

9. NOISE EMISSIONS

9.1 ASSESSMENT CRITERIA

9.1.1 EPA objective

The EPA management objectives for noise are:

- *All potentially significant noise impacts are identified and addressed in the environmental review information submitted by the proponent in a consistent manner which is acceptable to the EPA*
- *The proposal can be managed to ensure that compliance with the Environmental Protection (Noise) Regulations 1997 and/or with relevant acceptable standards is substantially achieved*
- *The proposal will be designed and managed in accordance with the “continuous improvement” and “as low as reasonably practicable” principles as outlined in the Act.*

9.1.2 Relevant legislation

Environmental Protection Act 1986

The *Environmental Protection Act 1986* (EP Act) provides the legislative framework for managing noise impacts. In particular, section 49 of the EP Act makes it an offence to emit noise that unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person, while section 51 requires occupiers of premises to, amongst other things, comply with the prescribed levels for noise.

Environmental Protection (Noise) Regulations 1999

The *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) prescribes noise levels that may be reasonably emitted (Table 9-1). Regulation 7 requires that noise emitted from any premises must comply with prescribed noise levels when received at any other premises and be free of the intrusive characteristics of tonality, modulation and impulsiveness. In addition, the noise emissions must not “significantly contribute” to an exceedance of the prescribed levels, where other sources of noise emissions are evident.

The prescribed levels differ according to the type of premises receiving the noise. For noise-sensitive premises, the prescribed levels recognise the time of day and the presence of commercial and industrial land use zonings and major roads within a 450 m radius of the receiver.

Construction noise

Under regulation 13 of the Noise Regulations, construction noise is not required to meet the prescribed levels if certain conditions are met, including restricting “noisy” activities to the periods 7:00 am to 7:00 pm on Mondays – Saturdays, and excluding public holidays. The Noise Regulations define construction sites as “premises or public places on which the sole or principal activity is the carrying out of construction work”. The EPA’s interpretation of the definition of “construction noise” in relation to mining operations, is the removal of topsoil to a maximum depth of 5 metres, and its storage, will be regarded as construction work, unless the topsoil is to be disposed of as a product

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(EPA 2007a). The DEC advises that the establishment of noise bunds is classed typically as construction (EPA 2009).

Table 9-1 Prescribed noise limits (from Environmental Protection (Noise) Regulations 1997)

Type of premises receiving noise	Time of day	Assigned level (dB)		
		LA 10	LA 1	LA max
Noise sensitive premises at locations within 15 m of a building directly associated with a noise sensitive use	0700 to 1900 hours Monday to Saturday	45 + influencing factor	55 + influencing factor	65 + influencing factor
	0900 to 1900 hours Sunday and public holidays	40 + influencing factor	50 + influencing factor	65 + influencing factor
	1900 to 2200 hours all days	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	35 + influencing factor	45 + influencing factor	55 + influencing factor
Noise sensitive premises at locations further than 15 m from a building directly associated with a noise sensitive use	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises	All hours	65	80	90

Table 9-2 Prescribed penalties for noise characteristics (from Environmental Protection (Noise) Regulations 1997)

Adjustment where noise emission is not music. These adjustments are cumulative to a maximum of 15 dB.			Adjustment where noise emission is music	
Where tonality is present	Where modulation is present	Where impulsiveness is present	Where impulsiveness is not present	Where impulsiveness is present
+5 dB	+5 dB	+10 dB	+10 dB	+15 dB

9.1.3 EPA Policies and guidance

Guidance No. 8 (Draft) Environmental Noise

The draft guidance deals with the assessment of environmental noise emissions, where those emissions come under the Noise Regulations, or other relevant acceptable standards. The guidance provides EPA policy covering a range of types of proposals that may emit noise, and guidance on the assessment of noise and presentation of information to the EPA.

Report 1308 Tutunup South Mineral Sands Project

Report 1308 (EPA 2009) provides the EPA’s advice to the Minister for the Environment on the proposal to develop and operate a mineral sands mine at Tutunup South (approx. 15 km southeast of Busselton) by Iluka Resources Limited (Iluka). This advice included potential noise impacts and their

management by Iluka. Although the proposal could exceed assigned levels by a predicted maximum of 10.6 dB(A) during the day and 9.4 dB(A) at night, the EPA recognised the worst case conditions used in the predictions and, as part of its conditional recommendation that the proposal could be implemented, included a number of stringent management conditions relating to noise.

