NOISE MANAGEMENT PLAN

LOT 262 (No. 220) QUEELUP ROAD, NORTH BOYANUP

October 2025

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Limitations

This report has been prepared by Accendo Australia Pty Ltd in accordance with the scope limitations provided in this report, or as otherwise agreed, between the Client and Accendo.

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The conclusions and recommendations in this report are based on assumptions made by Accendo described in this report where and as they are required. Accendo disclaims liability arising from any of the assumptions being incorrect.

The report is based on site specific conditions encountered and information received at the time of preparation of this report or the time that site investigations were undertaken. Accendo disclaims responsibility for any changes that may have occurred after this time.

The preparation of this report has been undertaken and performed in a professional manner, in consideration of the scope of services and in accordance with environmental consulting practices. No other warranty is made.

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1 INTRODUCTION

1.1 Background

JW Cross Maintenance Pty Ltd (the applicant) is proposing to extract sand from approximately 16.36 hectare (ha) area within Lot 262 (No. 220) Queelup Road, North Boyanup (herein referred to as the subject site) (refer to **Figure 1** and **Figure 2**).

The available volume of sand (*insitu* volume of approximately 500,000 m^3) is to be extracted, commencing to the south of the subject site and moving in a northerly direction.

The slope of the final contours of the pit will slope from approximately 22.3 m Australian Height Datum (AHD) in the south to 24.6 m AHD in the centre of the extraction area back to 23.7 in the north.

Slopes of the batters at the end of excavation will be retained at 1:5 vertical to horizontal.

1.2 Purpose and Scope

This Noise Management Plan (NMP) has been prepared to fulfil the relevant requirements provided within the Shire of Capel's *Local Planning Scheme No. 8* and the Shire of Capel's *Local Planning Policy No. 6.2 Extractive Industries*. It is intended to provide the Shire of Capel, the public and relevant government agencies with an understanding of the proposal and the environmental strategies and commitments proposed to address noise emissions associated with the proposed land use. This document has been prepared to support and should be read in conjunction with, the *Extractive Industry Operations Plan* prepared by Accendo Australia (2025) for sand extraction within the subject site.

The Plan will describe the proposed management measures necessary to ensure noise impacts on surrounding receptors will be managed in accordance with best practice and the *Environmental Protection (Noise) Regulations 1997*.

2 EXISTING ENVIRONMENT

2.1 Land Use

The subject site is zoned 'Rural' under the Shire of Capel's *Local Planning Scheme No. 8* (LPS 8) and the *Greater Bunbury Region Scheme* (GBRS). The subject site is located within the 'Special Control Area – Strategic minerals and Basic raw materials' under the LPS 8. The proposed extractive industry is a permitted land use within this zone subject to development approval from the Shire of Capel.

Land use to the east and southeast of the subject site is zoned 'Rural' and 'Local Road' under the LPS 8 and 'Rural' under the GBRS. Properties to the north, west and southwest of the subject site are zoned 'Rural' under the LPS 8 and GBRS. Properties that are located to the northeast of the subject site over Queelup Road are zoned 'Rural Residential' under the LPS 8 and 'Rural' under the GBRS.

Historically the subject site has been used for livestock grazing, resulting in the disturbance of the majority of native vegetation onsite. Intact remnant vegetation remains in the southwestern portion, with the remainder of the subject site comprised of mature paddock trees.

2.2 Topography and Soils

The current topography of the subject site can be described as sloping with the elevation ranging from 24 m AHD in the north and northwest corner to 33 m AHD in the centre before falling again to 26 m AHD in the southeast (refer to **Appendix A**).

The subject site is located within the Bassendean System of the Bassendean Zone consisting of fixed dunes inland from coastal dune zone containing non-calcareous sands, podsolised soils with l ow-lying wet areas. The Bassendean system consists of "*Sand dunes and sandplains with pale deep sand, semi-wet and wet soil*" (Natural Resource Information (NRInfo)).

The subject site is located within the Bassendean B1b soil phase consisting of "*very low relief dunes of undulating sand plain with deep bleached grey sandy A2 horizons and pale yellow B horizons*" (NRInfo).

2.3 Climate

The climate of the locality is classified as Mediterranean with warm to hot dry summers and cool wet winters.

The closest weather recording station is Bunbury (Station 9965). Temperatures are highest on average in February, at approximately 30.1°C. July has the lowest average temperature of the year of 7.4°C.

Rainfall for the area is approximately 737.3 mm per annum with approximately 90% of the rain falling during the winter months, April to October inclusive.

During the summer months the dominant wind in the mornings is from the south-east at 17-18 knots, swinging to the south-west at approximately 22 knots in the afternoon. During winter, the winds are most commonly 12-19 knots from no dominant prevailing direction. During storms, winds from the west and north-west can reach 40 knots (BoM 2020).

Rainfall intensity has been calculated using the Bureau of Meteorology (BoM) Intensity-Frequency-Duration (IFD) data system which yields the two hour 1 in 10 (10%) annual exceedance probability storm event for the subject site as 39.1 mm/hr.

3 EXTRACTION ACTIVITIES

The sand pit will cover an area of approximately 16.35 ha, with a current maximum elevation ranging from 24 m AHD to 33 m AHD. It will be excavated to a maximum depth ranging from 1.96 m to 6.26 m below ground level (BGL) commencing in the south and moving initially in a northerly direction in stages 2 ha in size (refer to **Figure 2**). The proposal does not include any crushing of material.

A 10 m buffer to the drip line of all trees outside of the extraction area and a 20 m buffer to the property boundary will be maintained, excluding the western boundary. Excavation will occur to the western property boundary to ensure topographic continuity with the adjoining property on which sand extraction has previously occurred.

It is estimated that the total maximum volume of sand to be removed will be approximately 500,000 m^3 with up to 50,000 m^3 excavated each year, depending on supply and demand.

The planned end use of the pit is to restore a natural soil profile and return the area to pasture, ensuring that there is no net loss of agricultural land.

3.1 Operational Works

3.1.1 Truck Movements

Access from the property will be via Ducane Rd and Queelup Rd, travelling north to Lillydale Road (refer to **Figure 3**). The road intersection will be asphalt, with sealing up to the length of a vehicle. Signage will be erected 100 m either side of the road access advising of trucks entering.

It is proposed to extract a maximum of approximately 100,000 m^3 or bank cubic metres (BCM) per year. The average daily extraction rate:

= 50,000 BCM / 52 weeks / 5 working days per week
= 192 BCM per day.

It is estimated that approximately 70% of the haulage is proposed to be undertaken from October to May (8 months). Therefore, the average daily extraction rate (main season):

= 50,000 BCM x 70% / 32 weeks / 5 working days
= 220 BCM per day.

The average daily extraction rate (LCM):

= 220 BCM x 1.15
= 253 LCM

It is proposed to utilise 19.0 m semi-tippers which in accordance with the *City of Busselton Local Planning Policy No. 2.3 – Extractive Industries* has a capacity of approximately 18.9 LCM of sand. Accordingly, the average daily truck movements during the main season are as follows:

= 253 LCM/ 18.9 LCM truck capacity
= 13 truck movements per day x 2 (to and from)
= 26 trips per day x 2 (peak fluctuations)
= 52 trips per day maximum.

Given the highly variable nature of the campaigns, these calculations are estimates only, there may be periods in which these daily truck numbers are exceeded.

3.1.2 Sand Extraction

The sand will be excavated by an excavator and loader to a stockpile or loaded directly to waiting trucks for transport. A summary of the proposed sand extraction activities is provided below:

- Prior to excavation commencing the site will be ground surveyed, the excavation footprint marked out and a 1 m contour plan developed.
- The topsoil will be stripped and stockpiled using a loader.
- An excavator or front-end loader will be used to dig the sand and transport it to a stockpile.
- The sand will then be picked up by a loader and loaded to trucks for transport.
- All static and other equipment, will be located on the floor of the pit to provide visual and acoustic screening.
- Excavation will commence in the south of the pit and then move in a northerly direction. The face and walls of the pit will act as noise barriers.
- Upon completion of each section of pit, the section will be reformed and back filled, where subgrade material is available, to achieve the proposed final contours.
- At the end of excavation, the floor of the pit will be deep ripped, covered by topsoil, and rehabilitated to a constructed soil.

3.1.3 Final Contours

The slope of the final contours of the pit will slope from approximately 22.3 m AHD in the south to 24.6 m AHD in the centre of the extraction area back to 23.7 in the north.

Slopes of the batters at the end of excavation will be retained at 1:5 vertical to horizontal which will enable the landform to be integrated with the surrounding landscape. This batter can be readily traversed by livestock, vehicles and machinery and is considered appropriate for the site's topographical relief.

3.1.4 Rehabilitation

Progressive rehabilitation within the extraction footprint will be undertaken as far as practicable. Works will commence in the south of the site and move in a northerly direction. Rehabilitation will be completed upon the completion of the pit.

Upon completion, the following broad completion criteria will be achieved:

- A self-sustaining cover of pasture;
- Weed levels that are not likely to impact on the viability of the reconstructed soils; and
- A safe and stable landform suitable for the proposed future land use which will be productive, grazing pasturelands.

3.2 Proposed Operating Times

Typical operating hours for quarries will be adopted for the subject site which involves 7 am to 5 pm each Monday to Friday. The subject site will be worked by 2 - 3 persons, depending on market demand.

The proposed transport route is a designated bus route. To ensure that trucks are not operating on designated school bus routes at the same time as the bus, trucks will not operate on the route during designated periods 15 minutes before and after the expected school bus times. Given that school bus times are regularly subject to change (due to school holidays and schedule changes based on pick up/drop off points), the applicant will be responsible for liaising with the school bus company prior to the commencement of school holidays and every school term. The pit operators will be careful to ensure compliance with these requirements.

3.3 Equipment

All operational equipment will work on the pit floor to provide maximum sound and visual screening. All equipment and infrastructure will be fully portable to facilitate movement throughout the site required for staged quarrying operations. The site will be secured by locked gates when it is not being actively worked. The boundary fencing will be maintained to prevent inadvertent and unauthorised entry.

