation area on Lot 202. The artificial hollows, or 'cockatubes' have the advantage of not being readily colonised by bees or used by smaller parrot species.

The Proposal area provides some value as foraging habitat for all three species of Black-Cockatoo, although the majority of vegetation (~99ha) within the Proposal's Development Envelope has been excluded from disturbance. Of the 21.04ha of foraging habitat to be cleared for the Proposal, almost all is considered to be of low-value due to its Completely Degraded to Degraded condition. The presence of feeding Forest Red-tailed Black-Cockatoos during the first survey (BCE, 2021) indicates that the general Site area is of some value for foraging for that species.

Several large eucalypts within the Proposal Development Envelope display hollows that have potential to be suitable for nesting although no actual evidence of use has been identified. Further investigation of these hollows (39 trees in total) identified only 1 tree within the proposed disturbance area that has potential to be suitable for a Black-Cockatoo although no evidence of actual use has been identified to date. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. An additional tree potentially suitable for use by a Black-Cockatoo is located within the Lot 63 S45C request area. Both trees have been avoided from disturbance.

The value of nesting resources within the Proposals Development Envelope (which has mostly been excluded from disturbance) are increased due to the bushland to the north which is the largest remnant patch in the Keysbrook area and is a confirmed roost site for Carnaby's Black-Cockatoo (within the Lot 202 Offset area). If Black-Cockatoos are to nest within the wider project area, it provides birds with a foraging area within close proximity and it also provides connectivity to other forested areas, in particular, 6km to the east along the Darling Scarp. Data gained from the Great Cocky Count confirmed the presence of four Carnaby's Black-Cockatoo roost sites within 4km the Site. Water sources are accessible in the form of farm dams and intermittent wetlands within the project area as well as a creek line to the north; such nearby water sources make large trees attractive for roosting.

Following the avoidance of ~99ha of foraging habitat for the Proposal, unavoidable clearing of 21.04ha of low-quality foraging habitat will be revegetated in accordance with the requirements of MS810 Condition 8, by revegetation of at ~30ha of local native provenance species within the Proposal area (i.e., ratio of 1:1.4ha). The revegetation will be undertaken with the objective of contributing to enhanced natural ecosystem function in the local area (e.g., such as by extending/establishing a native vegetation corridor) and providing additional Black Cockatoo foraging habitat.

In accordance with *WA Environmental Offsets Policy, September 2011* (Government of Western Australia, 2011)*, WA Environmental Offsets Guidelines* (Government of Western Australia, 2014) and the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy Oct 2012* (DSEWPaC, 2012a), offsets may only be applied after other mitigation measures have been considered, as per the following hierarchy:

- Avoid;
- Minimise;
- Rehabilitate;
- Offset.

Following the application of this mitigation hierarchy (on-site avoidance and mitigation measures), a significant residual impact of 21.04ha of low-quality foraging habitat for three species of Black-Cockatoos remains. As such KLPL are proposing to offset the significant impact through land acquisition in accordance with the EPBC Act.

6.8. ENVIRONMENTAL OUTCOMES

KLPL considers that with the implementation of the above listed key mitigation measures and provision of a suitable offset in consultation with DBCA and DCCEEW to offset residual impacts to conservation significant fauna habitat, that the EPA's objective to protect terrestrial fauna so that biological diversity and ecological integrity can be maintained.

7. ENVIRONMENTAL FACTOR – INLAND WATERS

7.1. EPA OBJECTIVE

To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.

7.2. POLICY AND GUIDANCE

EPA Policy and Guidance

Environmental Factor Guideline – Inland Waters (EPA, 2016e).

Other Policy and Guidance

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000).*
- *Western Australian Water in Mining Guideline. Water licensing delivery report series. Report No. 12 (DoW, 2013).*
- *Hydrogeological Reporting Associated with a Groundwater Well Licence. Operational Policy 5.12. (DoW, 2009).*
- *Identification and investigation of acid sulfate soils and acidic landscapes (DER, 2015a).*
- *Treatment and management of soil and water in acid sulfate soil landscapes (DER, 2015b).*

7.3. ORIGINAL PROPOSAL

7.3.1. GROUNDWATER

The Original mining area is located on the superficial Bassendean Sand aquifer and overlies the deep Leederville aquifer. KLPL proposed to extract up to 1.8 GL per annum from the lower Leederville aquifer; and 0.2GL per annum from the shallow Superficial aquifer during the life of the mine. On-site monitoring and modelling of groundwater levels conducted by Rockwater Pty Ltd (2007) indicated that groundwater drawdown associated with the Original Proposal should not adversely affect the aquifers and surrounding bore users.

At the time of referral and assessment, the Original Proposal area fell within the then unproclaimed Karnup-Dandalup Underground Water Pollution Control Area. The Karnup-Dandalup UWPCA was not proclaimed and advice pertaining to protection of groundwater resources in the area for drinking water purposes was rescinded in 2009 (email 28 March 2019, C Johnston, DWER).

According to the WAPC Planning Bulletin No.64 *Acid Sulfate Soils,* the majority of the Original approved mining area was classified as "moderate to low risk" of Acid Sulfate Soils at depths greater than 3m below ground level (mbgl). Mining was proposed to an average depth of 2mbgl, with a maximum depth of 6mbgl when mining in more elevated sandy dunes. Sampling undertaken by DORAL confirmed that the soil profile where ASS is likely to occur will not be disturbed via excavation or dewatering during the life of the mine.

Key risks to groundwater associated with the Proposal were:

- A reduction in the quantity of groundwater available to surrounding users associated with the abstraction for process water and dust suppression;

- A decline in groundwater quality associated with the potential disturbance of acid sulfate soils.

Groundwater abstraction from the Leederville aquifer is seasonal and generally limited to summer and autumn months. Abstraction is minimised by the retention of surplus water in winter and spring in decommissioned tailing dams, for later drawing into the process circuit as the site moves to water deficit. Annual groundwater abstraction has varied between 49% and 57% of the annual licence allocation.

7.3.2. ORIGINAL PREDICTED GROUNDWATER DRAWDOWNS

A numerical groundwater flow model for the Project was originally developed by (Rockwater, 2006) to provide dewatering predictions of groundwater inflows to the proposed Keysbrook mine (based on the mine plan current in 2006) and also to predict the impact to the environment due to mining. The original groundwater model was complemented by additional field investigations and modelling by (Rockwater, 2007). It should be noted that a revised mining schedule was used in Stage 2 modelling (2007), thus some of the original mining area were not modelled. Salient points from both reports (Rockwater 2006 & 2007) in regard to the impacts to the groundwater levels in the Superficial aquifer are as follows:

- Groundwater levels in the shallow Superficial aquifer will be locally and temporally lowered to the base of the mined depth (i.e., the base of the Bassendean Sand);
- The impact to groundwater levels is unlikely to be significant beyond the proximity of the proposed mining area, with modelling predicting drawdowns of less than 0.5m at distances greater than 500m from the mine boundaries (Figure 7-1);
- The modelling indicates that the impacts to the Superficial aquifer from dewatering and tailings deposition are short term (i.e., about a month or two), typically comprising a brief drawdown from dewatering, followed by slight mounding from tailings deposition (due to artificial recharge to the local Superficial aquifer).

A revised and recalibrated groundwater flow model was developed by GRM (2017) based upon the earlier Rockwater model (2007). This more recent modelling indicated that:

- Dewatering requirement for the pits (as per 2017) is small, up to 11 L/s;
- Seepage from the tailings to the Superficial aquifer is about 7.5 L/s;
- Confirmed the short-term impacts to the Superficial aquifer from dewatering and tailings deposition is consistent with the original Rockwater models (2006 & 2007).

7.3.3. EXISTING GROUNDWATER LICENCES

KLPL has been granted 4 groundwater abstraction (5C) licences, allowing groundwater abstraction of up to 1.8 GL per annum from the Leederville Aquifer (water supply purposes) and up to 0.6 GL per annum from the Superficial Aquifer (dewatering purposes).

7.3.4. MONITORING BORE NETWORK

Two production bores (KL2P and KL3P) and seven monitoring bores were constructed in the Mariginiup Member of the Leederville Formation. Two production bores have been installed to provide the make-up water to meet the Project's process water demand, with each bore capable of producing 28 L/s. Additionally, 36 shallow monitoring bores were initially constructed into the Superficial formations to monitor potential water level change in the Superficial aquifer due to operation of the Leederville aquifer production bores and dewatering and tailings infiltration into the Superficial aquifer.

In early 2022, 5 shallow monitoring bores were additionally constructed in the Superficial aquifer across Lot 56. Some of the superficial aquifer monitoring bores are located close to the sensitive vegetation (CCW and TEC within Lot 56) to measure any drawdown that may occur in these sensitive areas.

Additionally, there are:

- 5 monitoring bores within Lots 201, 507 and 508 that were constructed in the Superficial formations to monitor historical groundwater abstraction from the Superficial aquifer within this area.
- 22 neighbouring landowner bores/windmills with some located close to the sensitive vegetation (CCW and TEC) and are occasionally monitored for any potential impacts.
- Five DWER monitoring bores (T570, T610, T620, T670 and T680B) which are part of the DWER regional monitoring program to assess regional impacts from groundwater abstraction.
- Six bores recently installed within Lot 63 to monitor drawdown impacts including the CCW (ID 14870) within Lot 63.

Existing bore locations are shown on Figure 7-2.

7.3.5. CURRENT (2021) DEWATERING AND IMPACTS TO SUPERFICIAL AQUIFER

Dewatering volumes, groundwater levels and water quality monitoring in the Superficial aquifer for the original Proposal has been undertaken and reported by KLPL as part of the conditions for groundwater licences (GWLs). The monitoring results from the 2021 Annual Groundwater Monitoring Summary (GMS) report (GRM, 2021) are as follows:

- Totals of around 350,000 kL (i.e., 11L/s) was recorded as being abstracted from the Superficial aquifer due to mining of the Bassendean Sand in 2021;
- Dewatering was done via in-pit sumps only during a two-month period (i.e., January to February 2021), which included recycled water recovered from tailings backfill;
- It is understood that for most of the year mining was carried out above the water table, consequently groundwater seepage into the pits was minimal;
- The groundwater level in the Superficial Aquifer continues to demonstrate a cyclical seasonal variability (between 0.4 to 3.6m, averaging 1.8m), forming a peak around August and September each year following winter rainfall and a trough around March-April at the end of the dry season. The pattern of seasonal variability in the Superficial aquifer indicates active rainfall recharge;
- The groundwater level contours for the Superficial aquifer during December 2015 and December 2021 are shown in Figure 7-3. The monitoring data shows a groundwater flow direction towards the west (as in the pre-mining period) and the data does not indicate any impacts to the Superficial aquifer associated with pit dewatering and tailings discharge, apart from within the immediate mining areas.
- Groundwater quality monitoring indicates that the Superficial aquifer is fresh to brackish, with a neutral to slightly acidic pH and to be of sodium chloride type. The salinity varied between less than 100 to around 6,500 mg/L TDS in 2021, which is consistent with known regional variability and also generally consistent with previous monitoring years (apart from some seasonal trends in some bores).
- The water chemistry analyses do not indicate any adverse trends in pH, chloride, nitrogen or sulphate in the Superficial aquifer.

7.3.6. SURFACE WATER

At a regional level, all surface drainage from the Project area ultimately flows to the Peel Inlet (Peel-Harvey Estuary). Streams from the Darling Scarp and foothills flow from the east to west through the mine area (MBS, 2006b). The Keysbrook Water Management Plan provides details of the regional streamflow monitoring stations (MBS, 2006b; 2015).

The majority of the Original Proposal area is within the Nambeelup Brook Subcatchment, which discharges to several lakes in the Serpentine River Catchment System. The watercourses flowing through, and adjacent to, the original Project are discussed in the *Public Environmental Review Keysbrook Mineral Sands Project* (MBS, 2006a). The Nambeelup Brook North is categorised as a Medium Watercourse, with peak flows of 1 to 2 cubic metres per second. As a result, it has 10m buffers and is bunded off and protected from disturbed mine areas. Minor watercourses passing through the Project with peak flows of less than 1 cubic metre per second are generally shallow and poorly defined (MBS, 2006b; 2015).

A number of Conservation Category wetlands exist on private property south of the original mining area and several ephemeral watercourses traverse the approved mine area from east to west.

The risk that implementation of the Original Proposal may indirectly impact on the wetlands was considered manageable by the EPA based on groundwater modelling predictions and expectations for implementation of appropriate groundwater and vegetation condition monitoring.

7.3.7. ACID SULFATE SOILS

As documented in the EPA Report and Recommendations Bulletin 1269 (EPA, 2007), the WAPC Planning Bulletin No. 64 *Acid Sulfate Soils*, shows the majority of the original Project area is classified as 'moderate to low risk' where ASS layers are predicted at depths greater than 3mbgl, with two areas classified as 'high risk' within Lot 57. Mining is proposed to an average depth of 2mbgl, with a maximum depth of 6mbgl when mining in sandy dunes. The ore body extends below the seasonal water table in some areas, where dewatering of soils would be required. The ore body is confined to the Bassendean Sand Formation. The soil profile where potential ASS (PASS) is likely to occur is in the underlying Guildford Formation, which would not be disturbed through excavation or dewatering.

Two site specific ASS surveys were undertaken as part of baseline environmental surveys for the original Project.

An initial survey was undertaken in 2005 over a range of different soil types, focusing on the identified high-risk sites as mapped in WAPC Bulletin 64 and on low-lying landforms that are the most likely sources of PASS. The results indicated PASS occurrence across the general area is as described in the WAPC Bulletin 64 maps, of low to moderate risk, with most results less than half the Action Criterion.

The assessment of the two high risk sites shown in the WAPC Bulletin 64 maps, demonstrated that they were not high-risk sites, with Titratable Peroxide Acidity (TPA) levels generally a quarter to half of the Action Criterion. An additional sampling program was undertaken to provide more detailed results on these two areas. The results of the additional sampling program were consistent with the first assessment and confirmed the low to moderate risk status of these sites.

Further field assessment sampling for ASS was undertaken in February 2007. Eighteen locations were drilled to depths of up to 4.6mbgl, using a Geoprobe Macro-core, and were tested for field pH (pH_F) and pH after oxidation (pH_{FOX}). The results of the sampling program were consistent with the previous assessments and confirm the general low to moderate risk status of the site. In addition, 16 samples were selected and

submitted for laboratory analysis, with only 3 samples, from two different locations exceeding the Action Criterion. Comparison with the geological database confirmed the elevated result for Hole 10 at 1.9m depth was below the base of the pit floor. Hole 8 at 2.4m depth however was within the mine profile, but the TPA value only just exceeded the Action Criteria.

To manage the minor occurrences of PASS at the Site, an ASS Management Plan (ASSMP) was prepared in accordance with MS810 Condition 12 which includes soil sampling (ore, tails and mine void), dewatering monitoring and groundwater monitoring. To date, no significant acid generating material has been encountered in mining in the Project area.

7.4. RECEIVING ENVIRONMENT

7.4.1. INLAND WATERS INVESTIGATIONS

The following hydrogeological and hydrology assessments were undertaken by AQ2 and are provided in Appendix 10:

- *Keysbrook Mineral Sands Mine, Groundwater Modelling Assessment for Western Extension* (AQ2, 2023a);
- *Surface Water Assessment for a Significant Amendment to the Keysbrook Mineral Sands Project* (AQ2, 2023b).

An Acid Sulfate Soil Investigation was also undertaken for the Proposal as reported in:

- *Acid Sulfate Soil Investigation, Western Extension to the Keysbrook Mineral Sands Project* (ABEC, 2023) (Appendix 11).

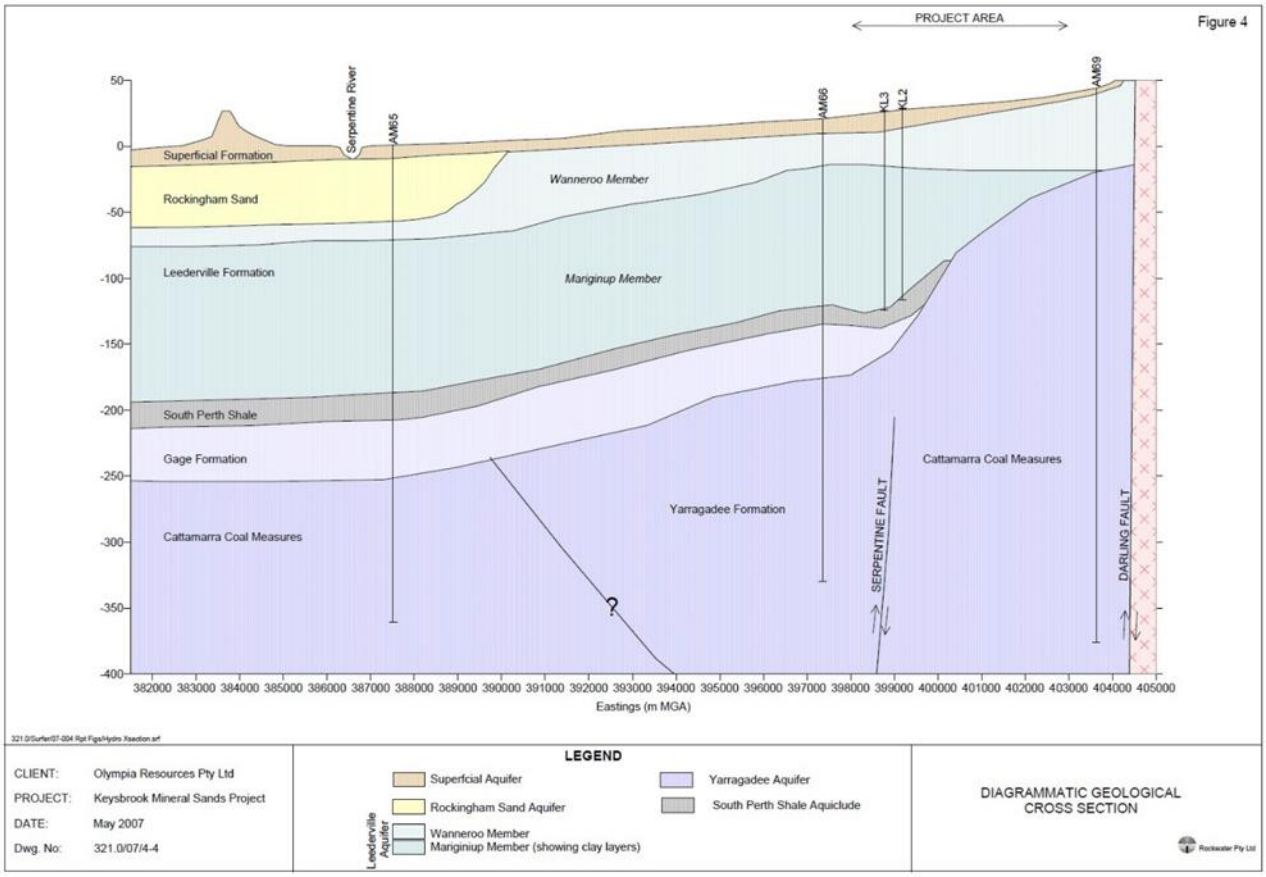
Information provided in these reports have been used to provide background information and assessment of potential impacts in the following sections. Furthermore, to assist with assessment of impacts, the Proposal area has been divided into Four Components as per table below.