9.1.4 Environmental Scoping Document

The Environmental Scoping Document (ESD, Strategen 2007) sets out the commitments for further studies made by the Proponent after the EPA decided to formally assess the Happy Valley Proposal. In regards to noise, the following commitments were made:

- research best practice in noise control and applicable standards
- identify noise risk in comparison to Gwindinup operations
- document previous performance in relation to noise impacts management by the Proponent (monitoring data, complaints, consultation)
- model noise emissions at sensitive premises, if considered within reasonable risk area, to demonstrate compliance with the *Environmental Protection (Noise) Regulations 1997*
- describe a Noise Management Plan.

9.1.5 Definitions and concepts

Site development

Site development is preparatory work required to expose the orebody prior to mining in any particular area. This includes clearing of vegetation, topsoil and subsoil removal and stockpiling, overburden removal and stockpiling, and construction of acoustic barriers. Work occurs in stages over different areas of the site, generally occurs in campaigns over the summer period, and is managed as a construction activity with restricted hours (7am to 5:30pm, Monday to Saturday, not on public holidays). Subsequent development phases may occur in parallel to mining operations, but in other areas of the project site.

Mining

Mining includes feeding ore into the screen units with loaders, separation in the wet plant, deposition of sand tails and clay fines. These activities occur 24 hours per day, 7 days per week. Additional activities may be carried out during day time only, including preparing ore for the feed loaders using a dozer or excavator, laying and moving pipelines and maintenance on plant and equipment.

Rehabilitation

Rehabilitation includes earthworks to return fines, tails, overburden and topsoil to the mined areas in preparation for seeding and planting. These earthworks are also managed as construction activities with restricted operating hours, on a campaign basis. Rehabilitation is progressive and will commence while mining is still in progress in other areas.

9.2 DESCRIPTION OF FACTOR

9.2.1 Identification of neighbouring residences

A review of residences in proximity to the Happy Valley Proposal identified six residences within 2 km of the site (Figure 9-1). Two of these residences are located on property owned by Bemax Resources, and hence occupancy can be controlled by the Proponent. There are four private residences in close proximity to the Happy Valley North site that may be impacted by mining operations. It is these residences that were considered in the environmental noise assessment. The nearest of these residences is approximately 50 m from the boundary of the mining tenement, and 350 m from anticipated activity.

9.2.2 Ambient noise levels

Existing ambient noise levels were assessed near Residence 2, as per the requirements of EPA Guidance No. 8. Noise levels were logged continuously over a period of three weeks in January 2009, using sample periods of 15 minutes duration, and fast time weighting as per AS1055.1. Corresponding wind speed and direction data was obtained from a monitoring station on the boundary of the Gwindinup minesite, just over 1 km from Residence 2.

Background noise levels, calculated as the “L90” of the LA90 levels are shown in Table 9-3 for weekday, evening/Sunday and night periods. Higher background noise levels for the night period are a reflection of the higher wind speeds recorded during the evenings and early morning. Plots of this data are provided in Appendix N1.

Table 9-3 Background noise levels near Residence 2.

TIME PERIOD	“L ₉₀ ” of L _A F ₉₀ levels (dB)
0700-1900 Mon – Sat	29.7
1900-2200 Mon – Sat and 0900-2200 Sun and PH	31.2
2200-0700 Mon – Sat and 2200-0900 Sun and PH	34.6

9.2.3 Community Consultation

To date community consultation has occurred primarily via the Happy Valley Working Party which has met four times since September 2007 to discuss the outcomes of studies conducted as part of the EIA process. Noise was identified by members of the Party as a key concern given the proximity of residences to the Happy Valley North sites and the Proponents’ performance at its current Gwindinup North operation. Key issues related to construction noise and night-time noise emissions and the impacts of these emissions on residents’ amenity.

9.3 ASSESSMENT OF POTENTIAL IMPACTS AND MANAGEMENT CONTROLS

9.3.1 Sources of potential impact

The Proposal will normally operate on a 24 hr, 7 day a week basis, resulting in noise emissions that will have the potential to impact on nearby residences. Specific noise emissions will include:

- **mobile earthmoving equipment operation;** including scrapers, haul trucks, dozers, loaders etc
- **fixed plant and equipment operation;** including the wet separation plant, screening units and pumps
- **vehicle operation;** including HMC haulage trucks and light vehicles.