Equipment and facilities that may be used onsite are provided in the Table below.

Table 1. Equipment

Equipment	Description
Site office and/or containers	May be required for the management and security of small items.
Toilet	A portable toilet may be required on site.
Water tanker	Used for dust suppression on the access roads and working floors when required.
Finlay Screen	Used for the screening of sand.
Front end wheel loader	Loaders will be used for the movement of sand and loading road trucks.
Radial Stacker	Used for removing sand material
Excavator	An excavator may be used for the removal of sand material.
Fuel storage	No fuel will be stored onsite.
Light vehicles	Access to and around the site.
Road truck	Removal of sand from site.

4 NOISE IMPACTS AND MANAGEMENT

4.1 Sensitive Receptors

The Environmental Protection Authority's (EPA) *Guidance for the Assessment of Environmental Factors* (June 2005) provides generic separation distances to assist in the determination of suitable buffers where industry may have the potential to affect the amenity of a sensitive land use. In particular, for extractive industries where no crushing will take place, a buffer distance of 300 m to 500 m is recommended from sensitive land uses.

The closest residential dwellings to the subject site are provided below and shown in **Figure 4.**

Table 2. Residential dwellings within 1,000 m of the subject site.

Resident No.	Distance to subject site (m)
1	65 m
2	93 m
3	168 m
4	188 m
5	271 m
6	448 m
7	592 m
8	595 m
9	612 m
10	675 m
11	752 m
12	900 m
13	992 m

The closest residential dwelling to the subject site is located 65 m from the eastern boundary. Additionally, a residential estate comprising of 17 houses is located approximately 448 m to 877 m from the northeastern boundary of the subject site.

4.2 Noise Generating Activities

The project works will involve the use of machinery and equipment that will generate noise during operation. Sources of noise from the subject site will included:

- Machinery noise from equipment use.
- Noise from safety equipment (beepers on machinery).
- Noise from trucks departing the site.

Reversing alarms can represent significant nuisance noise to sensitive receptors. There are a number of alternatives to alarms that maintain a safe work environment and also comply with occupational health and safety legislation. Reversing alarms alert pedestrians when a vehicle is moving, however, given that no pedestrians will be onsite (private property), the applicant has committed to using flashing lights or a broadband alarm system as an alternative. The sound of a broadband alarm is much less intrusive by nature than the sound of a tonal alarm and tends to be masked by the background noise at a lesser distance. This will eliminate/reduce noise emissions associated with reversing alarms.

Extraction activities will only be undertaken during standard hours of operation (in accordance with the conditions of the Extractive Industry Licence). A summary of potential noise generating activities is presented in **Table 3**.

Table 3. Noise generating activities.

Activity	Duration	Equipment to be used	Sound pressure Level (dB(A))	Comments
Topsoil stripping	3 weeks per year	CAT 966 Front end Wheel Loader (FEL) or similar	109	Initial impact to closest resident which will reduce as stockpiles increase.
Excavation and stockpiling of sand	80% of works undertaken within 6 months of the year	CAT 330F Excavator	104	Noise will be muffled by stockpiles present at edge of excavation areas.
Loading of trucks from stockpiles	A maximum of 5 years with up to 80 loads per day, dependent on demand.	Single Semi-loader, semi – tipper or road train	103	Noise will be muffled by stockpiles, vehicles are new and well maintained.

Noise levels have been obtained from a combination of manufacturers' specifications and from measurement of the plant undertaken at Nuttman Road, Walsall (Lloyd George Acoustics 2022).

A Noise Assessment was undertaken by Lloyd George Acoustics (Lloyd George 2025) (refer to **Appendix B**) which demonstrated that noise levels resulting from the extraction and screening works, are predicted to exceed the assigned level of 45dB $L_{A10.}$ To address the noise exceedance, it is recommended to construct noise bunds around the future location of the proposed screening fixed plant. The height of these boundary bunds should be as high as is reasonably practicable to a minimum of 5.0 m above the base of pit ground height as detailed within **Figure 6-1** of **Appendix B**.

The predicted noise levels with these bunds in place are below the assigned level of 45dB L_{A10} at all residents.

4.3 Noise Management Measures

The proponent will ensure that noise emissions comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* at all times. In addition, the management measures prescribed within **Table 4** will be implemented to reduce noise emissions as far as practicable.

Table 4. Management actions for noise.

Item	Action	Trigger/Timing	Responsibility
Inductions			
1	As part of site inductions, employees, contractors and visitors to the site are reminded of their responsibility to undertake work activities in an environmentally sensitive manner, including minimising noise while on site, or entering and leaving the site.	Ongoing	Site Manager
Planning Controls			
2	Daily Planning • The use of significant noise generating equipment or activities simultaneously is avoided. • The noisiest activities are scheduled to the least sensitive times of the day.	Where possible	Site Manager
3	Regular review of meteorological data, specifically wind speed and direction, to guide decisions on quarrying activities.	As required, with consideration to the intensity of activities onsite and the prevailing weather conditions	Site Manager
Operational Controls			
4	Equipment and Machinery • Use machinery and equipment with minimal noise output levels. • Ensure all machinery is regularly serviced as per the equipment's maintenance schedule to minimise noise generation. • Where appropriate, all machinery and equipment will be shut off when not in use. • Use flashing lights/broadband alarms instead of tonal reversing alarms on excavators/loaders. • Apply speed restrictions (15 km/hr within site) and a ban on exhaust braking.	Continuous	All employees & contractors
5	Earth bunds • Topsoil will be used to form perimeter bunds to assist with noise screening. • Earth bunding around the fixed plant, as specified in Figure 6-1 of **Appendix B** will be constructed to reduce noise impacts surrounding Residents.	Prior to quarrying	Site Manager

Item	Action	Trigger/Timing	Responsibility
Inductions			
Complaints Management			
6	Erect on-site signage directing public to make complaints to the relevant person.	Prior to quarrying	Site Manager
7	Maintain a complaints register (refer to **Appendix C**). A Complaints Register will be established for the site to record the following information: • Date, time, location and nature of the exceedance. • Identify the cause (or likely cause) of the exceedance and responsible parties. • Identify the activities that were occurring at the time of the non-compliance. • Determine the activities that were most likely contributing to the non-compliance. • Describe what action has been taken to date. • Describe the proposed measures to address the exceedance. If the complaint is verified as being due to a site source, remedial action will be undertaken within 2 hours. The Shire of Capel will be advised of all complaints as soon as they are received. If a compliant cannot be resolved within the 2 hour response period, it may be necessary to cease operations.	Upon receiving complaint	Site Manager

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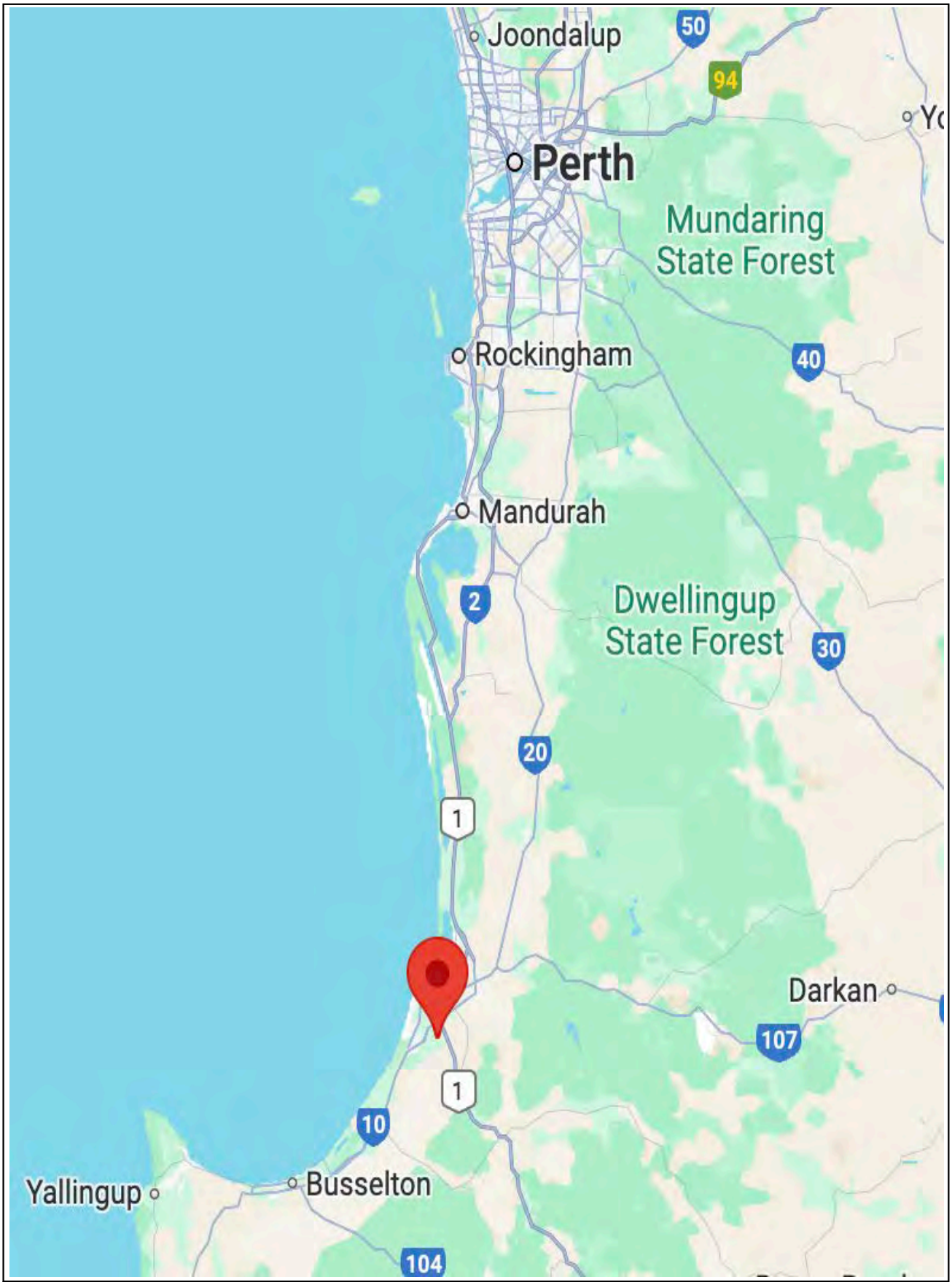
FIGURES