TABLE 7-1: PROPOSAL COMPONENTS

SECTION	MINING LOTS	MINING BLOCK NUMBERS	MINING PERIOD	APPROXIMATE PROPOSED DISTURBANCE (MINE) AREA (HA)
1	201, 507 and 508	403-473	January 2026 to February 2028	203
2	64	332-400	February 2028 to December 2029	177
3	63	273, 277, 309, 319, 320, 321, 328, 329	December 2029 to May 2030, & May 2031	25
4	62 and 20	211-269	May 2030 to April 2031	122

7.4.2. GEOLOGY

The Proposal is located in the Perth Basin and is underlain by about 10 to 15m of superficial formations (Quaternary age), comprising the Bassendean Sand and the underlying Guildford Formation. These formations unconformably overlie about 50 to 130m of the Leederville Formation – Wanneroo and Mariginiup Members – of Cretaceous age. The Mariginiup Member underlies most of the Proposal area whereas the Wanneroo Member, up to 25m in thickness, is present only in the very western part. The Leederville Formation unconformably overlies the Cattamarra Coal Measures in the east and conformably overlies the South Perth Shale in the west. A schematic conceptual geological west-east cross section of the Perth Basin provided by Rockwater (2007) is shown below.



7.4.3. HYDROGEOLOGY

The Proposal lies on the Swan Coastal Plain, 3km west of the Darling Scarp, within the Serpentine and Murray groundwater management areas, west of the towns of Keysbrook and North Dandalup.

Two major aquifers, the Superficial and Leederville, have been identified within the Proposal. A detailed description of the Proposal area's aquifers by Rockwater (2006; 2007) and GRM (2021) is summarised below.

Superficial Aquifer

The Bassendean Sand and Guildford Formation form an unconfined Superficial aquifer. The permeability of the superficial aquifer is variable and depends on sediment type, with saturated sands having higher permeability than clays. At the Proposal, the Bassendean Formation forms the main portion of the aquifer, with the upper 4 to 8m of this formation being moderately permeable, while the Guildford Formation is of lower permeability, owing to its more clayey nature. The high sand content in all the superficial units at the site mean they are in hydraulic connection and behave as a single aquifer unit.

The Bassendean Sand has a variable thickness (up to 5m), thickening to the west. Owing to the shallow base of the Bassendean Sand, this sand is in places fully unsaturated in summer/autumn, and partly-saturated in winter/spring; water levels fluctuate about 1m annually. In other areas, the formation extends below the summer water table and is partly to fully saturated year-round. The underlying Guildford Formation extends to 9 to 15 m below ground level (mbgl) and is mostly saturated, with the exception of the upper one metre or so where the Bassendean Sand is thinnest.

The groundwater level within the Superficial Aquifer varies from 0 (surface level) to 5mbgl, with groundwater flow mainly to the west, under the prevailing hydraulic gradient. Groundwater salinity can be quite variable and is fresh to brackish, ranging from about 200 to 5,000mg/L total dissolved solids (TDS).

The groundwater in the Superficial aquifer is derived from recharge resulting from direct rainfall and the local stream runoff from ephemeral drainage networks.

Leederville Aquifer

The Leederville aquifer is a confined groundwater system, separated from the overlying Superficial aquifer by the confining Guildford Formation. The Leederville aquifer comprises interbedded sandstones and siltstones, which extend to at least 130mbgl and have a modest to high permeability in the vicinity of the Proposal. The piezometric level within the Leederville Formation is typically lower than that of the Superficial aquifer, although some local variability has been reported (Rockwater, 2013). The Leederville aquifer receives groundwater from the Superficial aquifer and transmits it mainly westwards. The groundwater quality of the Leederville Formation is fresh to brackish, reporting a salinity of less than 1,500 mg/L TDS.

7.4.4. GROUNDWATER USERS

A search of the DWER Water Information Reporting (WIR) database on other groundwater users was conducted by (AQ2, 2023a), which identified 551 bores within a 10km radius of the Proposal. Locations of these bores are provided in Figure 3 of AQ2 (2023a) and summarised as follows:

- Two artesian Yarragadee monitoring bores (AM64 and AM66) are located north east and south west of the Proposal and form part of the DWER Groundwater Assessment Network;
- A series of Superficial aquifer monitoring bores are located within and adjacent to the Proposal area. This series of bores (which includes T610, T620, T570 and T660) also forms part of the DWER Groundwater Assessment Network;
- There are numerous registered bores within and surrounding the Proposal area with little or no information in the WIR database.

7.4.5. HYDROLOGY

Regional Hydrology

At a regional level, all surface drainage from the Project area ultimately flows to the Peel Inlet (Peel-Harvey Estuary). Streams from the Darling Scarp and foothills flow from east to west through the mine area (MBS, 2006b). MBS (2006b; 2015) provides details of the regional streamflow monitoring stations.

Local Hydrology

The Proposal area and surrounds are characterised by low relief topography that results in a landscape that becomes flatter and increasingly poorly draining westward from the scarp. In the pastured areas, most of the low-lying areas, creeks and wetlands have been cleared and drained. Downstream of the Proposal, west

of Hopelands Road, the low relief is even more pronounced, resulting in a wetland chain all the way to Peel Inlet (MBS, 2006b).

The watercourses flowing through, and adjacent to, the Proposal are discussed in the Surface Hydrology Report (MBS, 2006b) and shown on Figure 7-4. The northern part of the Proposal is located within the Dirk Brook subcatchment, which flows to the Serpentine River and into Goegrup Lake and the Peel Inlet. The majority of the Proposal is located within the Nambeelup Brook subcatchment, which discharges to several lakes in the Serpentine River Catchment System and then into the Peel Inlet. The western section of Lot 507 drains into the Punrack Drain subcatchment, which flows into Lake Amarillo, one of the Serpentine Lakes.

The watercourses associated with each Section of the Proposal are discussed below.

Section 1

Two unnamed tributaries of Dirk Brook flow in a westerly direction as well-defined watercourses to the north of the proposed areas of disturbance within Section 1, but do not fall within their extent. A small unnamed stream flows through the southern half of the Section and continues to the west to converge with other tributaries of Nambeelup Brook.

Section 2

Nambeelup Brook North Tributary flows through the south-eastern corner of Section 2 and continues to the west to converge with other tributaries and form Nambeelup Brook. A smaller unnamed tributary of Nambeelup Brook flows west through the centre of the Section.

Section 3

Nambeelup Brook North Tributary flows from Section 2 and continues south-westerly through the northern part of Section 3. A smaller unnamed tributary of Nambeelup Brook flows south-westerly through the Section.

Section 4

The largest tributary of Nambeelup Brook that crosses the Project, Balgobin Brook, flows westerly through Section 4, joining with Balgobin Brook South close to the centre of the Section which also flows westerly through the southern half of Section 4. A smaller unnamed tributary of Balgobin Brook flows westerly through the southern half of the Section.

Watercourse classifications reported by MBS (2006b; 2015) are presented in Table 7-3, along with their management philosophies which are discussed in more detail in the following sections.

TABLE 7-3: WATERCOURSE CLASSIFICATIONS (MBS, 2006b;2015)

WATERCOURSE CATEGORY	PEAK FLOWS (M^3/S)	WATERCOURSES	MANAGEMENT PHILOSOPHY	SECTION
Major	2-5	Balgobin Brook North Dandalup River Tributary	Watercourse buffers	4 -
Medium	1-2	Dirk Brook Tributary Nambeelup Brook North Tributary Balgobin Brook South Tributary	Watercourse buffers	1 2, 3 4

WATERCOURSE CATEGORY	PEAK FLOWS (M^3/S)	WATERCOURSES	MANAGEMENT PHILOSOPHY	SECTION
		Nambeelup Brook South Tributary		-
Minor	<1	Unnamed	Diversion of upstream catchments	All

Water Quality

The existing regional water quality relative to the Project was discussed by MBS (2006b; 2015). The Statewide River Water Quality Assessment (DoW,2007; AQ2, 2022b) shows water quality data for Nambeelup Brook (Site 614063), located 10km downstream (southwest) of the Project was of neutral pH, with very high nitrogen and phosphorus concentrations and high turbidity. This shows water quality has been affected by historic and existing land uses prior to any mining taking place.

7.4.1. CONSERVATION CATEGORY WETLANDS

A number of Conservation Category Wetlands (CCW) are located to the north and west of the Proposal area, as shown in Figure 7-5. A summary of those that are located downslope of mine disturbance areas and potentially impacted by the Proposal is provided in Table 7-4. More details are to be found in Rockwater (2021; 2022b) and Ecoedge (2021; 2022; 2023) all of which report that these monitored CCW areas were degraded due to historical pastoral clearing and use.

TABLE 7-4: SUMMARY OF CCW IN PROXIMITY TO PROPOSAL

SECTION	SUB CATCHMENT	CCW ID	TYPE	MANAGEMENT CATEGORY
1	Dirk Brook	14850 14887	Dampland	Seasonally waterlogged
	Punrack Drain	14760 7000 14472	Palusplain	Seasonally waterlogged
	Nambeelup Brook North	14825 14763	Palusplain	Seasonally waterlogged
		14798	Dampland	Seasonally waterlogged
2	Nambeelup Brook North	14807	Sumpland	Seasonally inundated
		14795	Palusplain	Seasonally waterlogged
3	Nambeelup Brook North	14870 14802 14803	Palusplain	Seasonally waterlogged
4	Nambeelup Brook North	14831 14804 14805 14806 14852 14465	Palusplain	Seasonally waterlogged

Section 1 (Lots 201, 507 & 508)

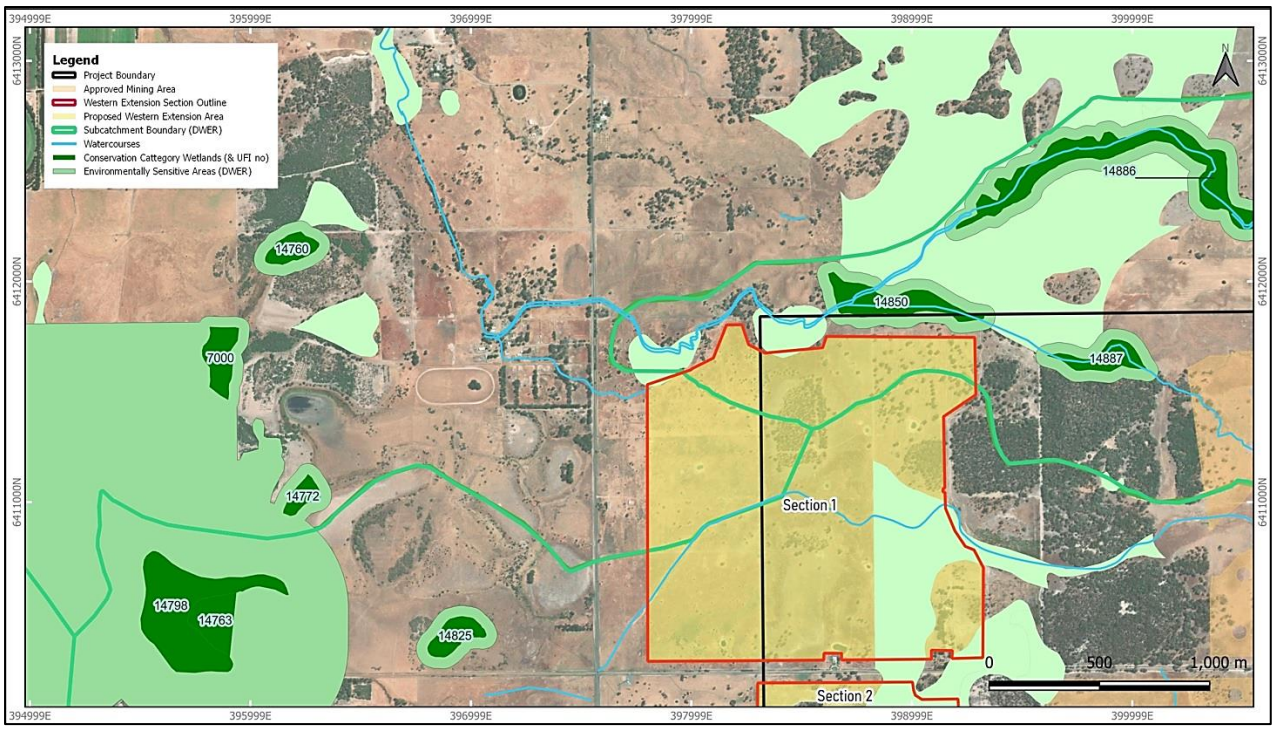
Two unnamed tributaries of Dirk Brook flow in a westerly direction as well-defined watercourses to the north of the proposed areas of disturbance within Lots 201, 507 & 508. A small unnamed stream flows through the southern half of these lots and continues to the west to converge with other tributaries of Nambeelup Brook.

Two CCWs (ID 14850 & 14887), shown on image below (AQ2, 2023a) are located immediately upstream of Lot 201 along with an area of Resource Enhancement wetland (Ecoedge, 2022). These are all dampland wetlands (i.e., seasonally waterlogged), associated with the Dirk Brook Tributary.

Additionally, three CCWs (ID 14760, 14472 & 7000) lie approximately 1.6, 1.6 and 1.9km to the west of Lot 507, respectively, associated with palusplain of the Punrack Drain.

There are also three CCWs (ID 14825, 14763 & 14798) located 0.75, 1.9 and 2km to the west of Lot 507, respectively, which are seasonally waterlogged wetlands associated with the Nambeelup Brook North.

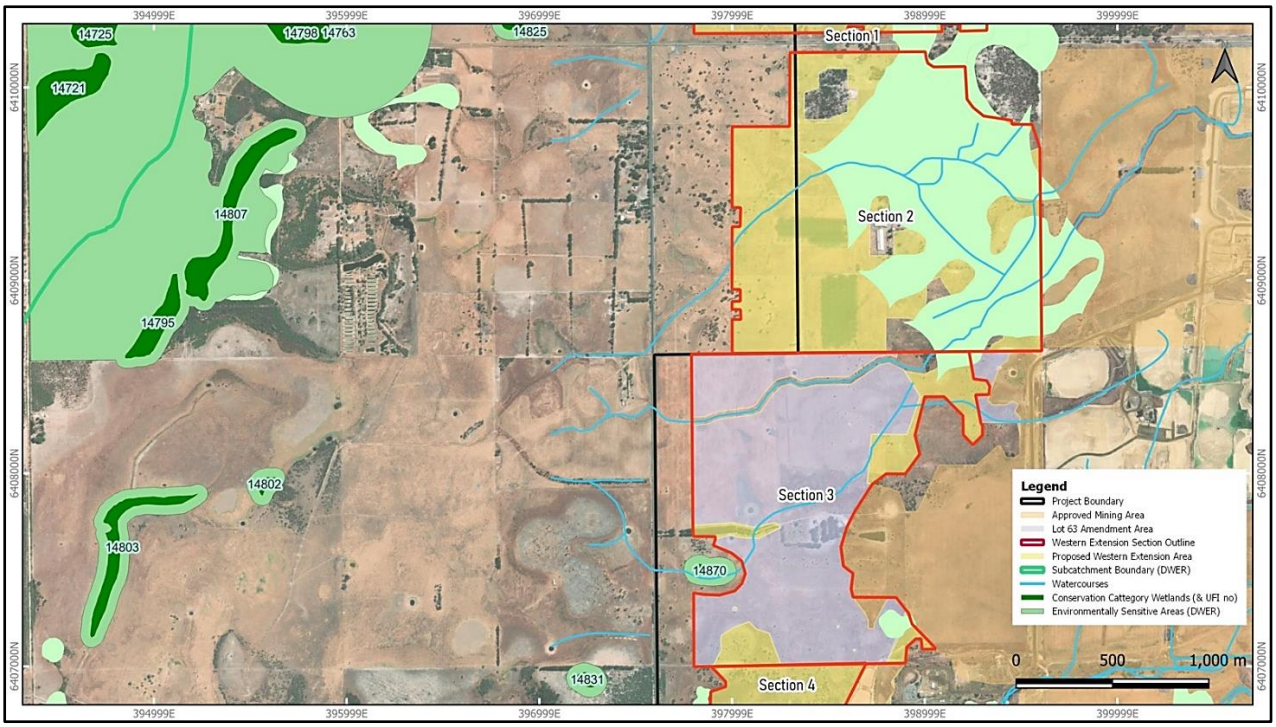
There are several Environmentally Sensitive Areas (ESAs) within and nearby the proposed Section 1 area, all of which are associated with CCWs, which occur near the northern and western boundaries of the Section 1 area (as shown on the image below).



Section 2 (Lot 64)

Nambeelup Brook North Tributary flows through the south-eastern corner of Lot 64 (Section 2) and continues to the west to converge with other tributaries and form Nambeelup Brook. A smaller unnamed tributary of Nambeelup Brook flows west through the centre of the Section 2.

There are two CCWs (ID 14807 & 14795) 2.3 and 2.9km to the west of Lot 64, respectively, which are associated with palusplain and sumpland of the Nambeelup Brook North. There are also ESAs to the west of the proposed Section 2, which are associated with CCWs as shown in image below (AQ2, 2023a).



Section 3 (Lot 63)

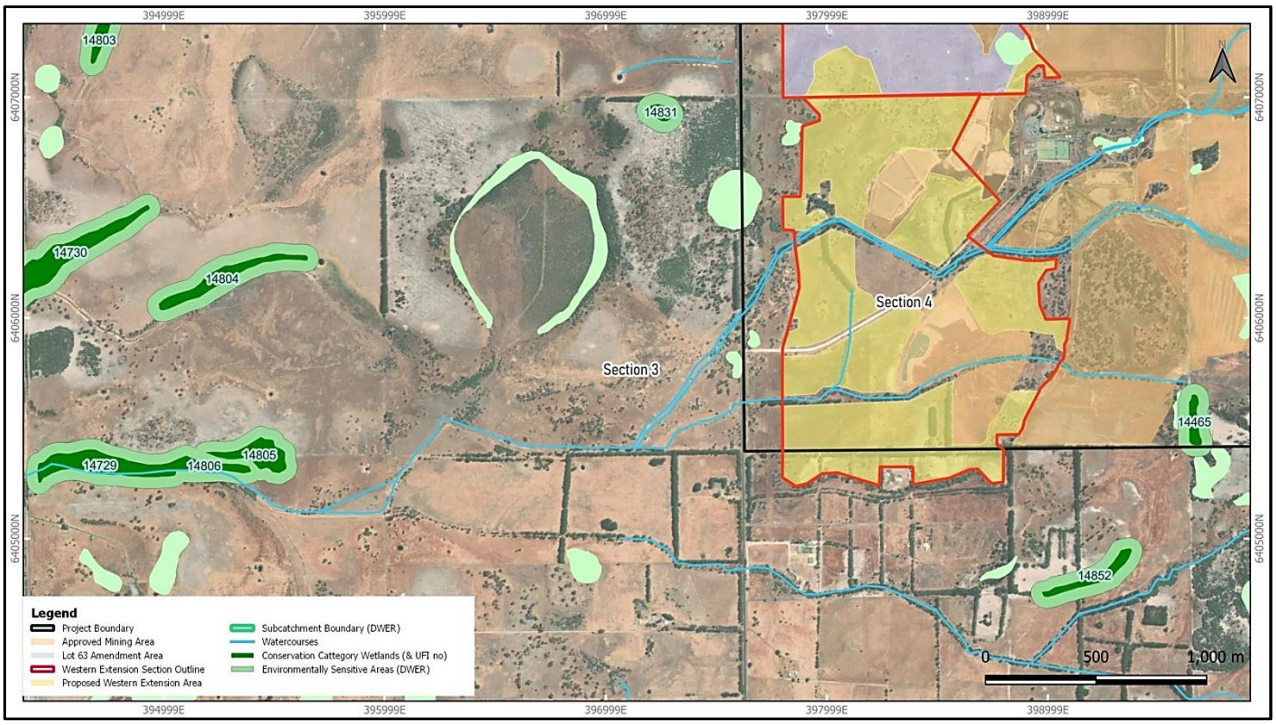
Nambeelup Brook North Tributary flows from Section 2 and continues south-westerly through the northern part of Section 3. A smaller unnamed tributary of Nambeelup Brook flows south-westerly through the Section.