9.3.2 Results of noise modelling

The potential for the Happy Valley Proposal to create noise emissions that could result in the prescribed levels being breached at neighbouring premises under certain conditions and at varying times has been predicted by recognised specialists, as per EPA Guidance No. 8. Herring Storer Acoustics (HSA 2009) has prepared an acoustic model on behalf of the Proponent to predict noise emissions from the proposed Happy Valley North site. The Happy Valley South site was not considered as there are no sensitive residences within 2 km of the site.

Method

HSA used the computer program SoundPlan (version 6.5) to predict potential noise levels in the area surrounding the proposed Happy Valley North site. The program incorporates parameters such as source sound power levels, ground topography (Figure 9-2) and atmospheric conditions to determine propagation of noise from the site. The program uses recognised algorithms (CONCAWE) to calculate the sound levels at receiver locations.

Mining scenarios

HSA modelled noise emissions for five different mining scenarios, plus contingencies of reduced equipment numbers. Several iterations of each scenario were used to determine the preferred position of equipment and size of acoustic bunds. The basic scenarios are outlined in Table 9-6. The mobile equipment used in each scenario was selected based on existing mining operations at Gwindinup. Sound Power Levels (SPL) from each source were calculated based on actual field measurements from the same type of equipment. The current mine schedule for Happy Valley North is shown in Figure 9-3.

Weather conditions

The acoustic modelling has been based on ‘worst case’ wind conditions from source to receiver (All Winds calculation mode⁶⁰) with inputs to the CONCAWE model of:

- weekday – 4 m/s wind, Pasquill Stability Class D, 20 degree temperature

⁶⁰ In the ‘All Winds calculated’ mode, for each piece of equipment (noise source) the wind is assumed to be blowing from the source to the receiver, simultaneously and regardless of relative location to other sources.

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- night – 3 m/s wind, Pasquil Stability Class F, 15 degree temperature.

These wind conditions approximate the typical worst case weather conditions for enhancement of sound propagation (EPA 2007a).

It has been found that under strong wind conditions the generation of local noise from trees and the like will generally mask noise emissions from mobile equipment and will most likely not have a measurable tonal characteristic. Hence the lighter wind conditions are generally considered the most significant for assessment under the regulations. HSA (2009) report that wind conditions other than the worst case modelled scenarios will occur for a significant proportion of the time (~70%), with predicted noise levels some 3 – 6 dB(A) less than shown for the worst case conditions.

Other assumptions

The sound model included the following assumptions:

- positioning of wet plant – three sides fully clad in sheet metal similar to part of the Gwindinup wet plant. Wet plant oriented with open side facing south-east direction, away from residences
- night mining loaders – CAT 980H Loader fitted with European standard acoustic attenuation package, or equivalent loader with equal or lesser sound power emissions
- apart from scenario 1 (construction), the acoustic model incorporates a 6 m acoustic barrier constructed to the north of the Northern Pit
- the northern wall of the Northern Pit will be relatively vertical (rather than a gradual ramp) to reduce night time noise emissions to the north
- scenarios model loader locations up to 80 m from the north end of the pit ore face, representing the greatest distance normally expected before the trommel is moved to improve mining efficiency
- the Southern Pit is modelled with a 8 m acoustic barrier bund at the north end of the southern pits. Scenario 5 incorporates the operation of equipment to raise a 3 m acoustic barrier on the north/north-east edge of the southern waste stockpile (scenario 2 equipment is modelled operating behind this stockpile 3m acoustic barrier.

Outcome

Predicted noise emissions were assessed against the assigned levels of the *Environmental Protection (Noise) Regulations 1997* (see Table 9-2). The assessment conservatively applied tonal characteristics to the emissions (as received) and the influencing factor, determined as per the Regulations.

Tonality

HSA (2009) advised noise emissions from the Proposal may be tonal in characteristic, with a +5dB ‘penalty’ being applied to the emissions (as per Regulation 9) as a result. Most of the mobile earthmoving equipment modelled emits some tonal components when measured at the point of emission. However, tonality of noise as received at sensitive premises will be influenced by factors such as ambient noise and wind generated noise causing masking. Consequently, noise that is tonal at source may not be tonal when received some distance away.