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		2538	Figure 1	A
DRAWING TITLE	Figure 1 – Site Locality	Designed NC	Checked	
		Drawn PN	Approved	
CLIENT	JW Cross Maintenance Pty Ltd	Date	05/06/2025	
		Local Authority	Shire of Capel	
		Sheet 1 of 1		

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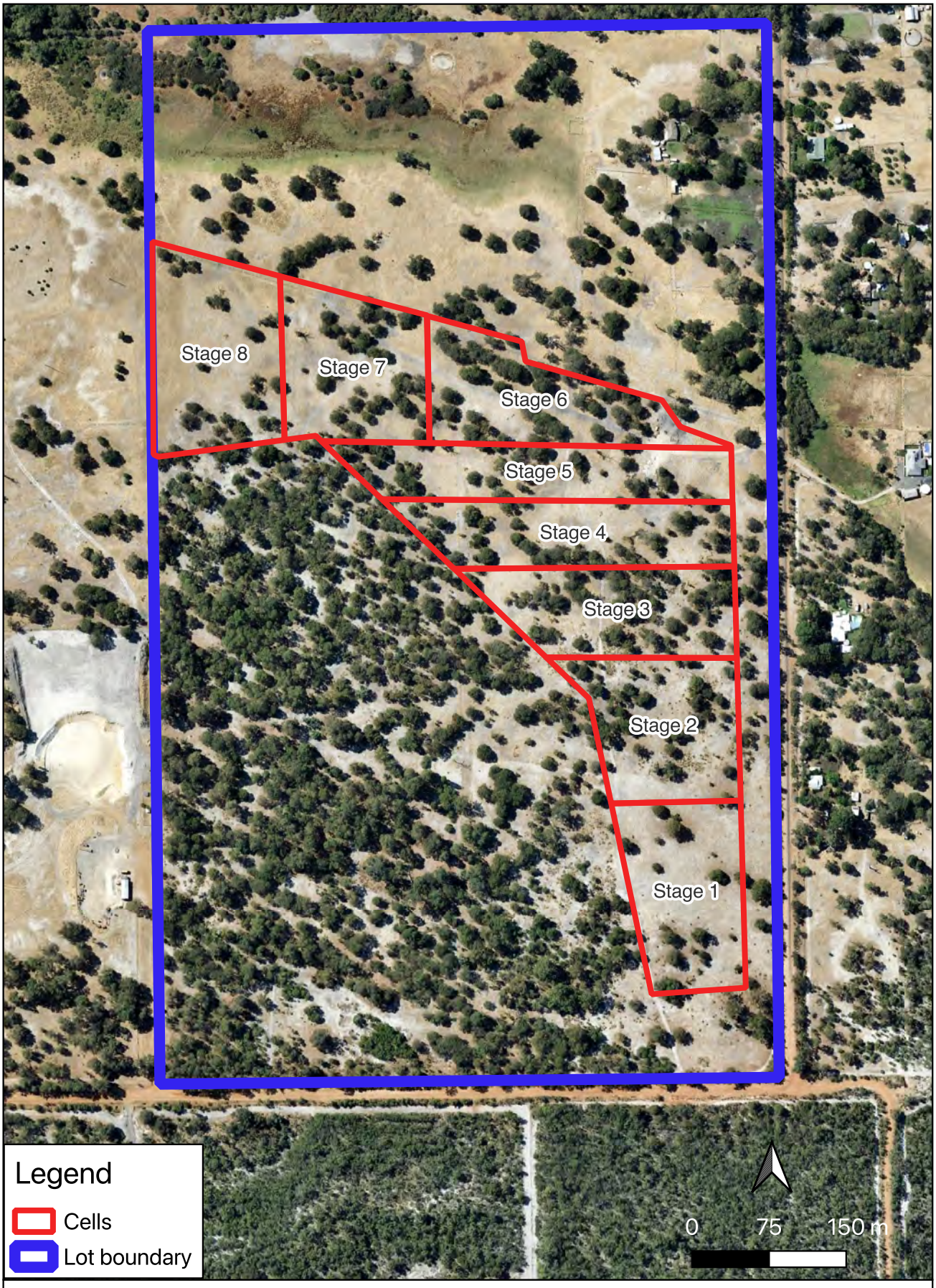

PROJECT	Lot 262 (220) Queelup Rd, North Boyanup	Project Number	Drawing Number	Revision
		2538	Figure 2	B
DRAWING TITLE	Figure 2- Site Extent	Designed NC Drawn PN	Checked Approved	
CLIENT	JW Cross Maintenance Pty Ltd	Date	23/09/2025	
		Local Authority	Shire of Capel	
		Sheet 1 of 1		

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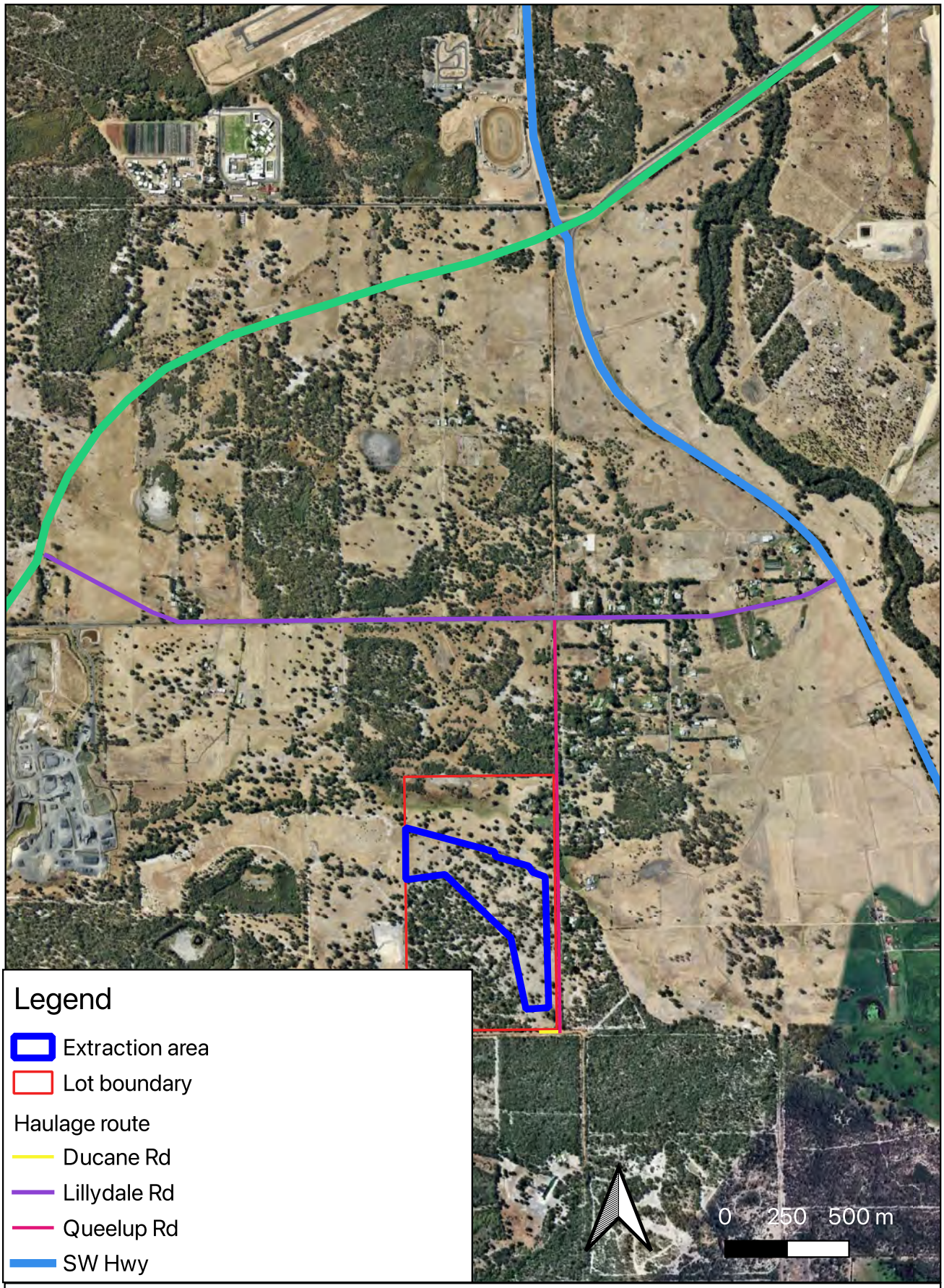

PROJECT	Lot 262 (220) Queelup Rd,Boyanup	Project Number	Drawing Number	Revision
DRAWING TITLE	Figure 3 - Haulage Route	2538	Figure 3	A
CLIENT	JW Cross Maintenance Pty Ltd	Designed NC Drawn PN	Checked Approved	
		Date Local Authority Sheet 1 of 1	30/09/2025 Shire of Capel	