There is one CCW (ID 14870) located within the proposed Western Extension area, on the western boundary of Lot 63. This CCW is mapped as palusplain (seasonally waterlogged flat) wetland.

There are also two CCWs (ID 14802 & 14803), 2.2 and 2.6 km to the west of Lot 63, respectively, which are all associated with palusplain flats of the Nambeelup Brook North. There are also ESAs to the west of the proposed Section 3, associated with CCWs (as shown in the above image; (AQ2, 2023a).

Section 4 (Lots 20 and 62)

The largest tributary of Nambeelup Brook that crosses the Proposal area, Balgobin Brook, flows westerly through Section 4, joining with Balgobin Brook South close to the centre of the Section which also flows westerly through the southern half of Section 4. A smaller unnamed tributary of Balgobin Brook flows westerly through the southern half of the Section as shown on image below (AQ2, 2023a).



There are two CCWs (ID 114852 &4465) located 0.5 and 0.7km to the south east and east of Lots 20 and 62, respectively, which are seasonally waterlogged wetlands associated with the Nambeelup Brook North.

Additionally, there are five CCWs (ID 14831, 14804, 14805 & 14806) located between 0.5 and 2.4km from the western boundary of Lot 62.

Similar to other Sections, there are several ESAs identified nearby the proposed Section 4, associated with CCWs as shown above (AQ2, 2023a).

7.4.2. ACID SULFATE SOILS

ABEC Environmental Consulting Pty Ltd (ABEC, 2023) (Appendix 11) conducted an ASS investigation for the Proposal area to identify the presence or absence of ASS at the Site, and if present, characterise the nature and extent of ASS likely to be affected as a result of the Project works. A total of 31 soil bores were sampled for ASS ranging in depth from 3mbgl to 9mbgl. Each soil bore was extended to a minimum of 1m below the maximum proposed excavation depth at each location. It is noted that the average depth of disturbance for the Proposal is ~1-2mbgl.

The soil profiles were logged and samples were subjected to field testing (pH_F and pH_{FOX}) and laboratory analysis using the CRS method, in accordance with guidance provided in (DER, 2015a).

The soil profiles predominantly comprised grey brown and yellow brown fine to medium grained well sorted sands in the upper horizons, followed by mottled grey/red/brown hard sandy clays and clayey sands with varying amounts of laterite gravel in the middle horizons, and light grey fine to medium grained well sorted saturated quartz rich sands in the lower horizons.

Results of the field testing (total of 310 samples) did not indicate the presence of actual (0 samples) or potential acidity (9 samples) with pH_F and pH_{fox} results generally above the field test criteria. A total of 19 samples of the 130 analysed for CRS, contained net acidity above the 0.03%S Action Criterion, however all samples are generally at or below the base of mining.

Results of the targeted ASS investigation for the Proposal, are very similar to the results from previous ASS investigations conducted in 2005 and 2007 for the original Keysbrook Project and 2022 for the Lot 56 amendment area, with only minor levels of acidity being detected within the soil profile, generally below the depth of mining. Mining methods for the Proposal area will be the same as for the existing areas of the Sites, comprising dry mining in the shallow Bassendean formation to an average depth of ~1-2mbgl, with minor dewatering required during winter periods. Given the targeted ASS investigation for the Proposal area has identified similar results to previous ASS investigation across the Site, it is considered appropriate that the existing ASSMP implemented as per MS810 Condition 12 is continued to be applied for the Proposal.

7.5. ASSESSMENT OF POTENTIAL IMPACTS

Potential impacts from the Proposal on Inland Waters are:

- Short-term dewatering of mine pits and associated drawdown of the water table, which may affect:
  - Superficial aquifer water flow regime;
  - Conservation Category Wetland (CCW) water levels.
  - Reduce health and condition of native vegetation.
- Hydrological impacts to downstream CCW's including:
  - Reduction in surface water yields;
  - Discharge of surplus water;
  - Disturbance of watercourses.
- Reduction in surface water quality as a result of discharge of water in emergency situations, which may have a localised adverse effect on the receiving environment.

7.5.1. SHORT TERM DEWATERING

GRM's 2017 groundwater model was updated by (AQ2, 2023a) to simulate the impact of groundwater drawdowns from the Proposal. Features of the 2017 groundwater model were retained (boundary conditions, aquifer geometry and parameters) and no other changes to the model were made by AQ2. To allow for easier transfer of data and more efficient computation, the groundwater model was converted to the Modflow USG groundwater modelling code, operating under the Groundwater Vistas graphical user interface (ESI, 1996 – 2021) (AQ2, 2023a).

The model simulates groundwater conditions in the Proposal area and includes the Superficial aquifer (Layers 1 and 2) and the underlying Leederville Formation (Layer 3), seasonal rainfall recharge and groundwater outflow to the west (down gradient). The model simulates seasonal groundwater conditions assuming long term average rainfall (rainfall of 66 mm per month over the period June to September of each year and zero recharge over the period October to May each year). The model also simulates the observed pre-development groundwater conditions in the area of the Proposal (i.e. groundwater levels of around 23 to 28mAHD).

Hydrographs of predicted water levels over the predicted mining and closure period for selected mining blocks (Blocks 212, 247, 320, 361, 433 and 454) are shown in Charts 7-1 and 7-2 below. Predicted water levels are shown for the case that includes the Proposal (i.e., Development) and the No Development Case. The locations of the selected mining blocks are shown in Figure 7-6. Predicted water levels show the reduction in water levels at each mining block over a short period of time (up to 3m). This is immediately

followed by recovery of groundwater levels over the subsequent months. The majority of the groundwater recovery (up to 2m) predicted for each mining block occurs within 3 years of the completion of mining. The remainder of the groundwater recovery is predicted over subsequent years, over a period of between 20 and 30 years. The predicted groundwater level reduction and subsequent recovery is consistent with the mining schedule that includes mining of each block within a period of one to two months and the subsequent infilling of each block (tailing deposition) at the completion of mining.

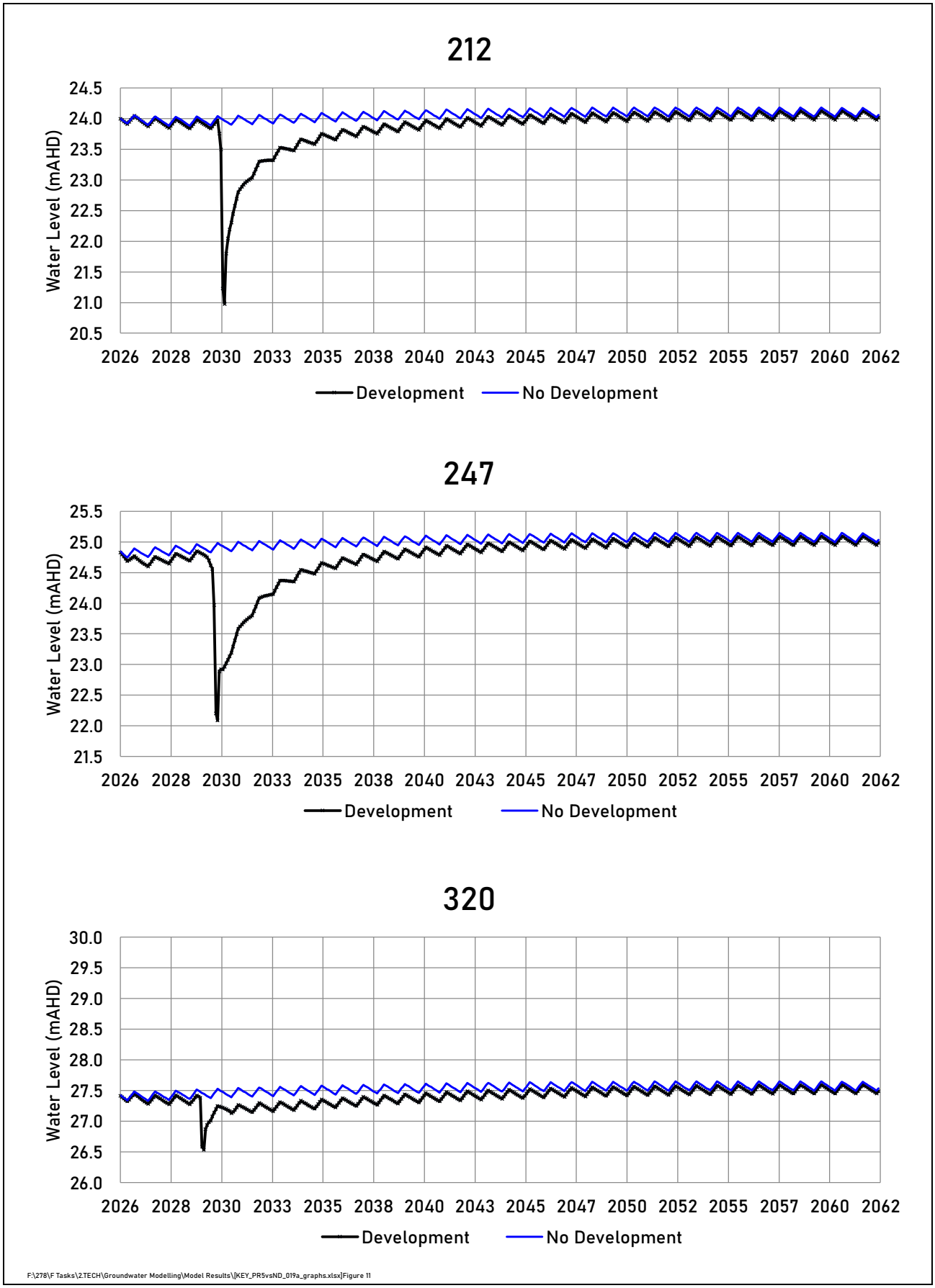


CHART 7-1: PREDICTED GROUNDWATER LEVELS AT SELECTED MINING BLOCKS (212, 247, 320)

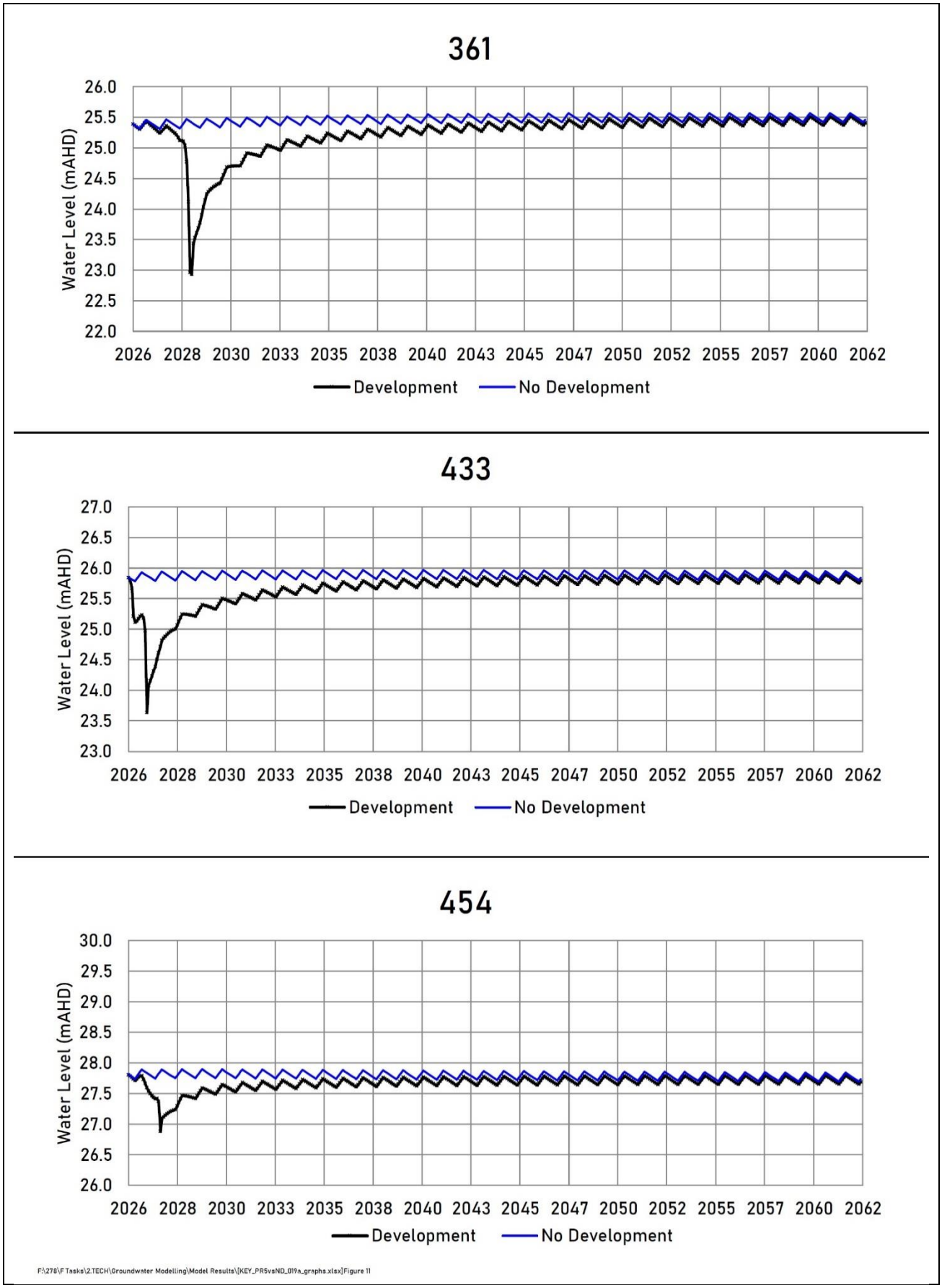


CHART 7-2: PREDICTED GROUNDWATER LEVELS AT SELECTED MINING BLOCKS (361, 433 and 454)

Several key locations (modelled observation locations) in the vicinity of the Proposal, where Conservation Category Wetlands (Figure 7-5) were identified, are also shown in Figure 7-6 and summarised, by section location (sections 1 to 4) in the table below. Hydrographs of predicted water levels at modelled observation locations over the prediction period are shown in Figures 21 to 29 in AQ2's Groundwater Assessment (2023a).

TABLE 7-3: SUMMARY OF MODELLED OBSERVATION LOCATIONS

MINING SECTION	OBSERVATION LOCATIONS
Section 1 (Figures 21 to 24 – AQ2, 2023)	MB1, MB2, MB3, MB4, MB5, MB6, MB7, MB8, MB9, MB10, MB11 and MB12
Section 2 (Figure 25 – AQ2, 2023)	MB13, MB14 and MB15
Section 3 (Figure 26 – AQ2, 2023)	MB16, MB17 and MB18
Section 4 (Figures 27 to 29 – AQ2, 2023)	MB19, MB20, MB21, MB22, MB23, MB24, MB25 and MB26

Predicted water levels at some modelled observation locations show similar trends in response to the mining block areas. At some locations, a reduction in water level is predicted over a period of a month (e.g., MB_1 and MB_2 in Section 1, Figure 21, MB_16 in section 3 and 4, Figure 26, and MB_21 in section 4, Figure 27. At MB_16, refer Figure 26 AQ2 (2023a) water levels over the period January 2026 to May 2029 are predicted to recover from dewatering simulated in 2025. These locations are generally within or very close to the proposed mining areas for the Proposal.

At locations further away from the proposed mining area, the predicted reduction in water level, to the minimum predicted level, is predicted over a period of several years as modelled observation locations are impacted later and/or by mining from more than one area (e.g., MB_3 in Section 1, Figure 21). At some locations further away from the mining areas (up to 2km from the proposed mining area), a total water level reduction of less than 0.5m is predicted in response to mining (e.g., MB_12 in Section 1, Figure 24, MB_13, MB_14 and MB_15 in Section 2, Figure 25, MB_17 and MB_18 in Section 3, Figure 26, and MB_19, MB_20 and MB_22 in Section 4, Figure 27 and 28.

Modelled observation locations show predicted groundwater recovery similar to that predicted at selected mining blocks. Further away from the mine area, groundwater levels are predicted to have recovered to pre-development levels approximately 20 years after the completion of mining. The majority of the predicted groundwater recovery is complete after a period of approximately 10 years, with the remainder of the recovery predicted to occur over the following 10 years.

Contours of the predicted drawdown at the completion of each mining stage are presented as follows:

- Figure 7-7, contours of predicted drawdown Section 1 mining (October 2027);
- Figure 7-8, contours of predicted drawdown Section 2 mining (November 2029);
- Figure 7-9, contours extent of predicted drawdown Section 3 mining (December 2029);
- Figure 7-10, contours of predicted drawdown Section 4 mining (April 2031).

Contours of predicted drawdown, when the maximum extent of drawdown is predicted in June 2035, are shown in Figure 7-11. The contours are calculated as the difference between groundwater levels predicted for the Development Case and the No Development Case for each stage of mining (October 2027, November

2029, December 2029 and April 2031) and the time of maximum predicted drawdown extent (June 2035). At the end of each section of mining, the maximum drawdown is predicted in each mining area, with drawdown predicted to extend radially away from the active mining area for Section 1, and from the active and mined areas for Sections 2 to 4.

At the end of Section 4 mining (refer Figure 7-10), drawdown of approximately 1 m is predicted in the last of the proposed mining blocks (located in the south of the proposed Western Extension mining area). Drawdown of approximately 0.1 m is predicted to extend a maximum distance of approximately 1.5 km north west, 1.6 km north and 0.8 km north east of the proposed mining area. As mining is only scheduled for the southern mining areas just prior to the end of mining in Section 4, drawdown of 0.1 m is predicted around 0.8 km to the south west and 0.4 km south east of the proposed mining areas.

The maximum predicted extent of the 0.1m drawdown contour (refer Figure 7-11) is predicted to extend a maximum distance of 2.3km to the west and 3.2km to the east of the mining area. Drawdown of 0.1m is predicted to extent a maximum distance of 3.1 km to the west and 1.2 km to the east of the mining area. Drawdown of 0.1 m is predicted to extent a distance of 1.9 km south of the proposed mining area and a distance of up to 1.6 km north of the proposed mining area. At this time, a maximum drawdown of approximately 0.25 m is predicted over the central and southern mining area.

7.5.2. HYDROLOGICAL IMPACTS TO CCW

A number of Conservation Category Wetlands (CCWs) and associated Environmentally Sensitive Areas (ESAs) are located to the north and west of the Proposal area (AQ2, 2023a), (AQ2, 2023b) as shown on Figure 7-5 and discussed in Section 7.4.1.

An assessment of the 0.5m and 2m contours, publicly available SRTM and satellite imagery was undertaken by AQ2 (2023b) to delineate the surface water catchments for CCWs that may potentially be impacted by the Proposal (Figure 7-12). The assessment identified that CCWs 14887, 14772, 14894, 14802, 14803, 14805 and 14831 will not be impacted by the Proposal. A summary of those, however, that are located downslope of mine disturbance areas and that may potentially be impacted by the Proposal is provided in the following table.

TABLE 7-4: SUMMARY OF CCW's POTENTIALLY IMPACTED BY PROPOSAL

SECTION	SUB-CATCHMENT	CCW ID	TYPE	MANAGEMENT CATEGORY
1	Dirk Brook Catchments	14850	Dampland	Seasonally waterlogged
	Punrack Drain	14760 7000	Palusplain	Seasonally waterlogged
	Nambeelup Brook North	14825 14763	Palusplain	Seasonally waterlogged
		14798	Dampland	Seasonally waterlogged
2	Nambeelup Brook North	14807	Sumpland	Seasonally inundated
		14795	Palusplain	Seasonally waterlogged
3	Nambeelup Brook North	14870	Palusplain	Seasonally waterlogged

SECTION	SUB-CATCHMENT	CCW ID	TYPE	MANAGEMENT CATEGORY
4	-	-	-	-

A summary of the potential reductions in CCW catchment areas are summarised in the table below. It is noted that the assessment takes into consideration areas that are being coincidentally backfilled and/or restored and are therefore also removed from the catchment.