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Bemax reviewed data from existing monitoring equipment at the boundary of the Gwindinup minesite. Night time mining operations have been occurring between 1,000 and 1,500 m from this location, with daytime construction activities as close as 400 m. Hence this data is more likely to represent “as received” noise than recordings made close to machinery. In addition to recording sound levels, this equipment records third octave band frequency distributions over 15 minute intervals, and makes audible recordings on a level trigger.

The data set was reviewed to select night time intervals where the L_{AS10} was between 34 and 37 dB for the 15 minute interval, and loader and/or trommel noise was audible in recordings. Assessments of tonality were made on the third octave $L_{Aeq\ 15\ min}$ levels. In most cases there were no tonal components present, or if present, the frequency did not match the emission spectrum of the mining equipment. Similar assessments were made during daytime recordings, with tonal frequencies matching machinery emissions present in some recordings, but not in others (Appendix N1). This finding is in common with the variety of experiences found at other mining operations (Table 9-4).

Due to worst case weather conditions used in the predictive modelling being based on only slight wind speeds, the assessment has been carried out with a presumption of tonality and is therefore considered conservative in this regard, as well.

Table 9-4 Case studies regarding tonal characteristics of noise emissions, WA.

Case	Activity	Position on tonality
Red Hill Quarry (Strategen 2008)	Blasting and heavy equipment for quarrying and screening of hard rock	Noise levels recorded at 6 monitoring locations surrounding the quarry showed no evidence of tonality. Tonality not considered in predictive modelling.
Wesfarmers Premier Coal Mine (EPA 2003c)	Mining of coal, including blasting, washing and screening	Noise emitted from the mine site, when received at premises referred to in column 1 of an item in the Table in Schedule 1, should be required to be free, for at least 90% of any period of 4 hours, from any tonality, impulsiveness and modulation (EPA condition).
Dardanup Mineral Sands Mine Extension, Doral (2008)	Dry mining of mineral sands, Burekup	Tonality found to be evident at some receiving locations (typically those closest to the mine) under some operating conditions. Tonality penalty incorporated into assessment of worst case conditions.
Tutunup South Mineral Sands project, Iluka (EPA 2009)	Dry mining of mineral sands, Tutunup	Tonality penalty incorporated into assessment of worst case conditions.

Influencing factor

At locations closer than 450 m from the proposed mining operation, the ‘industrial land use’, as characterised by the mining operation, results in an increase in the influencing factor and the prescribed level applicable under the Noise Regulations. The prescribed levels utilised in the assessment are provided in Table 9-5. Note the influencing factors presented are those calculated by Bemax based on GIS mapping, and differ from those in the HSA report, which were based on manual area estimations⁶¹.

⁶¹ Overall, the revised estimations (+ or – 1dB) are more conservative in effect than those used by HSA.

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Table 9-5 Residential Influencing Factors and Assigned Levels (values in brackets have no penalty for tonality)

RESIDENTIAL LOCATION	OWNERSHIP	INFLUENCING FACTOR	NIGHT-TIME LA10 ASSIGNED LEVEL (dB)	DAY-TIME LA10 ASSIGNED LEVEL (dB)
R1	Private	1	36 (31)	46 (41)
R2	Private	1	36 (31)	46 (41)
R5	Private	9	44 (39)	54 (49)
R6	Private	1	36 (31)	46 (41)
R7, R8	Owned by Bemax			

Predicted levels for each receiving premises

Predicted noise levels for each of the private residences are given in Table 9-6. Noise contours for each scenario (including contingency equipment reductions) are shown in Figure 9-5 to Figure 9-9.

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Table 9-6 Predicted worst case noise levels at private residences, including 5 dB(A) penalty for tonality.