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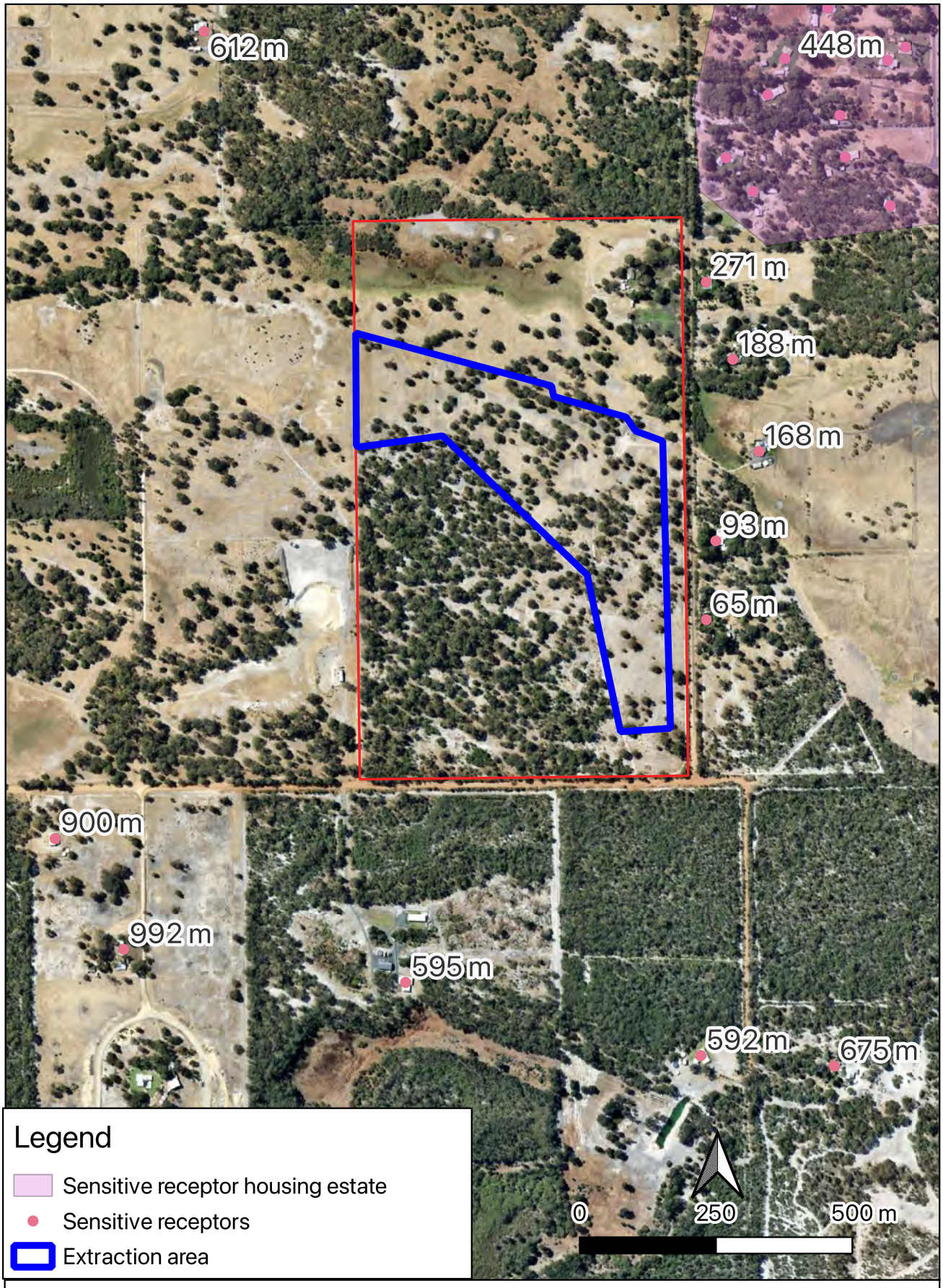

PROJECT	Lot 262 (220) Queelup Rd,Boyanup	Project Number	Drawing Number	Revision
DRAWING TITLE	Figure 4 - Sensitive receptors	2538	Figure 4	A
CLIENT	JW Cross Maintenance Pty Ltd	Designed NC Drawn PN	Checked Approved	
		Date Local Authority Sheet 1 of 1	23/09/2025 Shire of Capel	

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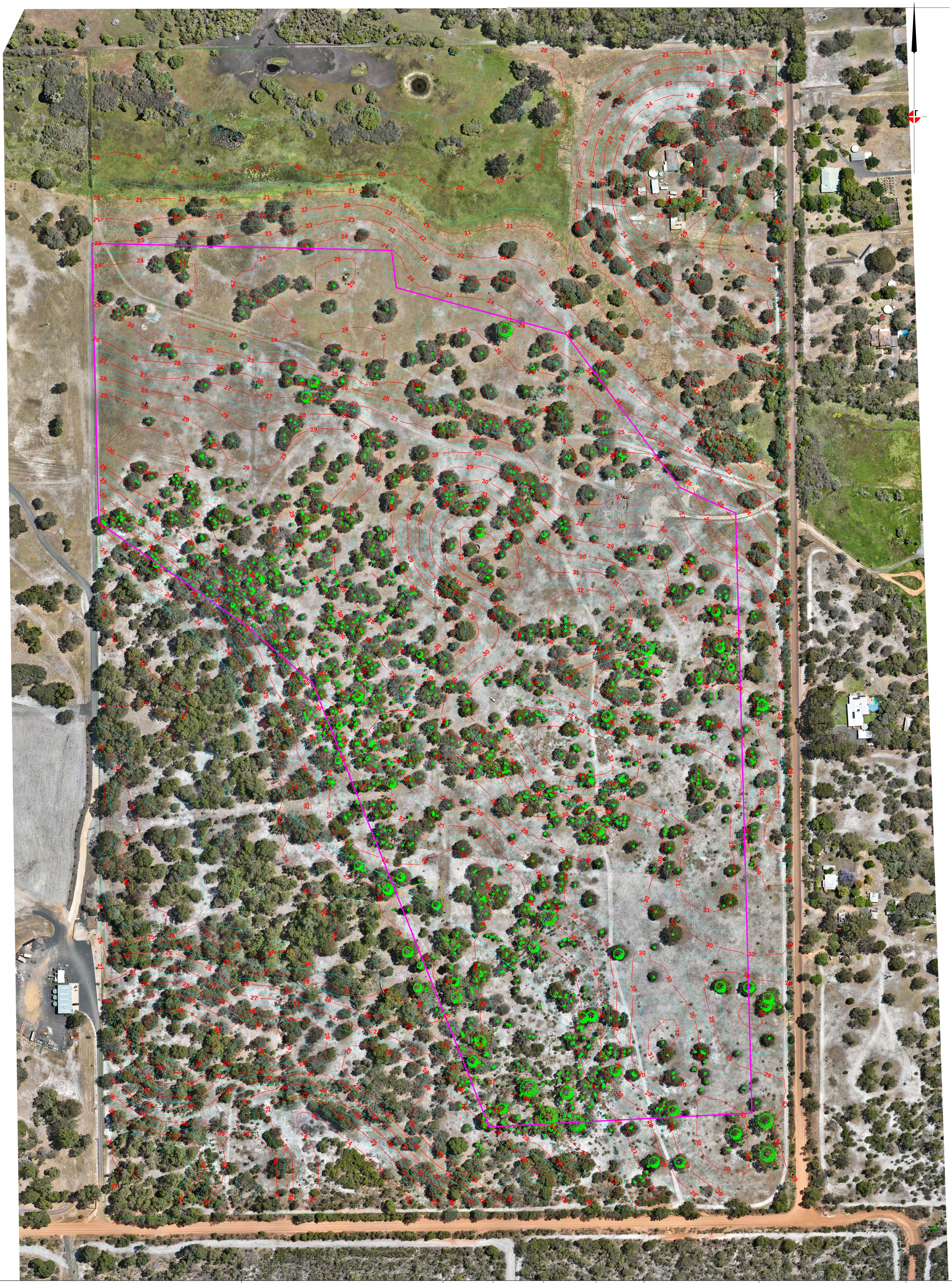
APPENDIX A – SITE CONTOUR SURVEY



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CLIENT:	J.W CROSS	Date: 09/12/2024	Drawn: PS	Surveyor: RRe	CHKd: PS
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REVISION SCHEDULE — Sheet 1 of 1

No.	Date	Description

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APPENDIX B - NOISE ASSESSMENT

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Environmental Noise Assessment - Extractive Materials Pit

Lot 262 (#220) Queelup Rd, North Boyanup

Reference: 250710497-01b

Prepared for:
JW Cross c/o Accendo Australia

Reference: 250710497-01

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Date	Rev	Description	Author	Verified
25-Jul-25	0	Issued to Client	Rob Connolly	Terry George
29-Jul-25	A	Heading change	Rob Connolly	-
21-Aug-25	B	Revised Plant	Rob Connolly	Terry George

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EXECUTIVE SUMMARY

The noise emissions resulting from a proposed extraction and screening operations at Lot 262 (#220) Queelup Rd, North Boyanup, Western Australia, have been assessed by means of predictive noise modelling and the results compared against the assigned levels within the *Environmental Protection (Noise) Regulations 1997*.

The proposed hours of operation are 7.00 am to 5.00 pm Monday to Friday. The site will be closed on Public Holidays.

The proposed plant required for the construction, extraction and crushing works includes:

- Finlay Screen;
- Radial Stacker;
- CAT 982 Front End Loader;
- CAT 336 Excavator;
- CAT Dozer for Construction Activates Only;
- Water cart moving at low speed;
- Haulage trucks moving at low speed.

Given that there is moving plant and the close proximity to the noise sensitive receivers to boundaries of the extractive area, compliance may not be practicable at all times. However based on the assumptions made, the noise predictions show that the operations can achieve compliance with the applicable regulatory criteria, between 7.00 a.m. and 7.00 p.m. Monday to Saturday at all noise sensitive receivers, providing the earth bunds are constructed around the screening plant as recommended in this assessment.

1. INTRODUCTION

Lloyd George Acoustics was engaged by JW Cross c/o Accendo Australia to undertake an environmental noise assessment for a proposed extractive pit to be located at Lot 262 (#220) Queelup Rd, North Boyanup - refer *Figure 1-1*.

Figure 1-1: Subject Site Location (Source: DPLH PlanWA)

With regard to noise emissions, consideration is given to noise from extraction, screening and loading operations when received at neighbouring properties, against the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*.

The product will be extracted from the area shown in *Figure 1-2.* The plant is assumed to be operating at base of pit level. It is understood that the Client will utilise the waste topsoil and overburden to construct noise bunds during the construction phase.