TABLE 7-5: POTENTIAL REDUCTIONS IN CCW CATCHMENT AREAS

SECTION	CCW	TOTAL CATCHMENT AREA (KM^2)	TOTAL POSSIBLE MINING AREA IN CATCHMENT (KM^2)	REDUCTION IN CATCHMENT AREA (%)
1	7000	0.9	0.1	12
	14825	6.5	1.4	21
	14850	23.9	0.04	<1
	14763 14798	7.9	1.4	17
	14760	26.5	0.2	1
2	14825	6.1	0.3	4
	14763 14798	7.9	0.3	3
	14807 14795	3.7	0.1	3
3	14870	0.7	0.2	0
4	-	-	-	-

Based on the CCW catchment assessment, Section 1 has the most significant potential impact on downstream CCWs. Disturbance from mining has the potential to result in a reduction of ~21% in the catchments to 14825 and 17% of the combined catchment area of 14763/14798. The proposed additional mining area of Lot 63 (Section 3) does not cause any additional reduction in the catchment of 14870.

Given these potential reductions in catchment area it is therefore recommended that, in addition to the SW monitoring, conducted in accordance with the Water Management Plan (MBS, 2015) (MS810 Condition 11), the presence or absence of standing surface water in the CCWs potentially impacted by the Proposal should be recorded monthly. The WMP also makes recommendations relating to vegetation monitoring of the small Dirk Brook CCW.

7.5.3. MINE CATCHMENT RUNOFF AND DISCHARGE POINTS

Runoff from the Proposal area will continue to be collected in the Process Water Dam (a series of 3 dams with overflow channels between them and a combined capacity of 74ML), located near the primary processing plant, as discussed in the Water Management Plan (MBS, 2015). KLPL will ensure that this has sufficient capacity to accommodate the Proposal.

Consistent with previously approved areas, runoff from within the Proposal is to be captured in a 'return water settling pond' prior to being pumped via the dewatering system to be harvested and stored in the Process Water Dam. If a rainfall sequence causes runoff from the disturbed areas to be in excess of water demand requirements, (i.e., where pumping to the Process Water Dam would cause levels to rise above normal operating levels), pumping to local emergency discharge locations is proposed. In the event of surplus water volumes being released into the environment, any surplus water discharged off the Site at the local emergency discharge locations would have naturally entered the waterways anyway and changes in flooding regime (other than minor local effects) are unlikely to occur. The mitigation measures required are those at the overflow release points into the environment.

To keep any emergency discharge returning to the same tributary as per the existing hydrological regime, KLPL have proposed an additional 10 temporary emergency discharge points, as shown on Figures 7-13 and 7-14, to allow for progression as the mining front moves in stages across the Proposal area. It should be noted that 8 temporary emergency discharge points within Section 3 have already been proposed as part of the Lot 63 amendment (S45C request) and are also shown on Figure 7-14. The operation of any of these would be the same as has been applied to date and the receiving environment of adjacent points would be the same whichever is adopted. Some of the proposed discharge points are into minor watercourses which will be progressively diverted during mining; however, they may be used prior to the diversion.

7.5.4. DISTURBANCE AND MANAGEMENT OF WATERCOURSES

As per the Water Management Plan (MBS, 2015), inflows from external catchments will either be diverted as clean water away from the disturbed mining area and back into a watercourse downstream, or flow through the mine site but remain separate from it. Other minor creek lines will be included in the mining activities, but then reinstated during rehabilitation.

Watercourse Buffers

Watercourses categorised as Major and Medium (refer to Table 7-3), with peak flows greater than one cubic metre per second, will have 10m buffers (MBS, 2006b) and will be bunded off and protected from disturbed mine areas.

Diversion of Upstream Catchments

Minor Watercourses passing through the Proposal with peak flows of less than one cubic metre per second are generally shallow and poorly defined (MBS, 2006b; MBS, 2015). Flow in minor watercourses and sheet flow in between watercourses will be managed by bunding of the operational areas and construction of diversion drains; only minimal earthworks will be necessary due to the low flows carried by these watercourses. These diversions are to ensure that inflows from the upstream catchments do not contribute runoff to the 'Disturbance Footprint' inflows.

Where practical, these diversions shall be constructed to ensure minimum erosion potential and to direct drainage back to its natural drainage line downstream at a velocity and depth that can be accommodated without increased scour. Diversions should be in place for the minimum time necessary and removed as soon as possible as part of progressive rehabilitation. During landform restoration, drainage will be re-established along original drainage lines. Contours of the restored landforms and drainage lines will be returned to pre-mining levels as closely as possible (MBS, 2015).

MBS (2006b) determined that the effects of drainage diversions on runoff volumes and flow rates at the regional scale are expected to be minor because:

- Only a small proportion of the total Project area catchments will be disturbed at any time;
- Surface water diverted around an active mine pit will be redirected back into the natural drainage line downstream.

A summary of the watercourse management requirements for each Section is provided in the following table and presented on Figures 7-13 and 7-14. Diversions for upstream catchments are proposed on the Figures, however the shape of the mine footprints within Sections 3 and 4 in particular do not allow for Life of Mine diversions to be proposed. KLPL will use progressive diversions around the mine footprint development in the areas indicated on Figure 7-13 and 7-14.

TABLE 7-6: WATERCOURSE MANAGEMENT

SECTION	WATERCOURSE	MANAGEMENT
1	Unnamed stream	Diversion J-K
2	Nambeelup Brook North Tributary	Buffer
	Unnamed stream	Diversion D-E
3	Nambeelup Brook North Tributary	Buffer
	Unnamed stream	Diversions L-M
4	Balgobin Brook Balgobin Brook South	Buffer
	Unnamed stream	Buffer*

* No buffer has been directly recommended for this watercourse however the mine disturbance area footprint appears to include one.

7.6. MITIGATION

7.6.1. AVOIDANCE

KLPL will avoid groundwater drawdown impacts as far as practicable to key ecological receptors (CCWs) by mining/dewatering mine pits in a staged approach, as per the mining schedule. Pits will be mined on a slight incline from the deepest point and then mined moving up gradient in order to retain pit water within a sump at the deepest point on the pit floor. This form of dewatering is known as 'passive' as no dewatering apparatus (e.g., spears) are used to actively abstract water and groundwater drawdown below the base of the pit (i.e., max pit depth of 5-6mbgl, average pit depth ~1-2mbgl) is highly unlikely to occur. Only suction pumps (no submersible pumps) are used for dewatering and the suction pumps are set up at a level to maintain a 0.5m saturated pit floor, thus avoiding exposure of the pit floor to significant atmospheric oxygen and potential for acidification of sulfide minerals, whilst also minimising the drawdown extents.

KLPL will avoid collection of surface water runoff from intercepted upstream catchments by constructing diversions around the disturbance areas. This will allow clean upgradient flows to go around the disturbance areas and into their intended catchment without intercepted site runoff from disturbed areas.

7.6.2. MINIMISE

Water Management Plan

The WMP (MBS, 2015), as required by MS810 Condition 11, defines the approach adopted for management of mine water which will continue to be applied for the Proposal. The WMP states that mining areas will have ring drains installed with a sump on the pad perimeter. Tails decant sumps will be installed in tailing areas within the mine void. Water from these sumps will be transferred to the process circuit. The mine void will be bunded to prevent surface inflows from adjacent areas. 'V' drains will be installed to divert surface flows around assets and operating areas.

MBS (2006b) recommended that surface water quality impacts can be minimised by the following measures:

- Isolating infrastructure areas that have the potential to contaminate surface water;
- Constructing sediment sumps, silt and oil traps where necessary to remove sediments or pollutants from runoff before water enters local drainage;
- Immediate clean-up of any spills of contaminants, such as oil or fuel.

The major water quality issue in the area is high levels of nutrients. Mining is unlikely to have any effect on nutrient levels in runoff, but care should be taken in rehabilitation activities to minimise actions that could raise nutrient levels such as use of excessive fertiliser.

As a result of heavy rainfall events, there is the potential for increased turbidity from recently rehabilitated areas that are not yet fully stabilised. The process water ponds however act as sedimentation basins, settling suspended solids prior to overflow. Based on monitoring undertaken in relation to the Project as a whole, a pH and a TSS exception was recorded in comparing the pond water quality with the water quality in the environment. In general, the measured background and pond water quality values reflect the disturbed nature of the receiving environment. As such, the consequence of captured water released into the environment is considered to be local only, with no significant impact on water quality.

Figure 7-15 shows existing surface water monitoring sites along with new locations proposed for the Proposal, which will be monitored for the same parameters and at the same frequency as the existing sites. The proposed sites are located either upstream of proposed mine disturbance areas (Sections 1 and 4) or downstream at the western edge of the Lot boundaries. In addition to monitor any potential impacts to CCWs, KLPL will conduct monthly observations of the presence or absence of water within them.

ASS Management Plan

KLPL will continue to implement the ASSMP as required by MS810 Condition 12. As per the ASSMP, material samples are currently collected weekly from the mine pit and tailings areas for analysis of acid generating risk. Data indicates no significant acid generating material has been encountered in mining to date. This is consistent with the low to moderate risk identified during ASS investigations, orebody geology and the limited depth of mining, which is confined to the upper, weathered part of the sand profile.

Mining methods for the Proposal will be the same as for the existing areas of the Site, comprising dry mining in the shallow Bassendean formation with minor dewatering required during winter periods.

Given the ASS investigation for the proposed amendment area has identified similar results to previous ASS investigation across the Site, and the low-risk nature of ASS identified during current sampling and analysis as part of the mining process, it is considered that the existing ASSMP required under MS810 Condition 12

is continued to be applied for the proposed amendment area and no additional risk from ASS will results from the inclusion of the amendment area.

7.6.3. REHABILITATION

The Proposal area will be rehabilitated progressively via direct co-disposal of sand and clay tails in accordance with the Rehabilitation Management Plan (MS810 - Condition 8).

7.7. ASSESSMENT AND SIGNIFICANCE OF IMPACTS

Potential impacts from the Proposal on Inland Waters are related to short-term dewatering of mine pits and subsequent mined pit void backfilling, and associated changes to water level (i.e., drawdowns and water level recharge), which may:

- Affect superficial aquifer water flow regime.
- Area adjacent to Conservation Category Wetland (CCW) water levels.
- Reduce health and condition of native vegetation.

Groundwater drawdown (i.e., decrease in water levels) and the groundwater recharge (i.e., increase in water levels) in the Superficial aquifer due to open pit dewatering and tailings backfilling for the Proposal have been predicted by the numerical model reported and discussed in (AQ2, 2023a) with the potential impacts on Inland Waters summarised below:

Superficial aquifer

- Dewatering due to mining for the Proposal is likely to result in negligible regional scale groundwater drawdown in the Superficial aquifer.
- Drawdown in the Superficial aquifer is predicted to be localised in the immediate area of the active mining (pits), be temporary in duration and relatively small (up to 3m, but generally up to 1m within the mining area).
- Long-term post mining effects on water levels are expected to be minimal. The recovery of water levels will commence immediately once the mining of each active mine pit is completed, owing to the backfilling of mined-out pits.
- Once all mining areas are completed, dewatering will cease and water levels will continue to rise until a steady state or equilibrium water level is resumed. The numerical model shows that the majority of water levels are predicted to return to pre-mining levels after approximately 10 years of mine closure. The remainder of the recovery predicted to occur over the next 10 years.
- Therefore, the Superficial aquifer is resilient and will cope with the proposed changes due to mining the Proposal.

CCW

- The magnitude of drawdowns along the CCW adjacent to the Western Extension vary depending upon the proximity of the active mining pits (refer to Figures 21 to 29; AQ2, 2023a).
- Groundwater modelling suggests that there will be drawdowns of generally less than 0.5m around the CCWs. However, there are two CCWs (ID 14850 – Section 1 and ID 14870 – Section 3), where maximum drawdowns of up to 2m are predicted, due to their close proximity to the proposed mining areas. However, all drawdowns will be localised and temporary. It should be noted that at CCW ID

14870 water levels are predicted to recover from dewatering already simulated for Part Lot 63 in 2025.

- As stated in (Rockwater, 2007):
    - The identified CCWs are not considered to be groundwater dependent, but rather surface water dependent.
    - The wetlands are generally recharged during the wet season (winter) and sporadically during the rest of the year as a result of storm runoff and direct rainfall.
    - The wetlands probably represent a source of recharge to the shallow groundwater system, rather than the reverse.
- Long-term monitoring of the health of vegetation near to Keysbrook mine (Rockwater, 2022a) indicates no changes in water regime that have the potential to impact the health of groundwater dependent vegetation. Additionally, the CCWs close to the mine site are in a Degraded to Completely Degraded Condition.

Cumulative Groundwater Drawdowns

The potential environmental impacts due to mining the Proposal were compared by AQ2 (2023a) to the predicted impacts from the Original Proposal modelling (Rockwater, 2006). A comparison of the contours of predicted drawdown at the end of each mining section area of the Proposal is shown in Figures 35 to 38 in AQ2's Groundwater Assessment (2023a).

The comparison of contours shows that the predicted drawdowns due to mining the Proposal are slightly higher (up to 3m) than the Original predicted drawdowns (up to 2m). This is due to the Proposal having a larger area to the north and west compared to the Original Proposal. These changes are likely to be local and mainly contained within the disturbance area.

It should be noted that the original mining schedule used in the 2006 modelling was revised in 2007. However, results (i.e., predicted drawdowns) of the 2007 modelling were not presented in the Rockwater report, thus it was not possible to compare the recently predicted impacts to the predicted impacts of the originally approved mining area. It is believed that the already approved parts of the Proposal (i.e., within Lots 62 and 63) had predicted drawdowns similar to the currently modelled (as the modelled area has not changed), with smaller original predicted drawdowns on the eastern and southern-eastern boundaries (AQ2, 2023a).

A summary of the most recent 2021 Annual Groundwater Monitoring Summary (GRM, 2021) are as follows:

- Totals of around 350,000kL (i.e., 11L/s) was recorded as being abstracted from the Superficial aquifer due to mining of the Bassendean Sand in 2021;
- Dewatering was done via in-pit sumps only during a two-month period (i.e., January to February 2021), which included recycled water recovered from tailings backfill;
- It is understood that for most of the year mining was carried out above the water table, consequently groundwater seepage into the pits was minimal;
- The groundwater level in the Superficial Aquifer continues to demonstrate a cyclical seasonal variability (between 0.4 to 3.6m, averaging 1.8m), forming a peak around August and September

each year following winter rainfall and a trough around March-April at the end of the dry season. The pattern of seasonal variability in the Superficial aquifer indicates active rainfall recharge;

- The groundwater level contours for the Superficial aquifer during December 2015 and December 2021 shows a groundwater flow direction towards the west (as in the pre-mining period) and the data does not indicate any impacts to the Superficial aquifer associated with pit dewatering and tailings discharge, apart from within the immediate mining areas;
- In the five years of abstraction to date there has been no evidence of impact on groundwater availability to surrounding users (GRM, 2021);
- Groundwater gradients in the Leederville aquifer that existed prior to abstraction are largely unchanged (GRM, 2021);
- Groundwater quality monitoring indicates that the Superficial aquifer is fresh to brackish, with a neutral to slightly acidic pH and to be of sodium chloride type. The salinity varied between less than 100 to around 6,500 mg/L TDS in 2021, which is consistent with known regional variability and also generally consistent with previous monitoring years (apart from some seasonal trends in some bores);
- The water chemistry analyses do not indicate any adverse trends in pH, chloride, nitrogen or sulphate in the Superficial aquifer.

Results of the above monitoring detailed in (GRM, 2021) indicate that the current management regime is sufficient to manage the proposed change to the groundwater system.

Surface Water

The surface water assessment (AQ2, 2023b) considers the potential changes to the surface water environment as a result of the Proposal, which has been separated into four progressively mined Sections. The surface water management philosophy of the approved Project has remained unchanged from that reported in the Water Management Plan (MBS, 2015). As a result, the buffer zone (as per MS810 Condition 7) surrounding Major and Medium watercourses will continue to apply, protecting them from disturbance. The smaller watercourses flowing across the Proposal will be diverted around mining areas and subsequently restored, minimising the impact on downstream flows.

Any surface water runoff from disturbed areas within the mine site will be collected and added to the process water circuit. Ten temporary emergency discharge locations for the Proposal have been proposed. Where release of surface water to the environment does occur, there is unlikely to be material change to the flooding regime downstream, as the discharge of water to the environment is returning catchment yield to the natural downstream hydrological environment, which had been removed by the development. Monitoring within the existing operations indicates the water quality in the mine ponds is similar to the background water quality in the receiving environment and release of the water would therefore not have a significant impact on downstream water quality.

The expanded mining area as a result of the Proposal will result in the removal of catchment runoff that would have previously reached the CCWs downstream, particularly due to Sections 1 and 2. There is no potential impact to any TECs identified due to reduction in catchment area. Additional SW monitoring locations to monitor the effects of operations within the Proposal area and identify potential impacts on the CCWs, along with monthly observations of the presence or absence of water within them will be implemented in accordance with the Water Management Plan (MBS, 2015).

Acid Sulfate Soils

Results of the targeted ASS investigation for the Proposal, are very similar to the results from previous ASS investigations conducted in 2005 and 2007 for the Original Keysbrook Project, with only minor levels of acidity being detected within the soil profile, below the base of the mine pits.

Currently material samples are collected weekly from the mine pit and tailings areas for analysis of acid generating risk. Data indicates no significant acid generating material has been encountered in mining to date. This is consistent with the low to moderate risk identified during ASS investigations, orebody geology and the limited depth of mining, which is confined to the upper, weathered part of the sand profile.

Mining methods for the proposed amendment area will be the same as for the existing areas of the Site, comprising dry mining in the shallow Bassendean formation with minor dewatering required during winter periods.

Given the ASS investigation for the proposed amendment area has identified similar results to previous ASS investigation across the Site, and the low-risk nature of ASS identified during current sampling and analysis as part of the mining process, it is considered that the existing ASSMP required under MS810 Condition 12 is continued to be applied for the proposed amendment area and no additional risk from ASS will results from the inclusion of the amendment area.

7.8. ENVIRONMENTAL OUTCOMES

KLPL considers that the with the current management regime for groundwater, surface water and acid sulfate soils, any additional impact from mining the Proposal will be minimal and that the EPA objective t*o maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected will be achieved.*

8. ENVIRONMENTAL FACTOR – SOCIAL SURROUNDINGS

8.1. EPA OBJECTIVE

To protect social surroundings from significant harm.

8.2. POLICY AND GUIDANCE

- *Environmental Factor Guideline – Social Surroundings* (EPA, 2016j)*;*
- *Environmental Protection (Noise) Regulations 1997;*
- *Aboriginal Heritage Act 1972.*

8.3. ORIGINAL PROPOSAL

8.3.1. HERITAGE

Doral commissioned Western Heritage Research Pty Ltd (WHR) to complete ethnographic and archaeological surveys of the original proposal area in 2006 (Western Heritage Research Pty Ltd, 2006). Five representatives from the Gnarla Kaala Booja (GKB) native title claimant group were involved in the ethnographic survey. They indicated that the survey area had been highly disturbed through agricultural land use and therefore, any ethnographic sites, such as camping areas, would have long been destroyed. No sites within the Project area exist on the Department of Indigenous Affairs database or in the Australian Interaction Consultants (2005) desktop study of the area. The GKB native title claimant group representatives had no objection to the Proposal as no ethnographic sites were identified (WHR, 2006).