SCENARIO	CONTINGENCY	R1	R2	R5	R6	Comment
Night Assigned Level, LA10 dB(A)		31	31	39	31	
Day Assigned Level, LA10 dB(A)		41	41	49	41	
1. CONSTRUCTION of northern acoustic barrier	100% equipment in operation	53	52	53	46	Three residences (R1, R2 and R5) could experience noise levels as high as 53 dB during the construction of the northern acoustic bund. Reducing equipment numbers reduced noise levels slightly, but would increase the duration to complete the bund.
	75% equipment in operation	52	52	52	45	
	50% equipment in operation	51	48	50	43	
2. DAYTIME mining in northern pit, overburden removal from southern pit to southern stockpile	100% equipment in operation	41	42	53	45	Predictions of noise emissions whilst mining is occurring in the northern pit, and overburden removal is occurring in the southern pit at surface indicate that exceedances of 1 to 4 dB(A) are possible when allowance is made for tonality. During construction of the northern barrier on the southern overburden stockpile levels at R6 are approximately 2dB higher because of direct line of sight to equipment on top of the barrier. Contingency reductions in equipment numbers are effective in reducing noise levels by 1 to 5 dB depending on the number of mobile equipment items shut down.
	75% equipment in operation	40	40	51	44	
	50% equipment in operation	39	38	48	41	
5. DAYTIME mining northern pit, overburden removal southern pit, raising acoustic barrier on southern stockpile (CONSTRUCTION)	100% equipment in operation	41	42	53	47	
	75% equipment in operation	39	39	51	46	
	50% equipment in operation	38	37	48	44	
3. NIGHTTIME mining in northern pit	100% equipment in operation	37	31	33	28	Results for mining in the northern pit predict exceedances of up to 6 dB (A) at R1. Limiting operations to one loader reduces the exceedance to 3 dB (A). Modelling indicates that under most prevailing wind conditions (easterly or south-westerly) that the noise level received at R1 for night mining in the north pit would comply with the assigned level.
	50% equipment in operation	34	29	32	26	
4. NIGHTTIME mining in southern pit	100% equipment in operation	34	32	39	34	Mining in the southern pit predicts potential exceedances of 1 to 3 dB at the four private residences. Limiting operations to one loader in the pit reduced the exceedances to 3 dB at R1 and 1 dB at R6, with levels at other residences being acceptable. An exceedance of 1-2 dB(A) 'worst case' wind conditions means that under most prevailing wind conditions the noise emissions would comply with the Regulation requirements. HSA also note that the noise emissions will not always be assessed as tonal, particularly where there are windy conditions or winds are from the east or north. Under these circumstances all predicted levels comply with assigned levels.
	50% equipment in operation	34	30	38	32	

Note: Pink background = predicted exceedances of 'assigned noise level' under 'worst case' wind conditions, yellow background = exceeded only if 'tonal characteristic' adjustment required. Bemax monitoring data from Gwindinup supports the conclusion that night-time noise is unlikely to be tonal.

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9.3.3 Management of key hazards

The Proponent is committed to complying with the prescribed levels of the Noise Regulations and keeping noise emissions as low as reasonably practical, as per the EPA management objectives for the factor. To achieve compliance with the Regulations at all times, including worst case conditions, the Proponent will proactively manage its operations to reduce the level of activity, as necessary. Management of activity levels will consider continuously the following risk elements:

- level and nature (i.e. tonality) of noise emissions from current and planned operations
- real-time and predicted weather conditions
- location of activities relative to sensitive premises.

Additionally, the Proponent has employed the predictive noise modelling conducted as part of the impact assessment to develop and test a number of noise attenuation measures, being based mainly on the location and size of noise bunds constructed of overburden material. These and other measures are described below.

Construction of northern acoustic bund

To help protect residence R1 from noise emissions emanating from operations within and around the Northern Pit, a 6 m high acoustic bund wall will be constructed at the northern end of the minesite (Figure 9-4). The bund wall will effectively sterilise a portion of the orebody and will also generate significant noise levels during the four week construction period (Scenario 1, Figure 9-5). The option of reducing the number of vehicles involved in the construction of the bund was assessed, but noise reduction was not significant enough to be deemed as beneficial, given the extended construction time that would result.

During this phase, the construction work will be conducted in accordance with prescribed noise control practices and will be limited to Monday to Saturday between 7 am and 7 pm and excluding public holidays.

Southern pit overburden removal and stockpiling

The noise model predicts that under worst case wind directions and including penalties for tonality, noise criteria are exceeded at three residences during construction of the southern overburden stockpile (Figure 9-4, Figure 9-6 and Figure 9-9). Reductions in numbers of operating equipment are predicted by the model to be effective in overcoming these conditions, and this measure will be implemented as necessary. Note the construction of the southern noise bund will be conducted during daylight hours only and will take approximately three weeks to complete.