The sand pit will operate within the day period of 7.00 a.m. to 5.00 p.m. Monday to Friday. It will not be operated on Public Holidays. Trucks will arrive on site and will be loaded with sand. It is anticipated that 250 – 300 tonnes per day will be extracted/loaded. This equates to 10 - 12 trucks (20 - 24 movements) accessing the pit during a typical day. Access points will be to the south of the lot – refer *Figure 1-3*.

Screening plant will only run in campaigns, sometimes only expected to run 30% of the time. The excavator will also cover rehab which are anticipated to be biannually or possibly even annually.

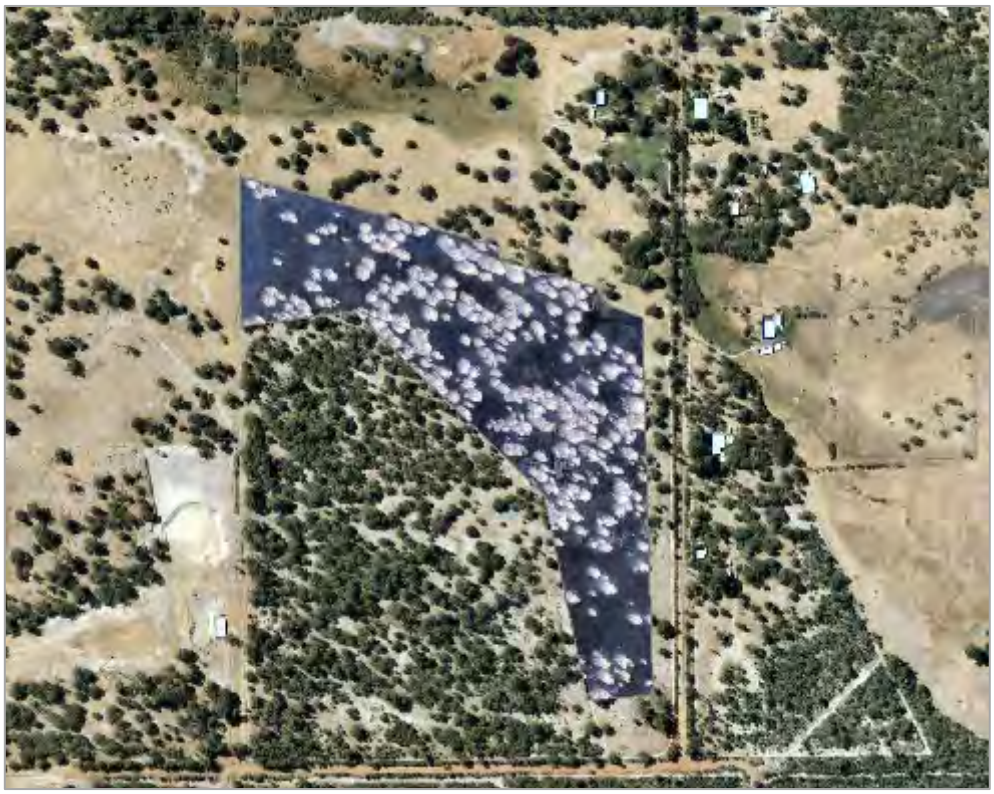


Figure 1-2: Area of Extraction Highlighted

Figure 1-3: Road Haulage Route

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

2. CRITERIA

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

2.1. Regulation 13

Regulation 13 provides the noise requirements that are to be satisfied whilst the construction activities are occurring and are detailed below:

Regulation 13(2)

"Regulation 7 does not apply to noise emitted from a construction site as a result of construction work carried out between 0700 hours and 1900 hours on any day which is not a Sunday or public holiday if the occupier of the premises or public place, shows that –

- *(a) the construction work was carried out in accordance with control of environmental noise practices set out in section 4 of AS 2436-2010 Guide to noise and vibration control on construction, maintenance and demolition sites; and*
- *(b) the equipment used on the premises was the quietest reasonably available; and*
- *(c) if the occupier was required to prepare a noise management plan … in respect of the construction site –*
  - *(i) the noise management plan was prepared and given in accordance with the requirement, and approved by the CEO or authorised delegate; and*
  - *(ii) the construction work was carried out in accordance with the noise management plan, excluding any ancillary measure;"*

Regulation 13(3)

"Regulation 7 does not apply to noise emitted from a construction site as a result of construction work carried out other than between the hours specified in subregulation (2) if the occupier of the construction site shows that -

- *(a) the construction work was carried out in accordance with control of environmental noise practices set out in section 4 of AS 2436-2010 Guide to noise and vibration control on construction, maintenance and demolition sites; and*
- *(b) the equipment used on the premises was the quietest reasonably available; and*
- *(c) the construction work was carried out in accordance with a noise management plan, excluding any ancillary measure, in respect of the construction site –*
  - *(i) prepared and given to the CEO or authorised delegate not later than 7 days before the construction work commenced; and*
  - *(ii) approved by the CEO or authorised delegate; and*
- *(d) at least 24 hours before the construction work commenced, the occupier of the construction site gave written notice of the proposed construction work to the occupiers of all premises at which noise emissions received were likely to fail to comply with the standard prescribed under regulation 7; and*
- *(e) it was reasonably necessary for the construction work to be carried out at that time."*

Regulation 13(6)

"A noise management plan prepared under subregulation (3)(c), (4) or (5A) is to include, but is not limited to -

(a) details of, and reasons for, construction work on the construction site; and
(b) details of, and the duration of, activities on the construction site likely to result in noise emissions that fail to comply with the standard prescribed under regulation 7; and
(c) predictions of noise emissions on the construction site; and
(d) details of measures to be implemented to control noise (including vibration) emissions; and
(e) procedures to be adopted for monitoring noise (including vibration) emissions; and
(f) complaint response procedures to be adopted."

Although it is stated that Regulation 7 does not apply, it is still referred to in terms of providing written notice.

2.2. Regulations 7, 8 & 9

This group of regulations provide the prescribed standard for noise as follows:

"7. Prescribed standard for noise emissions

(1) Noise emitted from any premises or public place when received at other premises –
(a) must not cause, or significantly contribute to, a level of noise which exceeds the assigned level in respect of noise received at premises of that kind; and
(b) must be free of –
(i) tonality; and
(ii) impulsiveness; and
(iii) modulation,
when assessed under regulation 9.

(2) For the purposes of subregulation (1)(a), a noise emission is taken to significantly contribute to a level of noise if the noise emission … exceeds a value which is 5 dB below the assigned level at the point of reception."

Tonality, impulsiveness and modulation are defined in regulation 9 (refer *Appendix A*). Under regulation 9(3), *"Noise is taken to be free of the characteristics of tonality, impulsiveness and modulation if -*

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

Table 2-1: Adjustments Where Characteristics Cannot Be Removed

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

* These adjustments are cumulative to a maximum of 15 dB.

The assigned levels (prescribed standards) for all premises are specified in regulation 8(3) and are shown in *Table 2-2*. The L_{A10} assigned level is applicable to noises present for more than 10% of a representative assessment period, generally applicable to "steady-state" noise sources. The L_{A1} is for short-term noise sources present for less than 10% and more than 1% of the time. The L_{Amax} assigned level is applicable for incidental noise sources, present for less than 1% of the time.

Table 2-2: Baseline Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays (Sunday)	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days (Evening)	40 + influencing factor	50 + influencing factor	55 + influencing factor
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and public holidays (Night)	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

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

As properties surround the proposed pit are in a rural area, away from any major or secondary roads and there are no commercial or industrial land usages, the influencing factor (IF), in relation to noise received at noise sensitive premises, has been calculated as 0 dB. It is noted that the dwelling identified as R0 is located on the same lot (Lot 262 #220 Queelup Rd) as the proposed extractive areas and as such an agreement will be entered into with the homeowner and the assigned noise levels will not be applicable at this dwelling. *Table 2-3* shows the assigned levels (ANL's) including the influencing factor during the operating hours of the pit at the receiving locations, being that of the baseline ANL's.

Table 2-3: Assigned Levels

Premises Receiving Noise	Time Of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
+0 dB IF Noise sensitive premises: highly sensitive area[1]	0700 to 1900 hours Monday to Saturday (Day)	45	55	65
Noise sensitive premises: any area other than highly sensitive area	All hours	60	75	80
Commercial Premises	All hours	60	75	80
Industrial and Utility Premises	All hours	65	80	90

It must be noted the assigned levels above apply outside the receiving premises and at a point at least 3 metres away from any substantial reflecting surfaces.

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

2.3. Regulation 3

"3. Regulations do not apply to certain noise emissions

(1) Nothing in these regulations applies to the following noise emissions –

(a) Noise emissions from the propulsion and braking systems of motor vehicles operating on a road;"

(b) a reversing alarm fitted to a motor vehicle, mobile plant, or mining or earthmoving equipment;

In regards to regulation 3(1)(a), while trucks associated with the loading of sand are on public roads, they are exempt from the Regulations, however, the noise must be assessed once they enter private land. In regards to regulation 3(1)(b), it is considered by DWER that any reversing alarms fitted to the mobile plant and transport trucks are not necessarily exempt under the Regulations, since they are not specifically required under another written law. The commonly used fixed noise output tonal reversing alarms also known as 'reversing beeper' emit, by their very nature, tonal and modulating noise at high levels. As such, this type of reversing alarm generally cannot comply with the Regulations even at distant receivers. Alternative alarms such as broadband alarms are commonly used to minimise the impact.

3. METHODOLOGY

3.1. Site Measurements

As this is a rural area, it can be expected that ambient noise levels will be low and that any noise resulting from operations at the sand pit will be audible at the nearest noise sensitive premises. Therefore, background noise monitoring was not considered to be required for this assessment.