The surveys did not identify any ethnographic or archaeological sites in the Project area. Therefore, no approval under section 18 of the State *Aboriginal Heritage Act 1972* was required.

8.3.2. NOISE

There are a number of residences in the proximity of the currently approved mining area. The environmental setting, existing semi-rural/rural land use, nearby highway and railway and the nature of mining operations results in a complex noise environment for the management of operational noise emissions.

The EPA (Bulletin 1269) identified operational noise emissions constituted a risk of:

- Impact on the amenity of local residents;
- Being unable to comply with assigned levels set under the *Environmental Protection (Noise Regulations) 1997*.

Condition 14 of MS810 was imposed, following resolutions of appeals by the Minister for Environment, to manage noise emissions from the Proposal.

Noise emissions in the period of construction and early operations from 2015 to 2017 lead to a number of complaints from nearby residents and engagement with the EPA Services Unit and DWER. Further detail of this period was described under Section 2.1. In response KLPL undertook a series of initiatives to reduce noise emissions, which included:

- Noise attenuation to a range of fixed and mobile plant, in accordance with a Noise Improvement Plan.

- Significantly increased noise monitoring with up to seven monitors providing real-time data from around the mine site.
- Detailed daily noise data reviews and planning to determine the night mining fleet size and location.

These measures were successful in reducing noise emissions from the operations. Coupled with targeted property acquisition and further amenity agreements with local residents (as provided for under MS810 Condition 14), this translated to a reduction in the number of community complaints regarding noise.

The regulation and management of noise was the subject of a detailed investigation established under Section 46 of the EP Act (refer to Section 2.1), with an inquiry initiated in December 2016. The history of noise management and background to the conditions recommended by the EPA is documented in EPA Report 1627 (December 2018). The inquiry concluded with the publication of MS1089 in February 2019. MS1089 set out an amended Condition 14 that provided a revised regulation regime for the management of noise emissions from the Project. Key elements of MS810 Condition 14 (as amended) include:

- Imposition of separation distances between noise sensitive premises (i.e., residences) and mining for day and night mining of 2km and 3.3km respectively;
- Imposition of a separation distance for mineral processing of 2km;
- Provision for the separation distances to be varied through an approved Noise Management Plan and/or through amenity agreements with landowners; and
- Application of evening and night time indoor noise limits in the event an amenity agreement provides for mining at distances less than the mandated separation distances,
- Ongoing noise monitoring and reporting.

Implementation of these measures minimises the risk of operational noise impacting on the amenity of local residents.

Through improved noise planning, monitoring and management, and the targeted replacement/attenuation of equipment, operational noise emissions were significantly reduced during 2017 and continued to be reduced in targeted areas during 2018. Coupled with additional amenity agreements this resulted in a corresponding reduction in the number of noise complaints from surrounding residents. The last formal noise complaint received by KLPL was logged in January 2018.

8.4. HERITAGE – RECEIVING ENVIRONMENT

KLPL engaged Ethnosciences and Archae-aus to undertake an archaeological survey of the Proposal area (Archae-aus, 2023) (Appendix 12). The survey area was located on Lots 20, 64, 201, 507, and 508. The fieldwork was undertaken by Archae-aus senior archaeologist Adrian Di Lello and assistant archaeologist Lauren Jollife with representatives from the Gnaala Karla Booja (GKB) Traditional Owner Group; John Michael, Gus Michael, Franklin Nannup and Harry Nannup on the 22 to 23 March 2023.

The findings from the survey determined that the Proposal area does not intersect with any previously recorded Registered Aboriginal Sites, or Other Heritage Places. No new Aboriginal Archaeological Sites were identified. However, the GKB representatives identified a potential ethnographic site within Lot 64. No archaeological material was identified at this place (Figure 8-1).

8.4.1. HERITAGE - MITIGATION

To avoid any potential impacts to Aboriginal Heritage or significant Sites, KLPL will exclude the potential ethnographic site within Lot 64 from the disturbance area of the Proposal.

8.5. NOISE - RECEIVING ENVIRONMENT

The Proposal is located within a rural farming land set 2.5km west of the Keysbrook town site and approximately 7.5km north west of the North Dandalup town site, in a generally flat to slightly undulating landscape. Wind data from the nearest Bureau of Meteorology (BOM) weather station, Mandurah (Site No. 009977) indicates the prevailing morning winds (9am) for most of the year are from the south to east, while mid-afternoon (3pm) winds tend to be south west. In the winter months, regional weather systems can result in strong westerly and north-westerly winds.

As discussed previously, MS1089 sets out conditions applying to noise emissions from the mining operations. Conditions 14-1 stipulates separation distances required to be maintained between mining operations and noise-sensitive areas unless an amenity agreement is in place. Conditions 14-3 through to 14-7 provide an allowance and process for the separation distances to be varied based on preparation of a Noise Management and Monitoring Plan (NMMP) which demonstrates that reduced distances will achieve compliance with the *Environmental Protection (Noise) Regulations 1997.*

Noise generating activities from the mining process include:

- Clearing and topsoil removal;
- Excavating and trucking ore to minerals processing facilities including the Mine Field Units (MFU) or mobile screens, from where it is pumped to a Wet Concentration Plant;
- Tails return and rehabilitation works.

Other activities include preparation of haul roads and dust suppression using water carts. Mining and rehabilitation activities are limited to daytime hours only, whilst mineral processing is a 24-hour operation.

Relevant noise sensitive premises within the vicinity of the Proposal are shown in Figure 8-2. The figure also shows the extent of the 2km zone surrounding the mining operations. Amenity agreements will be in place for all noise sensitive premises within the buffer. Several receptors are located within the proposed mining area which are under current amenity agreements (receptors 20, 24, 26 & 30) and it is anticipated that these properties will be vacant for the duration of mining.

8.5.1. PROJECT NOISE LEVELS

In accordance with Condition 14-2 of MS1089, daytime noise emissions from mining and minerals processing operations are not subject to noise limits for receptors with amenity agreements within prescribed separation distances. However, indoor noise limits will apply during evening and night-time periods. Since mining operations are restricted to daytime hours only, these indoor limits are applicable to noise emissions at receptors within 2km of mineral processing activities. Beyond 2km, noise emissions must comply with the Assigned Levels defined in the *Environmental Protection (Noise) Regulations 1997* (the Regulations).

The following project noise limits are based on the requirements of MS1089 and the Regulations as well as assumed operating times (i.e., 24 hours for mineral processing and daytime only for mining and

tailing/rehabilitation operations). They represent external noise limits (assuming an outdoor-to-indoor reduction of 15 dB where appropriate) and assume that tonality is present in noise emissions.

TABLE 8-1: PROJECT NOISE LEVELS

RECEPTORS	WEEKDAY	EVENING AND SUNDAY/ PUBLIC HOLIDAY	NIGHT
Sensitive receptors with an amenity agreement	-	40	35
Sensitive receptors without an agreement	40	35	30
1 Weekday: 0700 to 1900hrs Monday to Saturday. 2 Evening and Sunday: 1900 to 2200hrs all days, and 0900 to 1900hrs Sunday and public holidays 3 Night: 2200hrs on any day to 0700hrs Monday to Sunday and 0900hrs Sunday and 0900hrs Sunday and public holidays			

8.5.2. NOISE MODELLING

A numerical computer noise model was prepared by Wood (2023) using the SoundPlan program developed by SoundPLAN LLC (Appendix 13). Seven noise modelling scenarios were developed with mining equipment situated at locations representing worst-case operational impacts for receptors within the 2km zone surrounding the operations. For each scenario, noise level predictions were undertaken for:

- Night-time mineral processing operations;
- Daytime mining (including tails and rehabilitation) and mineral processing operations.

The noise modelling initially assumed no restrictions on equipment selection nor on the number of items of equipment operating simultaneously. Where the noise predictions showed exceedances of the Project Noise Limits, the model was used to investigate the noise mitigation measures required to achieve compliance.

The seven scenarios include operations within the following Lots as shown on Figure 8-2:

- Scenario 1, Lot 507;
- Scenario 2, Lot 508;
- Scenario 3, Lot 201;
- Scenario 4, Lot 64;
- Scenario 5, Lot 63;
- Scenario 6, Lot 62;
- Scenario 7, Lot 20.

Further detail of the plant and equipment included for the day and night-time periods are provided as follows

Minerals Processing

Minerals processing involves feeding ore into the mobile screening plants (otherwise referred to as mobile field units or MFUs) using a front-end loader. Two similar screening plants spaced 200m apart are assumed to be operating in all scenarios except for operations within Lot 20, where a single MFU was assumed. Each mobile screening plant comprises a feed unit (the JDM feeder) which receives ore via a hopper from the front-end loaders. The ore from the JDM feeder is transferred by a short conveyor to a secondary screen. The following sources for each mobile screening plant are included in the modelling scenarios:

- 1 x JDM feeder;
- 1 x Secondary screen;
- 1 x CAT 988 Front-end loader. The loader is assumed to be operating at high-idle in an elevated position on the ramp to JDM feeder.

8m high L-shaped noise bunds spaced 15m from the screening plants and oriented to attenuate sound propagation towards the nearest affected receptors are included in all scenarios.

Other noise emitting equipment associated with minerals processing includes the equipment at the wet concentrator plant (WCP) and field pumps.

Noise sources at the WCP include:

- Cyclone;
- Process / MFU water pumps;
- WCP building;
- Deslime cyclone feed pump;
- Rougher feed pump;
- Thickener overflow pump;
- Thickener hydraulic power unit (HPU).

The number of field pumps varies depending on the distance between the mobile screening plants and the wet concentrator plant. 2.8m high noise barriers spaced 6m from each pump and oriented to attenuate sound propagation towards the nearest affected receptors are included in all scenarios.

Mining, Tails and Rehabilitation Operations

During mining, ore is extracted using an excavator and is transferred to the mobile screening plant using either a front-end loader or haul trucks. Tails / rehabilitation and road preparation / maintenance activities involve operation of the excavators, haul trucks, dozers, graders and water trucks.

The locations and numbers of items of mobile equipment will vary. In order to represent a worst-case scenario, it is assumed that all available equipment will be operating simultaneously within 500m of the MFUs. In addition to the equipment listed above for minerals processing operations, the following additional equipment is assumed to be operational during daytime hours:

- 1 x Komatsu PC1250 excavator;
- 1 x CAT390F excavator within 150m of the MFUs;
- 1 x CAT 988 Front-end loader. The loader is assumed to be operating at high-idle between the PC1250 excavator and the MFUs;
- 3 x CAT 745 haul trucks operating between the PC1250 excavator and the MFUs (1 at high idle, 1 driving and 1 at low idle);
- 1 x Komatsu FG655 grader operating between the PC1250 excavator and the MFUs;
- 1 x CAT740 watercart operating between the PC1250 excavator and the MFUs;

- 2 x CAT D7R dozers operating within 500m of the MFUs.

Figure A-1 to Figure A-7 of the Noise Assessment (Wood, 2023) show the locations of the noise sources for each scenario, including equipment operating during daytime and night-time hours. For clarity, the wet concentrator plant (located in the northeastern section of Lot 62) is excluded from these figures.

8.6. POTENTIAL IMPACTS

The potential impacts from the Proposal to Social Surroundings (noise) include:

- Numerous rural-residential premises located within 2km of the Proposal may potentially be impacted by noise from Minerals Processing and Mining, Tails and Rehabilitation Operations

8.7. ASSESSMENT OF POTENTIAL IMPACTS

Noise level predictions are provided in the following sections for all properties located within the 2km zone surrounding the Proposal for the seven scenarios detailed previously (Figure 8-2). Results presented in **bold** font indicate noise level predictions which exceed the Assigned Levels (when adjusted for tonality) at the receptor. This is for information only, to highlight the most affected receptors. It is anticipated that all receptors within the 2km buffer zone will have noise amenity agreements and noise emissions will need to comply with the Project Noise Limits. Composite noise contours for daytime and night-time operations are also presented which represent the worst-case envelope derived from the individual scenarios. (Noise contours for each individual scenario are presented in Appendix B of Wood, 2023).

8.7.1. NIGHT-TIME MINERAL PROCESSING

TABLE 8-2: PREDICTED NOISE LEVEL FOR NIGHT-TIME OPERATING SCENARIOS

RECEPTOR	Lot 507	Lot 508	Lot 201	Lot 64	Lot 63	Lot 62	Lot 20
4	24.7	23.5	23.3	24.9	24.0	26.5	23.9
5	26.8	24.7	24.1	24.4	22.8	26.1	22.1
6	26.8	24.8	24.2	24.5	22.9	26.3	22.2
7	**34.3**	29.3	26.9	23.8	24.5	22.3	18.8
8	15.8	15.8	15.8	20.2	23.3	24.6	27.9
9	**34.1**	29.7	27.1	24.4	24.0	21.9	18.4
10	**31.8**	28.9	28.7	**33.8**	**33.6**	**33.8**	28.5
11	**33.1**	28.9	28.5	**32.2**	**32.3**	29.8	25.3
12	**33.4**	29.1	28.6	**32.1**	**32.3**	29.6	25.1
13	**33.3**	28.9	28.6	**34.1**	**32.5**	**31.6**	26.8
14	19.8	19.8	19.8	23.1	26.1	28.1	**34.8**
15	14.6	14.6	14.6	14.6	23.4	23.1	26.4
16	16.3	16.3	16.3	21.5	24.5	24.5	28.6
17	19.6	19.6	19.6	23.0	26.6	27.2	34.8
18	12.1	12.1	12.1	12.1	21.4	22.6	21.4
19	13.1	13.1	13.1	13.1	22.2	23.5	22.4

RECEPTOR	Lot 507	Lot 508	Lot 201	Lot 64	Lot 63	Lot 62	Lot 20
25	16.7	16.7	16.7	20.6	24.9	27.1	25.6
28	13.3	13.3	13.3	13.3	22.4	23.9	22.4
31	17.5	17.5	17.5	21.0	25.0	27.8	25.4
32	15.0	15.0	15.0	15.0	23.2	25.3	25.0
60	32.2	28.9	26.3	24.9	22	19.9	16.7
61	26.5	24.5	22.9	20.2	20.2	19.1	15.9
62	31.8	33.0	34.7	26.7	23.5	20.4	17.3
66	27.9	27.7	23.8	22.2	19.7	18.1	15.1

*Values not adjusted for tonality

The results demonstrate that some receptors are likely to receive noise above the Assigned Levels, however none are located beyond the 2km buffer zone and therefore, predicted noise levels are below the project limits for all receptors with amenity agreements.

8.7.2. DAYTIME MINING AND MINERAL PROCESSING

TABLE 8-3: PREDICTED NOISE LEVEL FOR DAYTIME OPERATING SCENARIOS

RECEPTOR	Lot 507	Lot 508	Lot 201	Lot 64	Lot 63	Lot 62	Lot 20
4	35.9	34.8	33.2	38.3	37.2	35.1	30.3
5	**40.3**	38.6	36.4	39.3	36.1	33.1	28.2
6	**40.3**	38.6	36.4	39.5	36.3	33.2	28.3
7	**49.2**	**46.2**	**43.0**	37.2	32.8	28.7	24.6
8	15.4	15.4	15.4	27.3	32.2	37.5	**44.9**
9	**49.1**	**46.3**	**43.3**	36.5	32.2	28.2	24.2
10	38.6	37.9	36.9	**48.2**	**47.6**	**41.5**	34.2
11	**43.6**	**42.2**	**40.5**	**49.3**	**43.2**	37.1	31.1
12	**44.0**	**42.6**	**40.8**	**49.4**	**42.9**	36.8	30.9
13	**41.2**	**40.3**	39.0	**50.0**	**45.6**	39.0	32.5
14	19.4	19.4	19.4	30.6	35.1	**41.5**	**49.7**
15	14.2	14.2	14.2	14.2	30.9	35.7	**43.5**
16	16.0	16.0	16.0	26.2	32.0	37.2	**46.2**
17	19.3	19.3	19.3	30.0	34.4	**40.4**	**51.8**
18	11.7	11.7	11.7	11.7	28.0	32.0	38.6
19	12.7	12.7	12.7	12.7	28.8	33.0	39.9
25	16.3	16.3	16.3	20.3	31.3	35.9	**44.0**
28	12.9	12.9	12.9	12.9	28.7	32.9	39.9
31	17.0	17.0	17.0	20.6	31.2	35.6	
32	14.5	14.5	14.5	14.5	29.5	32.8	38.0

RECEPTOR	Lot 507	Lot 508	Lot 201	Lot 64	Lot 63	Lot 62	Lot 20
60	**44.9**	**43.4**	**41.7**	33.7	29.6	26.0	22.4
61	**40.7**	39.1	37.4	31.5	28.1	25.0	21.6
62	37.4	38.4	**40.6**	32.9	29.5	25.9	22.8
66	39.4	38.6	37.4	30.5	37.2	23.9	20.4

The results demonstrate that some receptors are likely to receive noise above the Assigned Levels, however none are located beyond the 2km buffer zone and therefore, predicted noise levels are below the project limits for all receptors with amenity agreements.

8.8. MITIGATION

The noise mitigation requirements assumed in the noise modelling (Wood, 2023) and which are required to demonstrate compliance with the Project Noise Limits are provided in the following table.

The mitigation measures relate to the implementation of noise bunds and barriers, and the number of MFU's running simultaneously. No specific noise management measures are required for mobile equipment, other than not exceeding the sound power levels and numbers of equipment items operating simultaneously assumed in the modelling scenarios.

TABLE 8-4: NOISE MITIGATION MEASURES

EQUIPMENT	MITIGATION INCLUDED IN NOISE MODELLING
Mobile Screening Plants	8m high L-shaped noise bunds oriented to attenuate sound propagation towards the nearest affected receptor
	Only 1 screening plant to be used
Field Pumps	2.8m noise barriers spaced 6m from pumps and oriented to attenuate sound propagation towards the nearest affected receptors

*Barrier pumps and locations can be optimised to achieve compliance e.g.; lower height barriers could be specified if they are installed closer to the pumps.

8.9. ASSESSMENT AND SIGNIFICANCE OF RESIDUAL IMPACTS

No impacts to Aboriginal Heritage or significant Sites will occur as a result of implementing the Proposal. KLPL have redesigned the proposed disturbance area to avoid the potential ethnographic site identified within Lot 64.

Noise modelling results for the Proposal demonstrate that mining, tails and rehabilitation activities can be undertaken while maintaining compliance with the project noise limits for all receivers with amenity agreements within the 2km buffer zone surrounding the mining operations. Compliance was demonstrated assuming implementation of the following noise mitigation measures:

- Noise bunds at mobile screening plants oriented to attenuate sound propagation towards the nearest affected receptors.
- Only 1 screening plant to be used for operations within 700 m of receptors 14 and 17.
- Noise barriers at field pumps oriented to attenuate sound propagation towards the nearest affected receptors.

No specific noise management measures are required for mobile equipment, other than not exceeding the sound power levels and numbers of equipment items operating simultaneously assumed in the modelling scenarios.

Predicted noise levels do not exceed the Assigned Levels at any receptors beyond the 2km buffer zone surrounding the mining operations.

Mineral processing can be undertaken at all times; however, mining operations are restricted to weekdays (Monday to Saturday 0700 to 1900hrs, excluding public holidays).