Due to the characteristics of sound propagation, acoustic bunds are most effective when either the source or the receiver or both are in close proximity to the bund. As the distances increase the effectiveness of sound attenuation is reduced. This effect will be addressed during construction of overburden stockpiles by raising the outer edge of the stockpile (closest to residents) initially and having subsequent construction occur behind this raised edge. Additional height can then be added to the barrier as the internal stockpile is raised.

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Night-time mining operations – northern pit

Results of the modelling indicate that under a worst case climatic scenario, and including penalties for potential tonality, noise criteria are exceeded at one residence during night-time mining at the closest point in the northern pit, even if only one of two loaders are operating (Figure 9-7). Under such conditions, pit operations in that area will be halted or relocated until climatic conditions improve. Mining of the northern pit will progress in a northerly direction, which will retain a relatively vertical pit wall to the north of the mining operation, providing an additional barrier effect.

The northern acoustic bund provides a barrier across the northern end of this pit where it would otherwise be open towards R1. Raising this bund to 9.5 m was assessed during the modelling, but did not provide additional benefit, and would have extended the period of elevated construction noise. Accordingly, the height of the bund was capped at 6 m.

There may be opportunities to use two loaders when wind conditions are favourable (not SSE to SSW), however this should be subject to field verification before being adopted as an operational practice (HSA, 2009).

Night-time mining operations – southern pit

Results of the modelling indicate that under a worst case climatic scenario, and including penalties for potential tonality, noise criteria are exceeded at three residences during night time mining operations in the southern pit (Figure 9-8). Restricting operations to one loader in the pit is effective in overcoming the exceedance at one of these residences. For the remainder, ensuring that tonality is not a characteristic of the emissions, as received, effectively ensures compliance at all residences under worst case conditions. Should tonality be present, then the Proponent will temporarily halt or relocate operations until climatic conditions improve.

The northern end of the southern pit opens into a valley, which has the effect of directing noise towards the west, northwest and north. During development of the noise model an 8 m barrier was introduced across the northern end of the pit, effectively closing off this avenue of sound propagation. This barrier was effective in producing a 4 to 5 dB reduction in noise levels at surrounding residences. This barrier has been included in the mine plan (Figure 9-4), extending across the northern end of both south pits, and tapering back along the western side to meet the natural rise in ground level. Construction of this bund is expected to be completed over approximately three weeks.

Fixed plant and equipment

As noted by HSA, assumptions were made during the modelling about the orientation of the wet plant. In the night-time scenarios the wet plant is a significant source of noise and as such the orientation of the wet plant will direct the open side towards the south east, away from residences.

9.3.4 Cumulative impacts

Mining of the Happy Valley deposits will occur sequentially following the completion of mining at the nearby Gwindinup minesite. However, initial construction at Happy Valley is planned to occur during the final stage of mining at Gwindinup to allow continuity of mineral production. Similarly, the final stages of rehabilitation at Gwindinup will occur after commencement of mining at Happy Valley.

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Additional scenarios were modelled to predict the cumulative noise associated with these potentially overlapping activities, with the following results:

- noise levels at residences during the construction of the northern noise barrier (Scenario 1) show no difference when emissions from Gwindinup mining operations are included in the model
- the Gwindinup rehabilitation activities add an additional 0 – 3 dB(A) to the noise levels for residences between the two sites for Scenario 2.

As part of its management of noise emissions, the Proponent will not conduct activities at both sites at the same time outside the hours of 7 am to 7 pm, Monday to Saturday and excluding public holidays.

9.4 NOISE MANAGEMENT COMMITMENTS IN DETAIL

9.4.1 Noise Management Plan

The Proponent recognises that noise emissions from the proposed Happy Valley North operations will have a high risk of failing the management objectives of the EPA and may also result in non-compliances with the Noise Regulations, unless noise generating activities and emissions are managed adequately and proactively. Accordingly, the Proponent has developed a draft Noise Management Plan (NMP) for the Proposal that describes the measures that will be taken to ensure compliance is met and noise performance is continually improved. The outline of the NMP is summarised below. This NMP serves as both a construction and operations management plan.