3.2. Noise Modelling

Computer modelling has been used to predict the noise emissions from the development to all nearby receivers. The software used was *SoundPLAN 9.0* with the CONCAWE algorithms (ISO 17534-3 improved method) selected, as they include the influence of meteorological conditions. Input data required in the model are listed below and discussed in *Section 3.2.1* to *Section 3.2.4*:

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

3.2.1. Meteorological Conditions

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

Table 3-1: Modelling Meteorological Conditions

Parameter	Day (7.00am to 7.00pm)[2]
Temperature (°C)	20
Humidity (%)	50
Wind Speed (m/s)	4
Wind Direction[1]	All
Pasquil Stability Factor	E

Notes:

1. The modelling package allows for all wind directions to be modelled simultaneously.
2. The conditions above are as defined in *Guideline: Assessment of Environmental Noise Emissions*; May 2021

* The modelling package allows for all wind directions to be modelled simultaneously.

Alternatives to the above default conditions can be used where one year of weather data is available and the analysis considers the worst 2% of the day and night for the month of the year in which the worst-case weather conditions prevail (source: *Draft Guideline on Environmental Noise for Prescribed Premises*, May 2016). In most cases, the default conditions occur for more than 2% of the time and therefore must be satisfied.

3.2.2. Topographical Data

Topographical data was adapted from publicly available information (e.g. *Google*) in the form of spot heights.

Surrounding existing buildings were also incorporated in the noise model, as these can provide noise shielding as well as reflection paths. All buildings are assumed to be single storey buildings and modelled with a height of 3.5 metres with receivers 1.4 metres above ground.

Figure 3-1 shows a 2D overview of the noise model with the location of all relevant receivers identified.

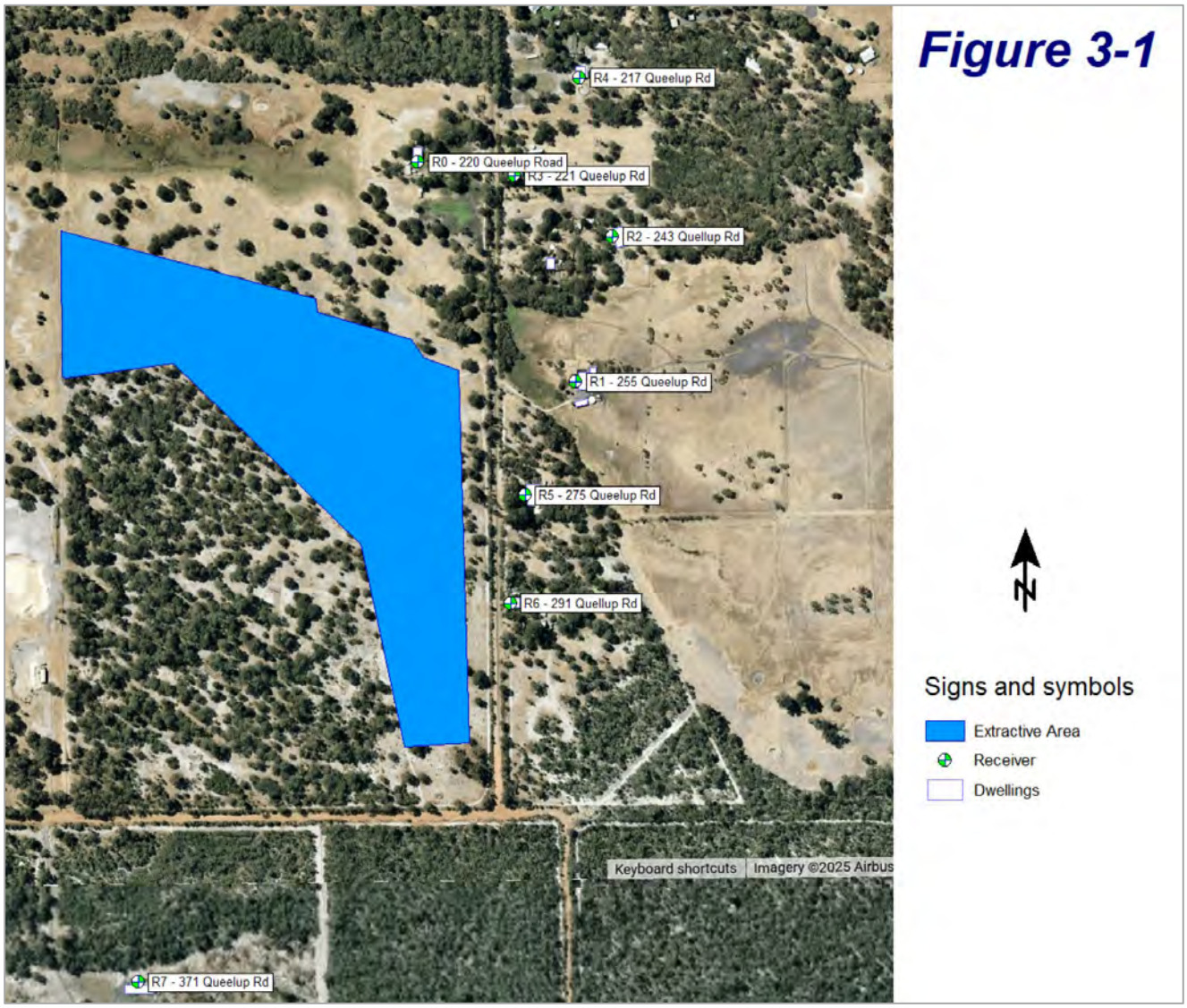


Figure 3-1: Overview of Noise Model

3.2.3. Ground Absorption

The ground absorption has been assumed to be 0.8 (80%) for the survey area, noting that 0.0 represents hard reflective surfaces such as water and 1.0 represents absorptive surfaces such as grass.

3.2.4. Source Sound Levels

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

Table 3-2: Source Sound Power Levels, dB

Description	Octave Band Centre Frequency (Hz)								Overall dB(A)
	63	125	250	500	1k	2k	4k	8k	
Excavator	112	110	104	99	98	95	90	0	**104**
Finlay Screen	108	120	105	103	100	99	100	88	**109**
Trucks	107	108	101	100	97	96	87	81	**103**
Dozer, For Construction Phase Only	104	113	110	107	107	105	100	100	**112**
FEL	102	112	104	105	104	102	98	93	**109**
Radial Stacker	95	93	94	88	93	90	78	75	**96**
Water Cart	93	101	97	93	94	92	86	78	**99**

The following is noted in relation to *Table 3-2*:

- Sound power levels are a mixture of both manufacturer's and on-file data;
- All plant is assumed to be 2.0 metres above ground level (AGL);
- Sound source represents L_{10} level;
- Truck and water cart moving sound power is converted from shown sound power in Sound*PLAN* software based on travelling speed at a maximum of 30 km/hr whilst onsite;
- All sources are modelled as operating concurrently;
- Scenario 2 noise model includes the 5 metre high noise bunds (meaning a minimum of 3 metres above the screening plant height) created around the fixed plant during the construction phase;
- Fixed plant source group contains the Finlay Screen and Radial Stacker;
- Moving plant source group includes haulage trucks and water carts;
- Mobile plant source group contains all other plant.

4. RESULTS

4.1. Noise Measurements

As this is a rural area, it can be expected that ambient noise levels will be low and that any noise resulting from operations at the sand pit will be audible at the nearest noise sensitive premises. Therefore, ambient noise monitoring was not considered to be required for this assessment.

4.2. Noise Modelling

The noise levels were predicted for various scenarios:

- Scenario 1: Construction Phase – Removing topsoil/overburden and constructing 5 metre high bunds around the future screening plant area. Ground works will include the use of up to 1x Excavator, 1x water cart, 1x dozer, 1x front end wheeled loader (FEL) and haulage trucks. Ground level will be lowered with the removal of overburden/topsoil during this phase. All plant operating concurrently.
- Scenario 2: Normal Operations – Removing the sand material involving the use of 1x FEL, 1x water cart, 1x excavator, 1x screen, 1x radial stacker and haulage trucks entering and existing the site after being loaded by the FEL. Noise model includes the 5 metre high noise bunds created around the fixed plant during the construction phase. All plant operating concurrently.