Mining within the Proposal area will extend the duration of mining and rehabilitation activities in the order of ~5.5 years and consequently the duration of exposure to potential noise emissions, for nearby residences. Noise management will continue to be applied in accordance with MS1089 Condition 14-1, which requires the use of amenity agreements for any noise sensitive premise within 2km of the mining operations. KLPL intends to have amenity agreements in place prior to commencement of the Proposal. However, if this does not occur, a Noise Management and Monitoring Plan will be prepared in accordance with MS1089 Condition 14-3 to 14-7 for approval by DWER, to demonstrate compliance with the *Environmental Protection (Noise) Regulations 1997.*

8.10. ENVIRONMENTAL OUTCOMES

KLPL have been operating the Keysbrook Mine for several years and is experienced at managing impacts associated with Noise at this Site as well as other mine sites in the Southwest of WA. Effective implementation of noise management strategies, including the use of avoidance strategies (i.e., no night time mining), engineering controls and administrative controls for mine scheduling (including Amenity Agreements), will ensure noise emissions from the Proposed operations continue to comply with the Noise Regulations and MS1089 Conditions.

The ethnographic survey of the Proposal area did not identify any new Aboriginal Archaeological Sites or intersections with Registered Aboriginal Sites or Other Heritage Places (Archae-aus, 2023). The Gnaala Karla Booja (GKB) Traditional Owner Group identified a potential ethnographical site within Lot 64, however no archaeological material was identified at this place. With this information, KLPL have excluded this area from disturbance area to ensure there are no impacts to Aboriginal heritage.

KLPL is confident the EPA objective to protect social surroundings from significant harm can be achieved.

9. ENVIRONMENTAL FACTOR – AIR QUALITY

9.1. EPA OBJECTIVE

To maintain air quality and minimise emissions so that environmental values are protected.

9.2. POLICY AND GUIDANCE

EPA Policy and Guidance

- *Environmental Factor Guideline – Air Quality* (EPA, 2020a).

Other Policy and Guidance

- *A guideline for managing the impacts of dust and associated contaminants from land development sites, contaminated sites remediation and other related activities* (DEC, 2011);
- *National Environment Protection (Ambient Air Quality) Measure* (AAQ NEPM);
- *National Greenhouse and Energy Reporting Act 2007 (NGER Act).*

9.3. ORIGINAL PROPOSAL

Dust

The Original Project was assessed as having the potential to generate dust from land clearing, topsoil stripping, ore excavation, vehicle movement on unsealed surfaces and wind erosion of exposed surfaces.

Dust generated from the Original Project has the potential to impact on local environmental values, the health, welfare and amenity of local residents, and the health of livestock.

9.4. RECEIVING ENVIRONMENT

The Proposal is located within rural farming land and is generally flat to slightly undulating landscape. Wind data from the nearest Bureau of Meteorology (BOM) weather station, Karnet (Site No. 009111) indicates the prevailing morning winds (9am) for most of the year are from the east. Mid-afternoon (3pm) the predominant wind vector is from the southwest to west.

The Proposal does not introduce any additional sensitive receptors beyond that already in proximity to the existing EPA approved mining area.

9.5. POTENTIAL IMPACTS

Continuation of dry mining for the Proposal has the potential to generate dust from the stripping of topsoil and overburden, by vehicular movement and surface lift-off from exposed surfaces (e.g., stockpiles, mine pits) during dry and windy ambient conditions. Dust may also be generated from rehabilitation activities, and areas recently rehabilitated prior to the establishment of pasture and/or vegetation. Dust generation can result in adverse impacts on surrounding vegetation and create nuisance to landowners in the vicinity of the mine disturbance areas.

Particulate emissions in the context of the Proposal are defined as:

- Airborne particles (aerosols) or particulate matter (PM) released during the Proposal activities;
- Airborne particles can be defined as comprising dust, fumes, smoke or mist (DEC, 2011);

- The only emission being generated by the Proposal will be dusts, which is defined as an aerosol formed by mechanical subdivision of bulk materials into airborne fibres having the same chemical composition, and being generally greater than one micrometre (DEC, 2011).

9.6. MITIGATION

KLPL will continue to implement the approved Air Quality and Dust Management Plan (Appendix 14), in accordance with MS810 Condition 15. Dust monitoring (PM10 and total suspended particulates) is undertaken around the perimeter of the mining area and levels transmitted in real time to a website enabling immediate review in high-risk periods. A program of dust mitigation is ongoing and particularly focussed in preparation for the seasonal strong easterly winds in the summer and autumn months. Key controls include:

- Progressive backfill and rehabilitation activities,
- Minimisation of open ground and stockpile areas,
- Utilisation of water carts to dampen active mining areas,
- Utilisation of water carts adapted to distribute wet clay fines to provide a clay sealant for open areas and stockpiles, and
- Stabilisation of backfilled mine voids by sowing an intermediate cover crop of ryegrass and oats to create a ground cover prior to topsoil replacement.

9.7. ASSESSMENT AND SIGNIFICANCE OF RESIDUAL IMPACTS

In relation to Dust impacts, the EPA considered that the Original Project could be managed, on the basis that:

- Mining occurs rapidly over the Project area (i.e., proximal receptors are exposed to a dust risk for a relatively short period of time)
- Agreement is reached with landowners when mining in close proximity to their residence;
- An Air Quality and Dust Management Plan is implemented.

In accordance with the approved Air Quality and Dust Management Plan (MS810 Condition 15), dust monitoring (PM10 and total suspended particulates) is undertaken around the perimeter of the mining area and levels transmitted in real time to a website enabling immediate review in high-risk periods. As described previously, a program of dust mitigation is ongoing and particularly focussed in preparation for the seasonal strong easterly winds in the summer and autumn months. Key controls include:

- Progressive backfill and rehabilitation activities,
- Minimisation of open ground and stockpile areas,
- Utilisation of water carts to dampen active mining areas,
- Utilisation of water carts adapted to distribute wet clay fines to provide a clay sealant for open areas and stockpiles, and
- Stabilisation of backfilled mine voids by sowing an intermediate cover crop of ryegrass and oats to create a ground cover prior to topsoil replacement.

Elevated dust emissions from the mine site can occur during periods of dry soil conditions and sustained strong winds which have been experienced on infrequent occasions in late summer and autumn. This generally also coincides with local background dust levels associated with the predominantly rural land use are also elevated.

On three separate occasions during extreme catabatic easterly winds in January and February 2021, KLPL received dust complaints from two residents located east of the current mining area. Investigations into the complaints revealed that despite shutting down the entire mining fleet with the exception of water and clay fines carts, KLPL had not maintained compliance with the 50ug/m3 PM10 (24-hour average) dust limit set under Condition 15-3 of MS810, on three separate occasions during these events. These three exceedances mentioned above were self-reported to the EPA and the Shire of Serpentine Jarrahdale on 5 February 2021.

Notwithstanding these isolated 'extreme' events, to date KLPL have maintained compliance with dust limits set under Condition 15-3 of MS810, which are to not cause dust levels outside the boundary of the Project area in excess of (i) 1,000ug/m3 total suspended particulates (15-minute average) or (ii) 50 ug/m3 PM10 (24-hour average) more than 5 times a year.

Access to the Proposal, immediately adjacent to the west of the current mine will extend the duration of mining by ~5.5 years and consequently the duration of exposure to potential dust emissions for nearby residences during ground preparations, mining and post mining prior to rehabilitation. The dust risk occurs during dry soil conditions which typically occur in late summer and autumn (indicatively January to May).

Similar to the operational noise risk, the Proposal does not introduce any additional sensitive receptors beyond that already in proximity to the existing approved mining area.

9.8. ENVIRONMENTAL OUTCOMES

Through continued implementation of the Air Quality and Dust Management Plan (MS810 Condition 15) and execution of amenity agreements with nearby landowners/residents, the regulatory risk and risk to local amenity and natural environment will continue to be minimised and meet the EPA's objective "*to maintain air quality and minimise emissions so that environmental values are protected*".

10. ENVIRONMENTAL FACTOR – GREENHOUSE GAS EMISSIONS

10.1. EPA OBJECTIVE

To minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable.

10.2. POLICY AND GUIDANCE

EPA Policy and Guidance

- *Environmental Factor Guideline – Greenhouse Gas Emissions* (EPA, 2020b).

10.3. ORIGINAL PROPOSAL

Greenhouse Gas

KLPL manage greenhouse gas emissions in accordance with the *National Greenhouse and Energy Reporting Act 2007* and report the following annually:

- Energy production;
- Energy consumption;
- Emissions.

The KLPL Project is wholly owned by Doral Mineral Sands Pty Ltd which is itself a subsidiary of Japanese (Iwatani Corporation) owned Iwatani Australia. Iwatani Australia and its subsidiaries have recently committed (2021) to reducing its Greenhouse Gas emissions carbon emissions to 50% by 2030 and to be carbon neutral by 2050. Related project investigations and investment by the Iwatani businesses in order to achieve these targets are presently underway in areas such as development in plant and equipment energy efficiencies, solar, offsite plantation (pine), energy transition opportunities and Hydrogen (Iwatani Australia).

Individually, the KLPL project operates below the EPA Greenhouse Gas threshold of 100,000 tonnes of CO_2 for both Scope 1 and Scope 2 emission. The most recent submitted 2021-2022 NGER reports (Appendix 15) the following greenhouse gas emissions associated with the Keysbrook Mine were reported as:

- Scope 1 – 8,742 tonnes of CO_2. (Predominantly diesel consumption for mobile machines and pumps).
- Scope 2 – 18,827 tonnes of CO_2. (Predominantly SWIS electricity supply for Fixed processing plant).

10.4. RECEIVING ENVIRONMENT AND POTENTIAL IMPACTS

Greenhouse gas emissions are not expected to be a key environmental factor for the Proposal, as the Proposal does not involve any change to existing mining or processing methods or volumes and it is therefore expected to contribute Scope 1 and Scope 2 greenhouse emissions of similar volumes of CO_2 equiv. per year to the existing operations. The key energy demands will continue to be from the Scope 1 combustion of diesel for operation of light vehicles, mining fleet diesel generators and pit dewatering pumps, and the Scope 2 supply of electricity from the South West Interconnected System (SWIS) for the operation of fixed processing plant and other infrastructure. The Scope 1 and 2 greenhouse gas emissions for the proposed amendment are not considered to increase KLPL's current overall greenhouse gas emissions, as the new emissions would effectively replace the current emissions, with the progression of mining the additional ore at the same rates. Doral's (including KLPL) greenhouse gas (GHG) is 28% of the EPA and National Safeguard Mechanism threshold of 100,000tCO_2.

10.5. MITIGATION

KLPL will continue to manage greenhouse gas emissions in accordance with the *National Greenhouse and Energy Reporting Act 2007* and report the following annually:

- Energy production;
- Energy consumption;
- Emissions.

KLPL's mitigation measures for Greenhouse Gas Emissions comprise minimising native vegetation clearing, consideration of operating efficiency in the procurement of vehicles and machinery, and conducting regular inspections and maintenance of processing equipment to maintain operating efficiency.

10.6. ASSESSMENT AND SIGNIFICANCE OF RESIDUAL IMPACTS

The Scope 1 and 2 greenhouse gas emissions for the Proposal is not considered to increase KLPL's current overall greenhouse gas emissions, as the new emissions would effectively replace the current emissions given mining operations will continue at the same operational rates as it currently does. KLPL will continue to manage greenhouse gas emissions in accordance with the *National Greenhouse and Energy Reporting Act 2007* and report the following annually:

- Energy production;
- Energy consumption;
- Emissions.

10.7. ENVIRONMENTAL OUTCOMES

KLPL considers that with the continued implementation of mitigation measures to reduce greenhouse gas emissions, the risk of environmental harm associated with climate change by reducing greenhouse gas emissions will be minimised as far as practicable.

11. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

KLPL proposes to refer the Proposal to the Commonwealth DCCEEW for consideration under the EPBC Act due to residual impacts (following application of the mitigation hierarchy) to low quality foraging habitat for the following Matters of National Environmental Significance (MNES):

- Listed threatened species and communities (s18 and 18A):
    - Carnaby`s Black-Cockatoo *Zanda latirostris* – listed as Endangered under the *BC Act* and *EPBC Act*.
    - Baudin's Black-Cockatoo *Zanda baudinii* – listed as Endangered under the *BC Act* and *EPBC Act.*
    - Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso* – listed as Vulnerable under the *BC Act* and *EPBC Act.*

11.1. LEGISLATION, POLICY AND GUIDANCE

Australian Government Protection

The Australian Government EPBC Act protects species listed under Schedule 1 of the EPBC Act. In 1974, Australia became a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). As a result, an official list of endangered species was prepared and is regularly updated. This listing is administrated through the EPBC Act. The current list differs from the various State lists however some species are common to both.

The EPBC Act aims to prevent significant impacts occurring to MNES, including threatened species, through assessment of proposed actions against the *Matters of National Environmental Significance: Significant Impact Guidelines (DoE, 2013).*

The EPBC Act objectives are to:

- *Provide for the protection of the environment, especially Matters of National Environmental Significance.*
- *Promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.*
- *Control the international movement of wildlife, wildlife specimens and products made or derived from wildlife.*

EPBC Guidance

- Matters of National Environmental Significance. Significant Impact Guidelines 1.1. *Environmental Protection and Biodiversity Conservation Act 1999* (DoE, 2013).
- *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy* (DSEWPaC, 2012a).
- *EPBC Act Referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable) Calyptorhynchus baudinii, Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso (DSEWPaC, 2012b).*

- *Conservation Advice Calyptorhynchus baudinii* Baudin's Cockatoo*. Canberra: Department of the Environment and Energy* (Threatened Species Scientific Committee, 2018b).
- *Approved Conservation Advice for Calyptorhynchus banksii naso (Forest Red-tailed Black Cockatoo). Canberra: Department of the Environment, Water, Heritage and the Arts* (DEWHA, 2009).
- *Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Redtailed Black Cockatoo Calyptorhynchus banksii naso) Recovery Plan. Department of Environment and Conservation, Western Australia* (Chapman, 2008).
- *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan. Department of Parks and Wildlife, Perth, Western Australia* (DPaW, 2013).

11.2. EXISTING ENVIRONMENT

11.2.1. LISTED THREATENED SPECIES AND COMMUNITIES (S18 AND 18A)

The status, distribution and habitat preferences, along with the results of targeted surveys and threats to the threatened species (listed as MNES) identified within the Development Envelope (i.e., Black Cockatoos) are outlined below in Table 11-1 to 11-3.

TABLE 11-1: CARNABY'S BLACK-COCKATOO (*Zanda latirostris*)

Species	Carnaby's Black-Cockatoo *Zanda latirostris*
EPBC Status and Distribution	Endangered. It is endemic to and widespread in the southwest of Western Australia. Occurring mostly in the Wheatbelt in areas that receive 300-750mm of rainfall annually, it is also found in wetter regions in the far southwest. Its range extends north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock). Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20km east-southeast of Condingup and Cape Arid. It has also occasionally been seen on Rottnest Island (Johnstone & Storr, 1998). The extent of occurrence is estimated at 32,000km² based on Birdlife International GIS. This estimate is considered to be of medium reliability (Garnett & Crowley, 2000). The range of Carnaby's Black-Cockatoo is said to have contracted by more than 30% since the late 1940s (Mawson, 1997) and the species is also said to have disappeared from more than a third of its former breeding range between 1968 and 1990 (Saunders & Ingram, 1998).
Habitat Preference	Carnaby's Black-Cockatoo prefers forest, woodlands, heathlands and farm environments where it feeds on Banksia, Hakea and Marri. This species has specific nesting site requirements - nests are mostly in smooth-barked Eucalypts with the nest hollows ranging from 2.5 to 12m above the ground, an entrance from 23-30cm diameter and a depth of 0.1-2.5m (Johnstone & Storr, 1998). Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe, 2004). Judging from records in the Storr-Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into Jarrah-Marri forest of the Darling Scarp and into the Tuart forests of the SCP including the region between Mandurah and Bunbury. Carnaby's Black-Cockatoo has been known to breed close to the town of Mandurah, as well as Dawesville, Lake Clifton and Baldivis (Ron Johnstone, WA Museum, pers. comm.) and there are small resident populations on the

Species	Carnaby's Black-Cockatoo *Zanda latirostris*
	southern SCP near Mandurah, Lake Clifton and near Bunbury. At each of these sites the birds forage in remnant vegetation and adjacent pine plantations (Johnstone, 2008). Carnaby's Black-Cockatoo lays eggs from July or August to October or November, with most clutches being laid in August and September (Saunders, 1986). Most of the breeding is in September through to December (Ron Johnstone pers comms). Birds in inland regions may begin laying up to three weeks earlier than those in coastal areas (Saunders, 1977). The female incubates the eggs over a period of 28-29 days. The young depart the nest 10-12 weeks after hatching (Smith & Saunders, 1986).
Results of Targeted Surveys	Small areas of low-quality foraging habitat present within Proposal's Development Envelope. No evidence of foraging (such as chewed marri fruits and pine cones) observed during either Survey. Clearing for the Proposal will affect 21.5ha of the ~118.5ha present. One potentially suitable nest tree is present within the disturbance area, although no evidence of recent use has been observed. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. This tree will be avoided from disturbance. No roosting sites identified within the Proposal's Development Envelope; however, 4 known roost sites surround the Project area.
Mapping	Figure 6-1
Threats	The decline of Carnaby's Black-Cockatoo is due primarily to the loss and fragmentation of habitat. This has been caused by the clearing of native vegetation, mainly for agricultural purposes, since the middle of the 20th century (Cale, 2003) (Mawson & Johnstone, 1997) (Saunders, 1986). Carnaby's Black Cockatoo is a highly mobile species. They move sequentially through the landscape, utilising different habitat types at different times of the year, makes them especially vulnerable to the loss, fragmentation or degradation of any one component of the landscape. The long-term survival of Carnaby's Black-Cockatoo depends on the persistence of suitable breeding habitat (i.e., woodland), nest-sites (i.e., tree hollows) and foraging habitat (e.g., heathlands) capable of providing enough food to sustain the population. At present, the loss of foraging habitat is thought to pose the greatest risk to the species (Saunders & Ingram, 1998). The breeding habitat of Carnaby's Black-Cockatoo has also been extensively cleared (Garnett & Crowley, 2000). Hollow-bearing trees that are suitable for nesting are now located in remnant patches of woodland and at sites where selected trees have been retained in areas that have otherwise been cleared of native vegetation (Saunders & Ingram, 1998). The impact of clearing has also had other consequences for the remaining habitat. In some areas, the remnant native vegetation has become threatened by an increase in the salinity of soils (Mawson & Johnstone, 1997). Clearing also exposes remnant habitats to invasion by weeds and, potentially, other processes that will degrade the habitat. Other threats include Competition for nest hollows, Illegal trade predation by Wedge-tailed Eagles *Aquila audax*, collisions with cars, drowning and entrapment in tree hollows (Saunders, 1982). Carnaby's Black-Cockatoo is a long-lived species (Saunders & Ingram, 1998) that does not breed until four years of age (Saunders, 1982, 1986), has an estimated generation time of 15

Species	Carnaby's Black-Cockatoo *Zanda latirostris*
	years (Cale, 2003) (Garnett & Crowley, 2000) and has a low rate of productivity (i.e. most successful pairs fledge only one young per year) (Saunders, 1982). These characteristics limit the potential of the species to sustain numbers or to recover in the presence or aftermath of a threatening process.

TABLE 11-2: BAUDIN'S BLACK-COCKATOO (*Zanda baudinii*)

Species	Baudin's Black-Cockatoo *Zanda baudinii*
EPBC Status and Distribution	Vulnerable. The range of the species is confined to the southwest of Western Australia, north to Gidgegannup, east to Mount Helena, Wandering, Quindanning, Kojonup, Frankland and King River and west to the eastern strip of the Swan Coastal Plain including West Midland, Byford, Nth Dandalup, Yarloop, Wokalup and Bunbury (Johnstone & Storr, 1998). Breeding has been recorded in the far south of the range (Higgins, 1999) (Saunders, 1979b) (Storr, 1991) . The extent of occurrence is estimated at 40,000km² based on published maps, and this estimate is considered highly reliable (Garnett & Crowley, 2000). No specific information is available on past changes in the extent of occurrence; however, it is likely to have declined due to the clearance of habitat (Blyth, 2005 pers. comm.).
Habitat Preference	The preferred habitat of Baudin's Black-Cockatoo is mainly Eucalypt forests where it feeds primarily on Marri seeds (Morcombe, 2004), *Banksia, Hakeas* and *Erodium* sp. They also strip bark from trees in search of Beetle larvae (Johnstone & Storr, 1998). Nests are built in large hollows in tall eucalypts, especially Karri, Marri and Wandoo (Johnstone & Storr, 1998) (Higgins, 1999) (Saunders, 1974) (Saunders, 1979b). As with other black cockatoos, Baudin's Black-Cockatoo nests in large vertical hollows of very long-lived trees. Trees with hollows suitable for Baudin's Black-Cockatoo are likely to be >50cm DBH. As trees approaching this size are close to developing suitable hollows, trees below 50cm DBH are considered to have the potential to develop hollows and are therefore also important resources for Baudin's Black-Cockatoo. Preferred roosts are in areas with a dense canopy close to permanent sources of water, providing the birds with protection from weather conditions (Johnstone & Kirkby, 2008).
Results of Targeted Surveys	Small areas of low-quality foraging habitat present within Proposal's Development Envelope. No evidence of foraging (such as chewed marri fruits and pine cones) observed during either Survey. Clearing for the Proposal will affect 21.04ha of the ~118.5ha present. One potentially suitable nest tree is present within the disturbance area, although no evidence of recent use has been observed. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. This tree will be avoided from disturbance. No roosting sites identified within the Proposal's Development Envelope; however, 4 known roost sites surround the Project area.
Mapping	Figure 6-1
Threats	Loss of habitat was formerly the major threat to Baudin's Black-Cockatoo; however, the threat has abated for several reasons: the clearing of forest for agricultural purposes has largely

Species	Baudin's Black-Cockatoo *Zanda baudinii*
	ceased; areas of forest that contain nest sites, or that are likely to contain nest sites, are protected from harvest or clearing; and logging practices are monitored (Blyth, 2005 pers. comm.). The major threats to the species at present appear to be illegal shooting and competition with introduced bees for nest hollows (Blyth 2005, pers. comm.). Baudin's Black-Cockatoo can feed on and do damage to cultivated fruit in orchards (Halse, 1986) (Long, 1985). To prevent such damage, the species was subject to shooting under an Open Season Notice from the 1950s until 1989, when the notice was revoked (Mawson & Johnstone, 1997). The species has been protected since 1996 (Mawson & Johnstone, 1997), but illegal shooting may still be occurring (Garnett & Crowley, 2000). Baudin's Black-Cockatoo has a low annual reproductive rate of 0.6 young per pair (Storr, 1991), which limits the potential of the species to recover in the presence or aftermath of a threatening process

TABLE 11-3: FOREST RED-TAILED BLACK-COCKATOO (*Calyptorhynchus banksii naso*)

Species	Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso*
EPBC Status and Distribution	Vulnerable. The Forest Red-tailed Black-Cockatoo is endemic to southwest WA from Gingin in the north and east to Mt Helena, Christmas Tree Well, West Dale, North Bannister, Mt Saddleback, Kojonup, Rocky Gully, upper King River and east to the Green Range (Johnstone and Storr, 1998). Small isolated breeding populations are on the Swan Coastal Plain and can be found during the fruiting season of Cape Lilac (*Melia azederach*) (CALM, 2006) (Stranger, 1997).
Habitat Preference	The Forest Red-tailed Black-Cockatoo prefers Eucalypt forests where it feeds on Marri, Jarrah, Blackbutt, Karri, Sheoak and Snottygobble and nests in the large hollows of Marri, Jarrah and Karri (Johnstone & Kirkby, 1999). In Marri the nest hollows of the Forest Red-tailed Black-Cockatoo range from 9-14m above ground, the entrance is 12-41cm in diameter and the depth is 1.5m (Johnstone & Storr, 1998). There are few records of breeding of the Forest Red-tailed Black-Cockatoo (Johnstone and Storr, 1998). Recent data however indicates that breeding in all months of the year occurs with peaks in spring and in autumn-winter (Ron Johnstone pers comms). Eggs are typically laid in October and November (Johnstone, 1997) (Johnstone & Storr, 1998) with an incubation period of 29-31 days. Young fledge at 8 to 9 weeks (Simpson & Day, 2004).
Results of Targeted Surveys	Small areas of low-quality foraging habitat present within Proposal's Development Envelope. Throughout the site visit (BCE, 2021), small flocks (approx. 2 to 10 individuals) of were encountered. They were observed actively feeding on all three days on site, mostly in Marri but also within introduced Eucalypts along the driveway in Lot 64. Foraging evidence on Marri fruit was abundant throughout the three Lots during the Survey. One potentially suitable nest tree is present within the disturbance area, although no evidence of recent use has been observed. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. This tree will be avoided from disturbance.

	No roosting sites identified within the Proposal's Development Envelope; however, 4 known roost sites surround the Project area.
Mapping	Figure 6-1
Threats	The main threats to the Forest Red-tailed Black-Cockatoo are habitat loss, nest hollow shortage, competition for available nest hollows from other species, injury or death from the European Honeybee (*Apis mellifera*), illegal shooting (Chapman, 2005) and fire (CALM, 2006).

11.3. POTENTIAL IMPACTS

Activities or aspects of the Proposal that may potentially affect MNES, not considering mitigation efforts, include:

Direct Impacts

- Clearing of up to 21.04ha of native vegetation, considered to represent low quality foraging habitat, for the development of mine areas, could potentially impact listed Threatened species and communities.

11.4. ASSESSMENT OF POTENTIAL IMPACTS

The Proposal area provides foraging value for all three Black-Cockatoo species. A total area of ~120ha of native vegetation/foraging habitat is present within the Proposal's Development Envelope, which although assessed as low-quality foraging habitat includes some patches that are at least of moderate foraging quality for all three species. The presence of feeding Forest Red-tailed Black-Cockatoos during the site visits in Survey 1 (BCE, 2021) confirmed the importance of the general Site area for foraging for that species. One potentially suitable nest tree is also present within the disturbance area, although no evidence of recent use has been observed. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. This tree will be avoided from disturbance for the Proposal. No roosting sites identified within the Proposal Development Envelope; however, four known roost sites surround the Project area.

KLPL have designed disturbance areas for the Proposal to utilise existing areas of cleared pasture (485.81ha) and avoid clearing native vegetation as far as practicable in order to reduce direct impacts to Black Cockatoo foraging and potential nesting habitat. This has resulted in the avoidance of ~99ha of native vegetation within the Proposal's Development Envelope, with the generally larger areas/patches of native vegetation, being avoided. The Proposal will however require direct disturbance of 21.04 ha of completely degraded to degraded native vegetation (and 485.81ha of cleared pasture) to facilitate the development of mine areas. This vegetation has been assessed as generally low-quality foraging habitat for Black Cockatoo's.

11.5. MITIGATION

11.5.1. AVOID

The Proposal has been designed to utilise existing cleared pasture areas (i.e., 485.81ha) and avoid the need for clearing native vegetation/foraging habitat as far as practicable. This has resulted in ~99ha of native vegetation being successfully avoided from disturbance. In addition, the one tree containing potentially suitable hollows will be avoided from disturbance.

11.5.2. MINIMISE

In accordance with MS810, KLPL will continue to implement the following key management measures to minimise impacts to terrestrial fauna values:

- MS810 Condition 6 - Protection of Native Vegetation.
    - 6-3 The proponent shall not clear any native vegetation within the Proposal area unless the land to be cleared is required for the extraction of mineral ore within 6 months of the date of clearing.
- MS810 Condition 7 - Protection of Watercourses and wetlands.
    - 7-1 The proponent shall not clear vegetation or undertake mining activities:
        a. Within 20m of the banks of watercourses shown in Fig 9 of the PER document.
        b. Within 100m of the boundary of a conservation category wetland.

11.5.3. REHABILITATE

Clearing of 21.04 ha of Black-Cockatoo low-quality foraging habitat for the Proposal, will be revegetated in accordance with the requirements of the approved Rehabilitation Management Plan (MS810 Condition 8) (Appendix 7). This will include revegetation of at least 30ha of local native provenance species (i.e., at a ratio of 1.4ha:1ha) within the Proposal area. The revegetation will be undertaken with the objective of contributing to enhanced natural ecosystem function in the local area (e.g., such as by extending/establishing a native vegetation corridor) and providing additional Black Cockatoo foraging habitat.

12. OFFSETS

Environmental offsets are actions that provide environmental benefits which counterbalance the Significant Residual Environmental Impacts or risks of a Proposal. In accordance with *WA Environmental Offsets Policy, September 2011* (Government of Western Australia, 2011)*, WA Environmental Offsets Guidelines (Government of Western Australia, 2014)* and the *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy Oct 2012 (DSEWPaC, 2012a),* offsets may only be applied after other mitigation measures have been considered, as per the following hierarchy:

- Avoid;
- Minimise;
- Rehabilitate;
- Offset.

As noted in the *WA Environmental Offsets Guidelines (Government of Western Australia, 2014)*, environmental offsets address significant environmental impacts that remain after on-site avoidance and mitigation measures have been undertaken. Environmental offsets will only be considered after strategies to avoid and mitigate significant environmental impacts have been applied. In general, significant residual impacts include those that:

- Affect rare and endangered plants and animals (such as declared rare flora and threatened species that are protected by statute);
- Areas within formal conservation reserve system;
- Important environmental systems and species that are protected under international agreements (such as Ramsar listed wetlands);
- Areas that are already defined as being critically impacted in a cumulative context.

The residual impact significance model detailed in the *WA Environmental Offsets Guidelines (Government of Western Australia, 2014)* identifies four levels of significance for residual impacts:

- Unacceptable impacts – impacts which are environmentally unacceptable or where no offset can be applied to reduce the impact.
- Significant impacts requiring an offset – any significant residual impact of this nature will require an offset. These generally relate to any impacts to species, ecosystems, or reserve areas protected by statute or where the cumulative impact is already determined to be at critical level.
- Potentially significant impact which may require an offset – the residual impact may be significant depending on the context and extent of the impact. These relate to impacts that are likely to result in a species or ecosystems requiring protection under statute or increasing the cumulative impact to a critical level. Whether these impacts require an offset will be determined by the decision-maker based on information provided by the proponent or applicant and expert judgement.
- Impacts which are not significant – impacts which do not trigger the above categories are not expected to have a significant impact on the environment and therefore do not require an offset.

Doral has considered all of these potential residual impacts and risks in the context of both State and Commonwealth values in defining offsets.

12.1. POLICY AND GUIDANCE

The relevant policy and guidelines which provide a framework for offsets for both State and Commonwealth governments are described in Table 12-1 and 12-2.

TABLE 12-1: STATE GOVERNMENT OFFSETS

POLICY/GUIDELINE	OVERVIEW
WA Environmental Offsets Policy, September 2011 (Government of Western Australia, 2011)	This Policy seeks to ensure that environmental offsets are applied in specified circumstances in a transparent manner to engender certainty and predictability, while acknowledging that there are some environmental values that are not readily replaceable. It serves as an overarching framework to underpin environmental offset assessment and decision-making in Western Australia.
WA Environmental Offsets Guidelines (Government of Western Australia, 2014)	These guidelines complement the *Western Australian Environmental Offsets Policy, September 2011* (Government of Western Australia, 2011) (above) by clarifying the determination and application of environmental offsets in WA. Application of these guidelines will ensure that decisions made on environmental offsets are consistent and accountable under the EP Act.

TABLE 12-2: COMMONWEALTH GOVERNMENT OFFSETS

POLICY/GUIDELINE	OVERVIEW
Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy Oct 2012 (DSEWPaC, 2012a).	This Policy Statement provides a description of the types of offsets that may be applied when impacts cannot be adequately reduced through avoidance and mitigation. Eight principles for environmental offsets are provided. Suitable offsets must: 1. 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. 2. Be built around direct offsets but may include other compensatory measures. 3. Be in proportion to the level of statutory protection that applies to the protected matter. 4. Be of a size and scale proportionate to the residual impacts on the protected matter. 5. Effectively account for and manage the risks of the offset not succeeding. 6. 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). 7. Be efficient, effective, timely, transparent, scientifically robust and reasonable.

POLICY/GUIDELINE	OVERVIEW
	8. Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

12.2. SIGNIFICANT RESIDUAL IMPACTS

The Proposal has been designed to, as far as practicable, avoid clearing of native vegetation and associated loss of Black Cockatoo foraging habitat. The design maximises the use of existing cleared areas which has resulted in ~96% of the disturbance area being located on cleared pasture.

The assessment of Key Environmental Factors is presented in Sections 5-9 of this Document and describes the residual impacts and risks of the Proposal that remain after on-site avoidance and mitigation measures (i.e., avoid, minimise and rehabilitate) have been applied. This assessment has determined that the Proposal has a potentially significant impact on low-quality Black Cockatoo foraging habitat.

The following provides an assessment of significance of the Proposal for this residual impact, against applicable matters listed in Section 5 of *Statement of Environmental Principles, Factors and Objectives* (EPA, 2018b):

a) *Values, sensitivity and quality of the environmental which is likely to be impacted.*

A total of 21.04ha of low-quality foraging habitat is unable to be avoided from direct impacts for the following three species:

- Carnaby`s Black-Cockatoo *Zanda latirostris* – listed as *S2* under the *BC Act* and *Endangered* under the *EPBC Act*.
- Baudin's Black-Cockatoo *Zanda baudinii* – listed as S3 under the *BC Act*, and *Endangered* under the *EPBC Act.*
- Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso* – listed as S3 under the *BC Act*, and *Vulnerable* under the *EPBC Act.*

b) Extent (intensity, duration, magnitude and geographic footprint) of the likely impact.

The Proposal will require direct disturbance of 21.04ha of completely degraded to degraded native vegetation to facilitate the development of mine areas. This vegetation has been assessed as generally low-quality foraging habitat for Black Cockatoo's. No potentially suitable nest trees will be disturbed for the Proposal.

No roosting sites were identified within the Proposal area; however, four known roost sites surround the Project area but will not be affected by the Proposal.

As part of KLPL's mitigation measures, a total of ~99ha of Black-Cockatoo foraging habitat (including two potential nesting trees) have been avoided from disturbance, and an area of 30ha is proposed to be rehabilitated with local native species, to counterbalance the total clearing area of the Proposal.

c) Consequences of the likely impacts (or change)

The Proposal area provides value for all three Black-Cockatoo species for foraging and to a lesser degree nesting. A total area of ~120ha of native vegetation/foraging habitat is present within the Proposal's Development Envelope, which although assessed as low-quality foraging habitat includes some patches that are at least of moderate foraging quality for all three species. The presence of feeding Forest Red-

tailed Black-Cockatoos during the site visits in Survey 1 (BCE, 2021) confirmed the importance of the general Site area for foraging for that species. Only one potentially suitable nest tree was identified within the Proposal area, although no evidence of recent use has been observed. This tree is a large, very unstable burnt stag and is likely to fall over during high winds. It has been avoided from disturbance as part of the Proposal

KLPL have designed disturbance areas for the Proposal to utilise existing areas of cleared pasture (i.e., ha) and avoid clearing native vegetation as far as practicable in order to reduce direct impacts to Black Cockatoo foraging and potential nesting habitat. This has resulted in the avoidance of ~99ha of native vegetation within the Proposal's Development Envelope, with the generally larger areas/patches of native vegetation, being avoided.

Direct disturbance of 21.04ha of completely degraded to degraded native vegetation to facilitate the development of mine areas is unlikely to significantly affect the availability of foraging resources for Black-Cockatoos in the area. The vegetation to be cleared represents low-quality foraging resources, with large areas of foraging habitat (~99ha) being retained for ongoing use of Black-Cockatoos within the Development Envelope. In addition, areas immediately adjacent (predominantly the north) to the Proposal contain significantly better-quality foraging and potential nesting habitat, including Lot 202 which is an existing offset for the approved Proposal.

d) Resilience of the environment to cope with the impact

Resilience is associated with the scale of impact to the local population. As previously stated, clearing associated with implementing the Proposal has been avoided as far as practical and only a relatively small area of impact to low-quality foraging habitat will occur. In accordance with the requirements of the approved Rehabilitation Management Plan (MS810 Condition 8) (Appendix 7). KLPL will revegetate at least 30ha of local native provenance species (i.e., at a ratio of 1.4ha:1ha) within the Proposal area. The revegetation will be undertaken with the objective of contributing to enhanced natural ecosystem function in the local area (e.g., such as by extending/establishing a native vegetation corridor) and providing additional Black Cockatoo foraging habitat.

It is considered that the local environment will be resilient to cope with short term impacts to low-quality foraging habitat, given there will be significantly more foraging and potential nesting habitat remaining within the Development Envelope which will be further improved through the creation of better-quality foraging habitat through targeted revegetation of Black Cockatoo foraging species.

e) *Cumulative impact with other existing or reasonably foreseeable activities, developments and land uses connections and interactions between parts of the environment to inform a holistic view of impacts to the whole environment*

Through a series of surveys in 2004, 2005, and 2017, 22 potential Black Cockatoo nesting hollows were identified on Lot 59 and Lot 300, of which 4 were outside the approved mine area and 9 were occupied by feral bees. This compares to 71 potential nesting hollows mapped locally outside of the approved mine area with 18 of these recorded on the conservation areas (2 occupied by bees), and a further 25 (6 occupied by bees) in native vegetation areas withdrawn from the Proposal during the course of the initial environmental assessment (on Lot 56). To date, in collaboration with the SJ Landcare 30 artificial nests have been installed in the conservation area on Lot 202. The artificial nests, or 'cockatubes' have the advantage of not being readily colonised by bees or used by smaller parrot species.

The cumulative impact of clearing an additional 21.04ha of low-quality foraging habitat represents an increase in impact of ~10%, however with the implementation of the avoidance, mitigation and rehabilitation measures, an overall net environmental benefit of the Proposal will be realised within the short to medium term (~10years for creation of foraging habitat).

f) *Level of confidence in the prediction of impacts and the success of proposed mitigation*

There is a high level of confidence in the prediction of direct impacts to low-quality foraging habitat for Black Cockatoo's and the associated mitigation measures (i.e. avoid, minimise and rehabilitate). KLPL (and Doral) have successfully created suitable habitat for Black Cockatoos, including as Offsets under the EPBC Act.

An assessment of Significant Residual Impact from the Proposal using the Residual Impact Significance Model is provided in Table 12-3, with a completed WA Environmental Offsets Table provided in Table 12-4, which describes the mitigation measures to be undertaken.

TABLE 12-3: RESIDUAL IMPACT SIGNIFICANCE MODEL

Part IV Environmental Factors	Vegetation and Flora			Terrestrial Fauna			
Part V Clearing Principles	Rare Flora	TECs	Remnant Vegetation	Wetlands & Waterways	Conservation Area	High Biological Diversity	Habitat for Fauna
Residual Impact that is environmentally unacceptable or cannot be offset	NA	NA	NA	NA	NA	NA	NA
Significant residual impacts that will require an offset- All significant residual impacts to species and ecosystems protected by statute or where the cumulative impact is already at a critical level	NA	NA	NA	NA	NA	NA	The Proposal will require clearing of ~21.04ha of low-quality foraging habitat and one potentially suitable nest tree, although no evidence of use has been identified. There is significantly more native vegetation (i.e., Dwellingup State Forest, ~180,000ha) present within 10km of the Development Envelope and there is therefore significant potential for Black Cockatoo breeding and/or foraging to take place in the wider area. A review of the 2018 Great Cocky Count database shows 4 documented, roost sites within 10km of the site (Peck, et al., 2018). As clearing will impact habitat of a species protected by statute, the impacts are considered significant and an offset is proposed.