4.2.1. Scenario 1 – Construction Phase

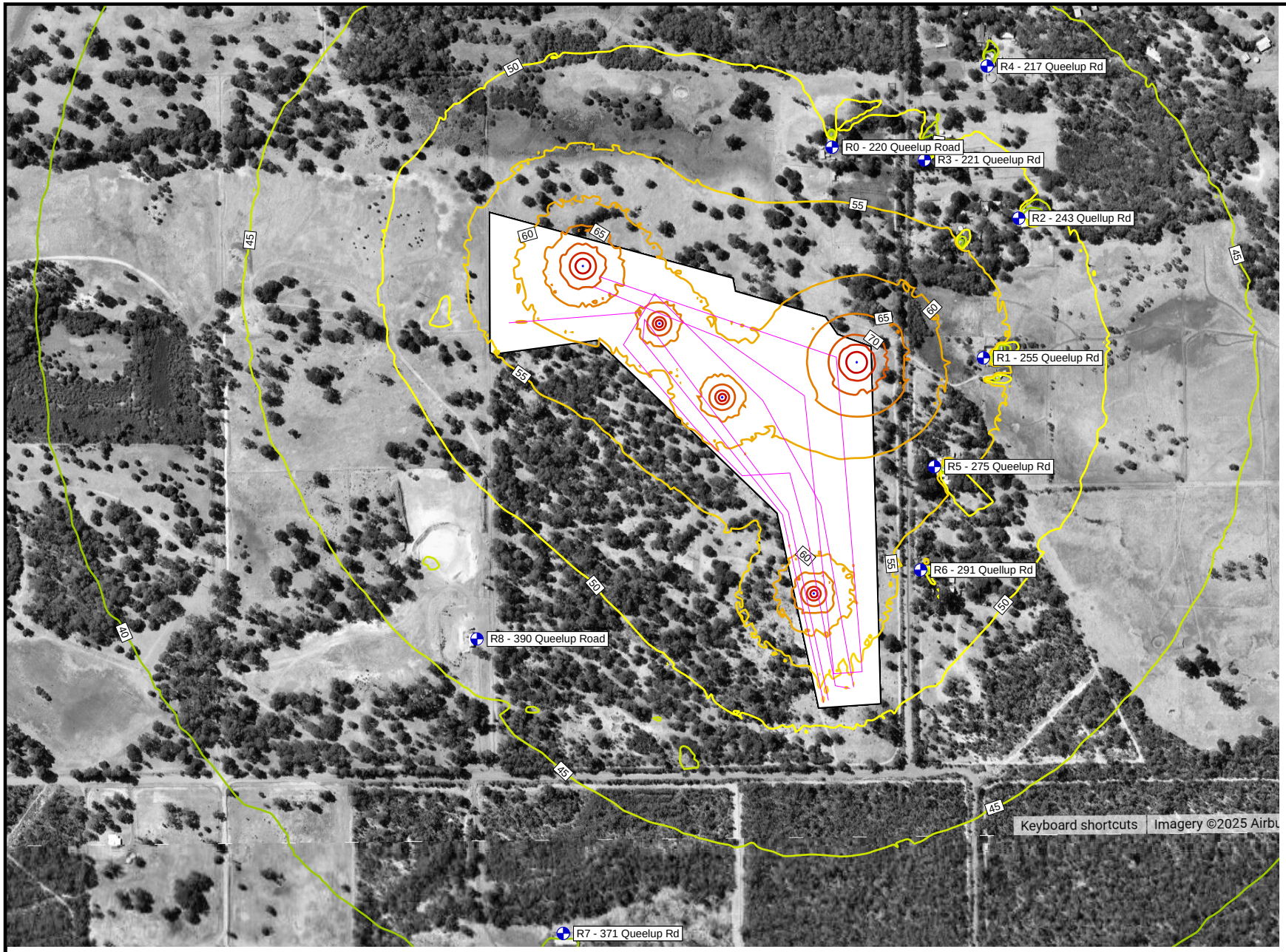
The predicted noise levels during the construction phase of stripping the topsoil, moving the topsoil and overburden and construction of 5 metre high noise bunds around the location of future fixed crusher/screening plant are provided in *Table 4-1*. A noise contour plot is also provided in *Figure 4-1* showing noise levels at ground floor.

Table 4-1: Scenario 1 - Predicted Levels during Construction Phase, L_{10} dB(A)

Receiver	Predicted Nosie Level	Adjusted Nosie Level[1]
R0 - 220 Queelup Rd	53	58
R1 - 255 Queelup Rd	57	62
R2 - 243 Quellup Rd	52	57
R3 - 221 Queelup Rd	52	57
R4 - 217 Queelup Rd	48	53
R5 - 275 Queelup Rd	57	62
R6 - 291 Quellup Rd	54	59
R7 - 371 Queelup Rd	42	47
R8 - 390 Queelup Rd	47	52

* Adjusted by + 5 dB for tonality

Figure 4-1



Predicted Noise l
L_{A10} dB

- = 40
- = 45
- = 50
- = 55
- = 60
- = 65
- = 70
- = 75
- = 80

N

Signs and symbols

- Extractive Area
- Point source
- Line source
- Receiver

Scale 1:8250

0 40 80 160 240 320 m

Scenario 1 - Construction Phase - Lot 262 (#200) Queelup Road, North Boyanup - Predicted Noise Levels

L_{A10} Noise Level Contours - Mobile Plant Only - No Tonality Penalty Included - Ground Floor

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4.2.2. Scenario 2 – Normal Operations

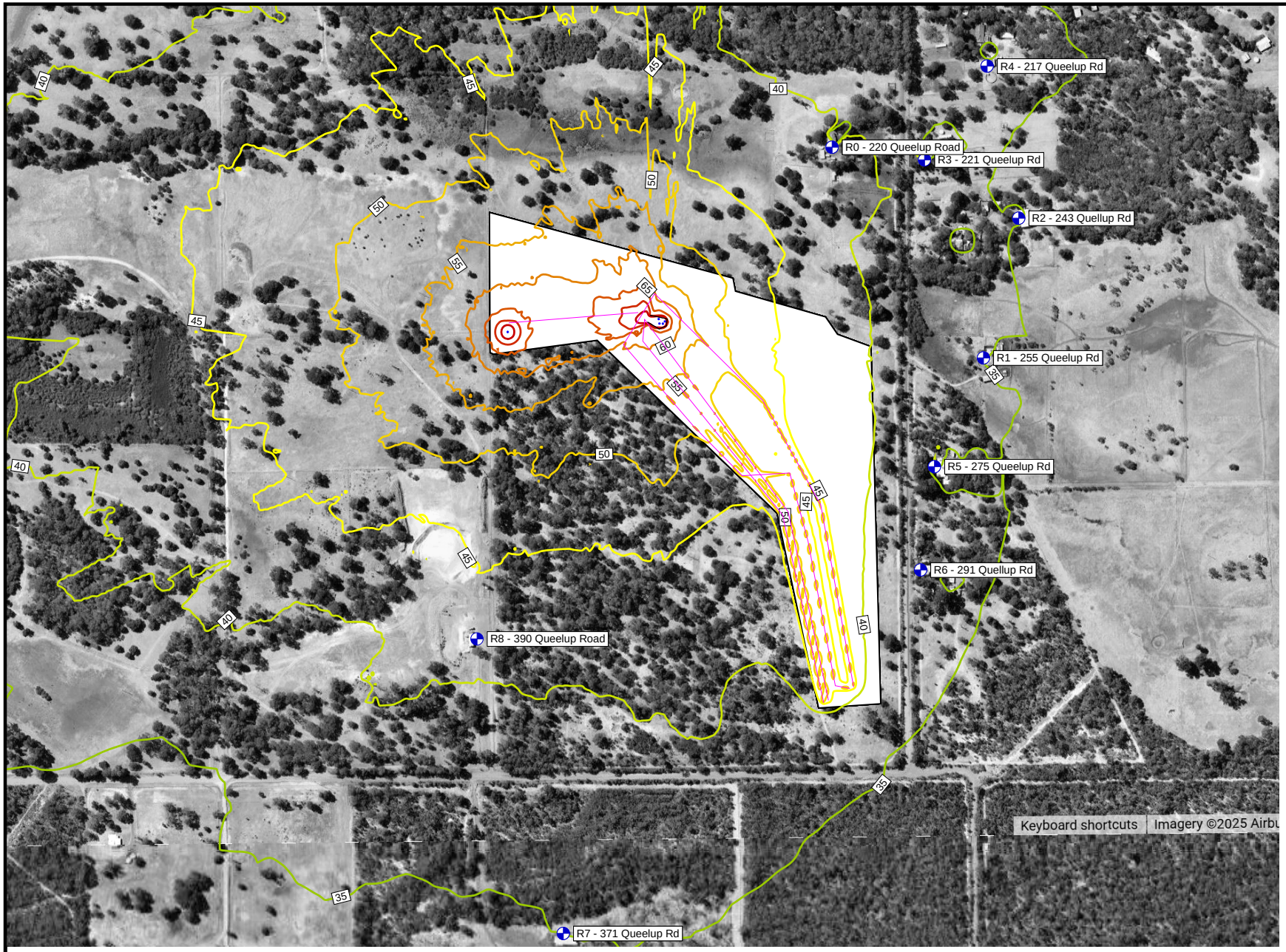
The results for the Normal Operations Scenario 2 are provided in *Table 4-2*. A noise contour plot is also provided in *Figure 4-2* showing noise levels at ground floor.

Table 4-2: Scenario 2 – Normal Operations Predicted Levels, L_{10} dB(A)

Receiver	Fixed Plant	Moving Haulage Trucks & Water Cart	Stationary Trucks Being Loaded	All Other Mobile Plant	Overall
R0 - 220 Queelup Rd	38	24	32	40	**42**
R1 - 255 Queelup Rd	29	25	22	35	**36**
R2 - 243 Quellup Rd	27	22	25	33	**35**
R3 - 221 Queelup Rd	30	22	27	37	**38**
R4 - 217 Queelup Rd	35	19	26	35	**36**
R5 - 275 Queelup Rd	36	29	25	37	**38**
R6 - 291 Quellup Rd	35	31	21	35	**37**
R7 - 371 Queelup Rd	32	19	22	32	**35**

The dominant source at all identified receivers is the fixed crusher/screening plant.

Figure 4-2



Predicted Noise l
L_{A10} dB

- = 35
- = 40
- = 45
- = 50
- = 55
- = 60
- = 65
- = 70
- = 75

N

Signs and symbols

- Extractive Area
- Point source
- Line source
- Receiver
- Noise Bund

Scale 1:8250

0 40 80 160 240 320 m

Scenario 2 - Normal Operations - Lot 262 (#200) Queelup Road, North Boyanup - Predicted Noise Levels

L_{A10} Noise Level Contours - Mobile & Fixed Plant Only - No Tonality Penalty Included - Ground Floor

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5. ASSESSMENT

5.1. Scenario 1

Table 5-1 provides the noise levels for Scenario 1 – Construction Phase. Intrusive characteristics are expected, so noise levels are adjusted by +5 dB for possible tonal characteristics.

Table 5-1: Adjusted Levels during Construction Phase, L_{10} dB(A)

Receiver	Predicted Nosie Level	Adjusted Nosie Level[1]
R0 - 220 Queelup Rd	53	58
R1 - 255 Queelup Rd	57	62
R2 - 243 Quellup Rd	52	57
R3 - 221 Queelup Rd	52	57
R4 - 217 Queelup Rd	48	53
R5 - 275 Queelup Rd	57	62
R6 - 291 Quellup Rd	51	56
R7 - 371 Queelup Rd	41	46
R8 - 390 Queelup Rd	46	51

* Adjusted by + 5 dB for tonality

Noise from the construction activity is not required to meet the assigned levels. However, under regulation 13, it must be demonstrated that the noise is being managed such that the emissions are as low as reasonably practicable. In this instance, this would be achieved by:

- using well-maintained equipment at all times;
- where practicable, orientating equipment such that the noise side faces away from the residences;
- where practicable and safe, any reversing alarms fitted to the mobile plant should be of the broadband noise type rather than tonal, beeping type. It was noted on the site visit that this was predominately the case already for the existing mobile plant.

5.2. Scenario 2

Table 5-2 assesses the noise levels for Scenario 2, Normal Operations. Intrusive characteristics are expected, so noise levels are adjusted by +5 dB for possible tonal characteristics and compared against the daytime assigned levels.

Table 5-2: Adjusted Scenario 2 Assessment, dB(A)

Receiver	Adjusted Level[1]	Assigned Level	Assessment
R0 - 220 Queelup Rd	47	N/A	*Complies*
R1 - 255 Queelup Rd	41	45	*Complies*
R2 - 243 Quellup Rd	40	45	*Complies*
R3 - 221 Queelup Rd	43	45	*Complies*
R4 - 217 Queelup Rd	41	45	*Complies*
R5 - 275 Queelup Rd	43	45	*Complies*
R6 - 291 Quellup Rd	42	45	*Complies*
R7 - 371 Queelup Rd	40	45	*Complies*

* Adjusted by + 5 dB for tonality

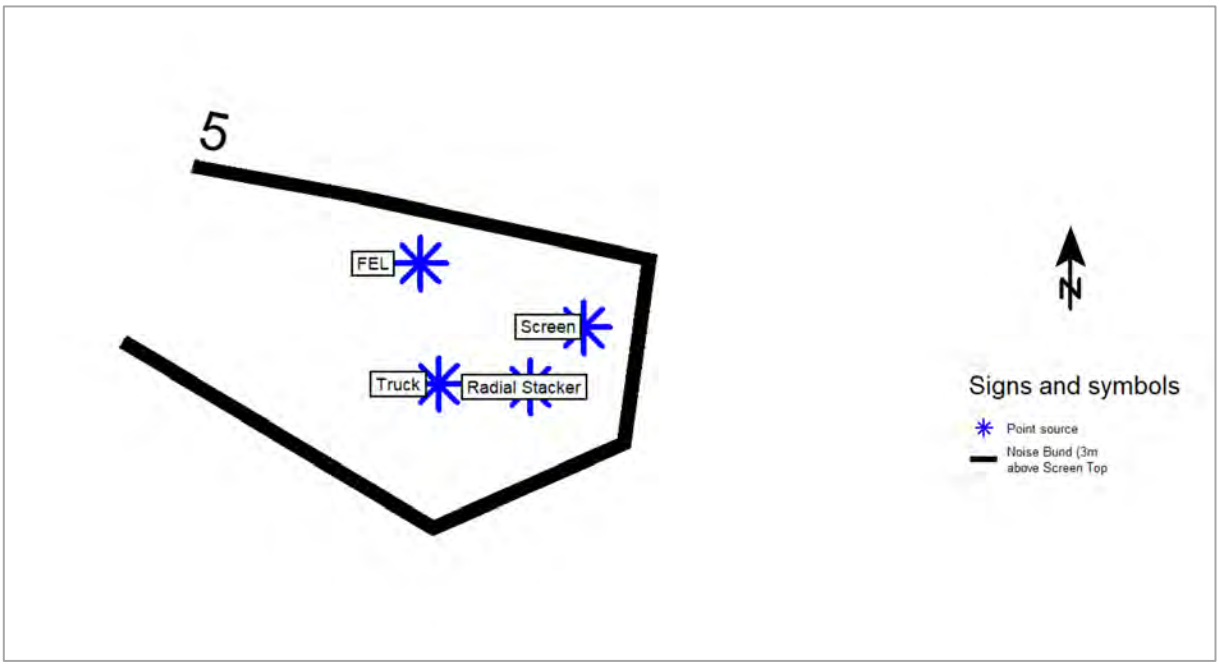
From the above, it can be seen that compliance is achieved at all identified receivers for normal operations.

6. RECOMMENDATIONS

Given that there is moving plant and the close proximity to the noise sensitive receivers to boundaries of the extractive area, compliance may not be practicable at all times. However based on the assumptions made, the noise predictions show that the operations can achieve compliance with the applicable regulatory criteria, between 7.00 a.m. and 7.00 p.m. Monday to Saturday providing earth bunds are constructed around the screening plant as part of the construction phase of works. The noise bunds should be constructed of topsoil and overburden as follows:

- Noise bunds to be constructed around the future location of the proposed screening fixed plant. Height of boundary bunds should be as high as is reasonably practicable to a minimum of 5.0 metres above the base of pit ground height (meaning a minimum of 3 metres above the screening plant height) at that location- refer *Figure 6-1*. These are to be considered to be carried out in the initial construction phase.

Figure 6-1: Noise Bund Detail Around Screening Plant



The noise should also be managed as follows:

- Make use of radio communication between wheeled loader and road truck operators to allow for positioning and loading of trucks without the use of horn signals as far as practicable;
- Mobile plant tonal reversing alarm alternatives should be considered where deemed safe (i.e. broadband);
- Selection of the quietest plant possible;
- Ensure that trucks aren't exiting and entering the site at the same time where practicable, so as to minimise noise impact at nearby receivers;
- There is to be only three haulage trucks operational on site at any one time where practicable;
- Purchasing staff need clear policy guidelines for procurement of new plant to ensure that noise levels do not increase over time;
- Maintenance staff may need to implement a maintenance programme to prevent noise levels increasing over time.

Appendix A – Terminology

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

- **Decibel (dB)**

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

- **A-Weighting**

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

- **Sound Power Level (L_w)**

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

- **Sound Pressure Level (L_p)**

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

- **L_{ASlow}**

This is the noise level in decibels, obtained using the A-frequency weighting and the S (slow) time weighting. Unless assessing modulation, all measurements use the slow time weighting characteristic.

- **L_{AFast}**

This is the noise level in decibels, obtained using the A-frequency weighting and the F (fast) time weighting. This is used when assessing the presence of modulation.

- **L_{APeak}**

This is the greatest absolute instantaneous sound pressure level in decibels using the A-frequency weighting.

- **L_{Amax}**

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

- **L_{A1}**

The L_{A1} level is the A-weighted noise level exceeded for 1 percent of the measurement period and is considered to represent the average of the maximum noise levels measured.

- **L_{A10}**

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

- **L_{A90}**

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

- **L_{Aeq}**

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

- **One-Third-Octave Band**

Means a band of frequencies spanning one-third of an octave and having a centre frequency between 25 Hz and 20000 Hz inclusive.

- **Representative Assessment Period**

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

- **L_{Amax} assigned level**

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

- **L_{A1} assigned level**

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

- **L_{A10} assigned level**

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

- **Tonal Noise**

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

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

(a) the A-weighted sound pressure level in any one-third octave band; and

(b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

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

This is relatively common in most noise sources.

- **Modulating Noise**

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

– a variation in the emission of noise that —

(a) is more than 3 dB $L_{A\ Fast}$ or is more than 3 dB $L_{A\ Fast}$ in any one-third octave band; and

(b) is present for at least 10% of the representative assessment period; and

(c) is regular, cyclic and audible.

- **Impulsive Noise**

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

– a variation in the emission of a noise where the difference between L_{Apeak} and L_{Amax} is more than 15 dB when determined for a single representative event.

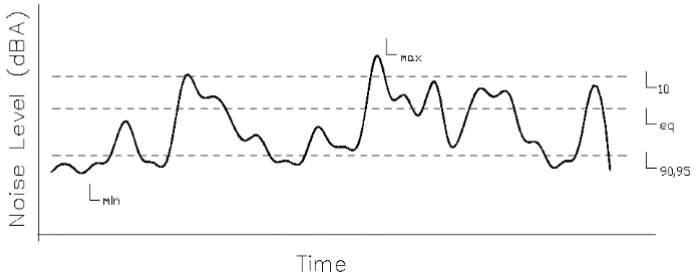
- **Major Road**

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

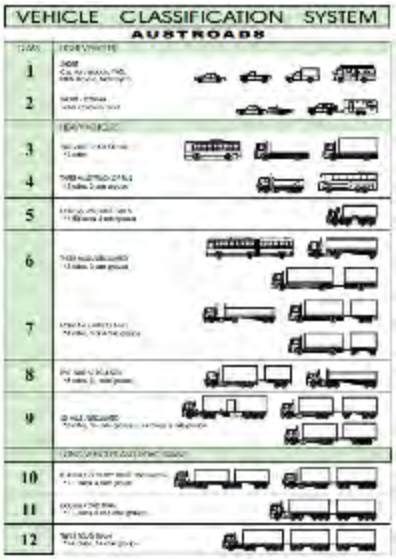
- **Secondary / Minor Road**

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

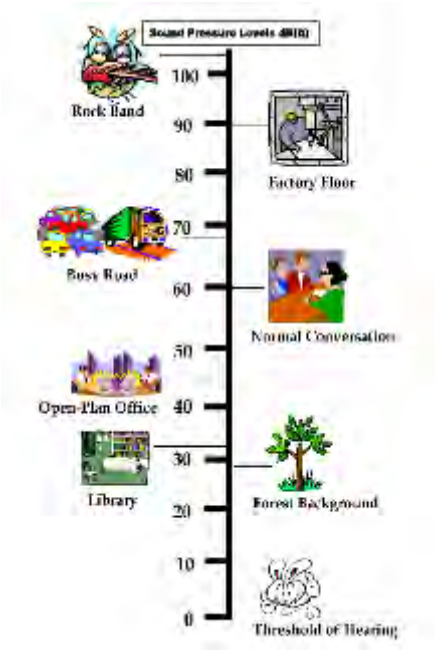
- **Chart of Noise Level Descriptors**



- **Austroads Vehicle Class**



- **Typical Noise Levels**



APPENDIX C - COMPLAINTS REGISTER

Complaints Register

Ref. No.	Date	Name & Address of Complainant	Time/Date of Complaint	Detail of Complaint	Summary of Actions Taken	Shire Notified	Person Responsible