Part IV Environmental Factors	Vegetation and Flora						
				Terrestrial Fauna			
Part V Clearing Principles	Rare Flora	TECs	Remnant Vegetation	Wetlands & Waterways	Conservation Area	High Biological Diversity	Habitat for Fauna
							With the implementation of the avoidance and mitigation measures, the extent and severity of impacts are expected to be minimised.
Significant residual impacts that may require an offset – Any significant residual impact to potentially threatened species and ecosystems, areas of high environmental value or where the cumulative impact may reach critical levels if not managed.	NA	NA	NA	NA	NA	NA	NA
Residual impacts that are not significant			The Proposal will clear ~21.04ha of a total ~118.5ha of native vegetation within the	There are several CCWs within or in proximity to the Proposal that may be temporarily impacted by reduction		The Proposal does not occur within an area of high biological	

Part IV Environmental Factors	Vegetation and Flora						
				Terrestrial Fauna			
Part V Clearing Principles	Rare Flora	TECs	Remnant Vegetation	Wetlands & Waterways	Conservation Area	High Biological Diversity	Habitat for Fauna
			Development Envelope. All vegetation is within Degraded or Completely Degraded condition. Clearing represents disturbance to 0.03%, 0.05% and 0.08% to the remaining areas of the Guildford, Bassendean and Southern River, vegetation complex's and does not significantly reduce their regional extents.	in surface water catchment areas. Given the short term and generally small nature in the reductions, no significant impacts are predicted.		diversity. All vegetation to be disturbed is within Degraded or completely Degraded condition.	

TABLE 12-4: WA ENVIRONMENTAL OFFSETS TABLE

PROJECT NAME: KEYSBROOK MINERAL SANDS PROJECT									
Existing environment/ Impact	*Mitigation*			*Significant Residual Impact*	*Offset Calculation Methodology*				
	Avoid and minimise	*Rehabilitation Type*	*Likely Rehab Success*		*Type*	*Risk*	*Likely Offset Success*	*Time Log*	*Offset Quantification*
Disturbance of 485.81 ha cleared pasture + 4.66ha planted species									
490.47ha of cleared pasture and planted non-endemic species	**Avoid** - The proposal has been designed as far as practicable to utilise existing cleared pasture rather than clearing native vegetation. This has resulted in the avoidance of ~99ha of native vegetation. **Minimise** - The following existing management plans, as per MS810 will continue to be implemented to minimise impacts to flora and vegetation values: 1.Weed and Dieback Management Plan 2.Rehabilitation Management Plan	485.81ha of cleared pasture and 4.66ha of planted non-endemic species will be returned to pasture in accordance with the Rehabilitation Management Plan, as per MS810 Condition 8.	High - Doral have significant experience with returning former mined/disturbed areas to pasture. Doral successfully rehabilitated 770ha of disturbed land at the Dardanup Mineral Sands Mine back to pasture and was relinquished by DMIRS.	No					
Clearing 21.04ha of low-quality Black Cockatoo foraging habitat	**Avoid** - The Proposal has been designed as far as practicable to utilise existing cleared pasture rather than clearing native vegetation. This has resulted in the avoidance of ~99ha of Black-Cockatoo **Minimise** - The following existing management plans, as per MS810 will continue to be implemented to minimise impacts to fauna values: 1.Weed and Dieback Management Plan	KLPL will rehabilitate ~30ha of native vegetation using local species to counterbalance the clearing impacts of the Proposal in accordance with the Rehabilitation Management Plan, as Per Condition 8 of MS810. Specially, the revegetation will aim to establish species suitable for Black-Cockatoo foraging habitat.	<u>Can the environmental values be rehabilitated/Evidence?</u> Yes, Black Cockatoo foraging habitat can be established and be self-sustaining within a relatively short time frame (i.e., 5-10 years). 30 artificial hollows have already been installed for the Project. <u>Operator experience in undertaking rehabilitation?</u> Doral (KLPL) have successfully rehabilitated three Offset areas back to native vegetation in accordance with EPA and DCCEEW conditions.	<u>Extent</u> 21.04ha of low-quality foraging habitat. <u>Quality</u> Low-quality foraging habitat mapped as completely degraded vegetation. <u>Conservation Significance</u> Considered of low conservation significance given it is low-quality foraging habitat in completely degraded condition. <u>Land Tenure</u> Freehold, minerals to owner <u>Time Scale</u>	Land acquisition	Low – Land to be secured and placed under Conservation Covenant with the National Trust of Western Australia by Doral or Doral to provide funding to DBCA for the purchase and management of the offset. It is expected that the offset will be a Ministerial Condition of the	High – Land acquisition and management in the southwest is well understood and has been previously implemented by Doral (KLPL) and DBCA as an offset for the Keysbrook, Yoongarillup and Yalyalup Mines. <u>Can the values be defined and measured?</u> Yes - values of vegetation communities can be measured. <u>Operator experience/Evidence?</u>	Secures habitat upon agreement - no time delay	Area contained within Land Acquisition Offset, to be provided (Appendix 16).

PROJECT NAME: KEYSBROOK MINERAL SANDS PROJECT									
Existing environment/ Impact	*Mitigation*			*Significant Residual Impact*	*Offset Calculation Methodology*				
	Avoid and minimise	*Rehabilitation Type*	*Likely Rehab Success*		*Type*	*Risk*	*Likely Offset Success*	*Time Log*	*Offset Quantification*
	2.Rehabilitation Management Plan		What is the type of vegetation being rehabilitated? Black-Cockatoo foraging species. Time lag? 5-10 years for foraging habitat to be established and self-sustaining. Credibility of the rehabilitation proposed (evidence of demonstrated success) KLPL have successfully rehabilitated three Offset areas as part of other mine operations.	The Proposal has an anticipated mine life of 5.5 years, with a further 2 years for rehabilitation. According to the agreed significance framework, residual impact is considered significant as clearing will affect a species protected by statute under the BC Act and EPBC Act.		approval of the Proposal.	Doral (KLPL) have successfully rehabilitated three Offset areas back to native vegetation in accordance with EPA and DCCEEW conditions. What is the type of vegetation being revegetated? Vegetation suitable as Black Cockatoo foraging habitat. Is there evidence the environmental values can be re-created (evidence of demonstrated success)? Yes, Doral (KLPL) have successfully provided a Land Acquisition offset as part of its Keysbrook, Yoongarillup and Yalyalup Mine Ministerial Conditions.		

13. HOLISTIC ASSESSMENT OF PROPOSAL

KLPL commenced mining the Keysbrook Mineral Sands Mine in 2015 in accordance with the Conditions of MS810 and MS1089. Based on the mining schedule, the current ore reserve within the approved mine area are due to be exhausted in 2024. In order for the continuation of the mine and workforce, KLPL seek a significant amendment of an approved proposal under Section 40AA of the *Environmental Protection Act 1986*.

The significant amendment (Proposal) is to extend the mine area of the Keysbrook Mineral Sands Mine, which consists of a shallow, low grade ore deposit. The Mine operates 24 hours a day, 7 days a week, however during evening and night time periods (7pm-7am) all mining earthworks activities cease and only the feed prep screening plant fed by a front-end loader and wet Concentrator plant remain in operation. The Proposal is to the west of the currently approved mine area.

Specifically, the Proposal is to include an additional 511.64ha of mine area located to the west of the currently approved Proposal, which would increase the total mine area from approximately 1,745ha to 2,257ha (~22.5% increase). The additional disturbance area includes 21.04ha of completely degraded native vegetation, with the majority comprising cleared pasture and some planted non-native vegetation. The majority of the proposed amendment area is located within the existing EPA Development Envelope, however a minor extension to include part Lot 64 and Lot 507 has been included.

Disturbance for the Proposal has been designed as far as practicable to utilise existing cleared areas, in order to reduce direct impacts to native vegetation and fauna (Black-Cockatoos) values. This has resulted in the avoidance of ~99ha of native vegetation within the Proposal's Development Envelope, with generally the larger areas/patches of native vegetation, being avoided. The Proposal will however require direct disturbance of 21.04ha of completely degraded to degraded native vegetation, with no conservation significance.

The vegetation to be cleared has been assessed as low-quality foraging habitat for Black-Cockatoos, with the presence of feeding Forest Red-tailed Black-Cockatoos observed during the initial Black-Cockatoo Survey (BCE, 2021) confirming the importance of the general Site area for foraging for that species. In accordance with the Rehabilitation Management Plan (MS810 Condition 8), KLPL will revegetate at least 30ha of local native provenance species (i.e., at a ratio of 1.4ha:1ha) within the Proposal area. The revegetation will be undertaken with the objective of contributing to enhanced natural ecosystem function in the local area (e.g., such as by extending/establishing a native vegetation corridor) and providing additional Black Cockatoo foraging habitat.

Following the application of this mitigation hierarchy (on-site avoidance and mitigation measures), a significant residual impact of 21.04ha of low-quality foraging habitat for three species of Black-Cockatoos remains. As such KLPL are proposing to offset the significant impact through Land Acquisition in accordance with the EPBC Act.

Mining methods for the amendment area will be the same as for the existing areas of the Site, comprising dry mining techniques in the shallow Bassendean formation to an average depth of ~1-2mbgl (max depth to ~6mbgl in minor areas). Minor dewatering of groundwater inflows into the pit will continue to be required during the winter months.

Groundwater modelling (AQ2, 2023a) indicates that Drawdown in the Superficial aquifer is predicted to be localised in the immediate area of the active mining (pits), be temporary in duration and relatively small (up

to 3m, but generally up to 1m within the mining area). Groundwater modelling suggests that there will be drawdowns of generally less than 0.5m around the CCWs. However, there are two CCWs (ID 14850 – Section 1 and ID 14870 – Section 3), where maximum drawdowns of up to 2m are predicted, due to their close proximity to the proposed mining areas. However, all drawdowns will be localised and temporary.

Original modelling for the Project (Rockwater, 2007) concluded that the CCWs are not considered groundwater dependent, instead being surface water dependent and groundwater drawdowns are unlikely to affect any of the CCWs. Long-term hydrogeological and environmental monitoring data, most recently reported for 2021 (Rockwater, 2022a) suggests that mining activities for the Project to date have not resulted in changes to the water regime that have the potential to impact the health of groundwater dependent vegetation at wetland monitoring sites.

KLPL's comprehensive groundwater monitoring program will continue to be implemented for the Project, incorporating the Proposal, in accordance with the Water Management Plan (MS810 Condition 11), Groundwater Licence Operating Strategy (required under GWL 164007) and the DWER environmental licence conditions (L8918-2015) to manage any additional effect to Inland Waters.

A 20m buffer zone surrounding the Nambeelup Brook North Tributary, Balgobin Brook and Balgobin Brook South (as required by MS810 Condition 7) will continue to apply for the Proposal, protecting these watercourses from disturbance. Additionally, a 100m buffer will be in place for CCW UFI 14870 and UFI 14850 to protect them from disturbance.

Any surface water runoff from disturbed areas within the mine site will continue to be collected and added to the process water circuit. To ensure any emergency discharge returns to the same tributary as per the existing hydrological regime, KLPL have proposed an additional 10 temporary emergency discharge points to allow for progression as the mining front moves in stages across the Proposal area. Discharge will continue to occur in accordance with the Site's DWER Licence conditions (L8918/2015/1).

Where release of surface water to the environment does occur, there is unlikely to be material change to the flooding regime downstream, as the discharge water is returning catchment yield to the natural downstream hydrological environment, which had been removed by the development. Monitoring within the existing operations indicates the water quality in the mine ponds is similar to the background water quality in the receiving environment and release of the water would therefore not have a significant impact on downstream water quality.

Based on the CCW catchment assessment, Section 1 has the potential to result in a reduction of ~21% in the catchments to 14825 and 17% of the combined catchment area of 14763/14798. The proposed additional mining area of Lot 63 (Section 3) does not cause any additional reduction in the catchment of 14870. SW monitoring will continue to be conducted in accordance with the Water Management Plan (MBS, 2015) (MS810 Condition 11), including measurement of standing surface water in the CCWs potentially impacted by the Proposal.

Mining the Proposal will extend the duration of mining in the order of 5.5 years and consequently the duration of exposure to potential noise emissions, for nearby residences. Noise management will continue to be applied in accordance with MS1089 Condition 14-1 and 14-2, in which KLPL will continue to actively seek the use of amenity agreements for any noise sensitive premise within 2km of the mining operations.

Continuation of dry mining for the Proposal has the potential to generate dust from the stripping of topsoil and overburden, by vehicular movement, surface lift-off from exposed surfaces (e.g., stockpiles, mine pits, rehabilitation areas) during dry and windy ambient conditions. However, inclusion of the Proposal area does

not introduce any additional sensitive receptors beyond that already in proximity to the existing approved mining area.

The Proposal will continue to contribute Scope 1 and Scope 2 greenhouse emissions of similar volumes of CO_2 equiv. below the EPA threshold of 100,000 tonnes per year for the existing operations, however given mining will continue at similar rates using similar machinery as to what is currently occurring for the Project, no net change in emissions is predicted. Doral's (including KLPL) greenhouse gas is 28% of the EPA and National Safeguard Mechanism threshold of 100,000tCO_2

Continued implementation of the Air Quality and Dust Management Plan (MS810 Condition 15) and execution of amenity agreements with nearby landowners/residents, KLPL consider the regulatory risk and risk to local amenity and the natural environment will continue to be minimised.

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FIGURE 2-1: REGIONAL LOCATION

FIGURE 2-2: WESTERN EXTENSION PROPOSAL AREA

FIGURE 5-1: FLORA AND VEGETATION SURVEYS

FIGURE 5-2: SOIL LANDSCAPE SYSTEMS

FIGURE 5-3: VEGETATION COMPLEXES

FIGURE 5-4: VEGETATION UNITS

FIGURE 5-5: VEGETATION CONDITION

FIGURE 5-6: DECLARED WEEDS

FIGURE 5-7: WETLANDS

FIGURE 6-1: BLACK COCKATOO FORAGING AND POTENTIAL NESTING HABITAT

FIGURE 7-1: ORIGINAL GROUNDWATER DRAWDOWNS

FIGURE 7-2: EXISTING GROUNDWATER MONITORING BORES

FIGURE 7-3: SUPERFICIAL AQUIFER GROUNDWATER CONTOURS

FIGURE 7-4: WATERCOURSES

FIGURE 7-5: CONSERVATION CATEGORY WETLANDS

FIGURE 7-6: LOCATIONS OF PREDICTED HYDROGRAPHS AT KEY POSITIONS

FIGURE 7-7: CONTOURS OF PREDICTED DRAWDOWN SECTION 1 MINING (OCTOBER 2027)

FIGURE 7-8: CONTOURS OF PREDICTED DRAWDOWN SECTION 2 MINING (NOVEMBER 2029)

FIGURE 7-9: CONTOURS OF PREDICTED DRAWDOWN SECTION 3 MINING (DECEMBER 2029)

FIGURE 7-10: CONTOURS OF PREDICTED DRAWDOWN AT THE END OF MINING (APRIL 2031)

FIGURE 7-11: MAXIMUM EXTENT OF DRAWDOWN (JUNE 2035)

FIGURE 7-12: CCW AND TEC CATCHMENTS

FIGURE 7-13: WESTERN EXTENSION WATERCOURSE MANAGEMENT – SECTIONS 1 & 2

FIGURE 7-14: WESTERN EXTENSION WATERCOURSE MANAGEMENT – SECTIONS 3 & 4

FIGURE 7-15: SURFACE WATER MONITORING SITES

FIGURE 8-1: POTENTIAL ETHNOGRAPHIC SITE

FIGURE 8-2: NOISE SENSITIVE PREMISES

APPENDIX 1: MINISTERIAL STATEMENT NO 810 AND 1089

APPENDIX 2: ANNUAL COMPLIANCE ASSESSMENT REPORT (CAR)

APPENDIX 3: PROPOSAL CONTENT DOCUMENT

APPENDIX 4: CERTIFICATE OF TITLE

APPENDIX 5: FLORA AND VEGETATION SURVEYS

A. Survey 1 – Detailed, Reconnaissance and Targeted Flora and Vegetation Survey, Lot 64 Elliot Road Keysbrook, WA (Ecoedge, 2021).

B. Survey 2 – Detailed, Reconnaissance and Targeted Flora and Vegetation Survey, Lot 57, 508, 201 Elliot Road and Part Lot 56 Westcott Road Keysbrook, WA (Ecoedge, 2022).

C. Survey 3 – Detailed, Reconnaissance and Targeted Flora and Vegetation Survey, Lots 20, 62, 63 and 211, Keysbrook, WA (Ecoedge, 2023).

APPENDIX 5A: FLORA AND VEGETATION SURVEY LOT 64

APPENDIX 5B: FLORA AND VEGETATION SURVEY LOT 56, 57, 508, 201

APPENDIX 5C: FLORA AND VEGETATION SURVEY LOTS 20, 62, 63 AND 211

APPENDIX 6: WEEDS AND DIEBACK

A. *Phytophthora* Dieback survey 2021a
B. *Phytophthora* Dieback survey 2021b
C. *Phytophthora* Dieback survey 2023
D. Weed and Dieback Management Plan (WDMP)

APPENDIX 6A: *PHYTOPHTHORA* DIEBACK SURVEY 2021A

APPENDIX 6B: *PHYTOPHTHORA* DIEBACK SURVEY 2021B

APPENDIX 6C: *PHYTOPHTHORA* DIEBACK SURVEY 2023

APPENDIX 6D: WDMP

APPENDIX 7: REHABILITATION MANAGEMENT PLAN

APPENDIX 8: WETLAND VEGETATION MONITORING PROGRAM

APPENDIX 9: BLACK COCKATOO HABITAT ASSESSMENTS

A. Survey 1 – Assessment of the nesting and foraging values of three Lots (508, 201 and 64) near Keysbrook for Doral Mineral Sands Pty Ltd, Keysbrook Mineral Sands Mine (BCE, 2021).

B. Survey 2 – Assessment of Nesting, Foraging and Roosting Values for Three Species of Black-Cockatoo in Lots 62, 63, 20 and 507 near Keysbrook, Western Australia (BCE, 2022).

C. Targeted assessment of potential nesting trees (ABCS, 2023a)

D. Targeted assessment of potential nesting trees (ABCS, 2023b)

APPENDIX 9A: BLACK COCKATOO SURVEY 1

APPENDIX 9B: BLACK COCKATOO SURVEY 2

APPENDIX 9C: TARGETED ASSESSMENT OF POTENTIAL NESTING TREES 2023A

APPENDIX 9D: TARGETED ASSESSMENT OF POTENTIAL NESTING TREES 2023B

APPENDIX 10: AQ2 GROUNDWATER & SURFACE WATER ASSESSMENTS

A. AQ2 Groundwater Assessment
B. AQ2 Surface Water Assessment

APPENDIX 10A: AQ2 GROUNDWATER

APPENDIX 10B: AQ2 SURFACE WATER

APPENDIX 11: ACID SULFATE SOIL INVESTIGATION

APPENDIX 12: ETHNOGRAPHIC SURVEY

APPENDIX 13: NOISE MODELLING ASSESSMENT

APPENDIX 14: AIR QUALITY AND DUST MANAGEMENT PLAN

APPENDIX 15: NGER REPORT 2022

APPENDIX 16: LAND ACQUISITION OFFSET

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