Purpose

The specific management objectives for noise emissions from the Proposal are:

- to ensure that operations do not adversely affect environmental values or the health, welfare or amenity of people and land uses by meeting statutory requirements and acceptable standards
- to minimise emissions to levels as low as practicable on an on-going basis (i.e. continuous improvement)
- to respond effectively to complaints
- to minimise off-site impacts on fauna.

Scope and Contents

The draft NMP will address the following aspects:

- identification and characterisation of noise sources, consistent with the original model
- scheduling of activities deemed to be ‘construction’, as per the Noise Regulations
- monitoring of atmospheric conditions and weather forecasts and development of triggers for the implementation of additional control measures
- transportation of HMC, including truck speeds, maximum number of journeys and the time of day for truck movements that will best meet the draft EPA guidelines
- description of management actions that will be implemented by Bemax including:

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- construction of bund walls and other noise barriers/screens and procedures to minimise noise impacts during construction
- consultative processes to alert potentially affected residences of expected higher noise levels during construction
- strategic placement/orientation of plant
- installation of noise reduction measures on mobile equipment
- regular noise monitoring, including continuous real time data available to operators
- sound power checks on key plant and equipment, based on AS/NZS 2012.1:1990
- work procedures to minimise noise generation i.e. operating times, speeds etc.
- complaint response procedures
- workforce training
- a monitoring, reporting and review program, based on performance indicators and also on continuous improvement principles embodied within the Bemax Environmental Policy.

The draft NMP will be amended following the ERMP process and resubmitted to the EPA for approval.

9.4.2 Amenity agreements

The DEC⁶² regards amenity agreements with affected residences as an acceptable approach in the situation where noise regulations cannot practicably be complied with. Bemax is actively seeking to establish such agreements with potentially affected residences surrounding the Happy Valley project. Note that, until such time that agreements are established, Bemax will conduct its proposed operations in accordance with the Noise Regulations, even if this requires shut-down of some equipment during critical atmospheric conditions.

9.5 OTHER MATTERS RELEVANT TO THE ASSESSMENT

9.5.1 Prior performance of the Proponent

As at the 30th June 2008 the proponent had twenty noise complaints recorded at their previous mine sites. These complaints were recorded over a period of approximately ten years across four separate mine sites. The Gwindinup operations will be discussed subsequently in further detail.

The greatest number of complaints was recorded at the proponents Yarloop site, with a total eleven complaints received over the 5.5 years of operation. The first two years averaged 3 complaints per year, by the final two years of operation this had been reduced to 1 complaint per year. Complaints related primarily to rocks in tromeles, heavy earthmoving equipment and unusual activities such as sand blasting taking place on site.

⁶² Advice received from DEC during review of preliminary draft ERMP

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Sandalwood had only one complaint over its five year mine life which related to night-time loader noise. The Tutunup and Ludlow mining operations received four complaints each over their four and three year life respectively. Complaints at Tutunup related to general machinery noise, haulage noise, tonal components and loader noise after hours and pump or motor noise. No two complaints were related to the same issue. The Ludlow complaints were typically in association with daytime activities such as clearing and soil profile reconstruction which required the use of heavy earthmoving equipment for a limited duration.

In the majority of these incidents the source of the noise was identified and the machinery shut down or the activity modified to mitigate the impacts immediately. Long term actions were also identified through strategies such as equipment modification, installation of buffering mechanisms or rescheduling of activities in order to minimise the potential for reoccurrence of these impacts.

Noise Risk in Comparison to Gwindinup minesite

As at 30th June 2008 the proponent has had seventy one complaints recorded at their current Gwindinup mine site since commencement of site development in June 2007. Over 98% of these complaints come from the same resident. Approximately half of the complaints received related to day time operations, and the other half to night – time operations, which commenced in late March 2008. Night-time complaints typically related to loader noise from the pit. Day-time noise related either specifically to heavy earthmoving equipment such as scrapers and dozers or to general noise conditions. Noise monitoring results to date indicate that typically operations are within the criteria of the Noise Regulations. However whilst the regulations are being met noise emissions from the Gwindinup mine site remain a key factor in the environmental management of the site, and a key concern for at least some of the neighbouring residents. In order to better manage the noise emissions from the site the proponent has initiated a number of strategies including:

- installation of a real time noise monitor at Gwindinup which feeds data back to the site to ensure site supervisors are aware of noise levels at all times
- use of noise bunds at the end of the mining pit and around overburden construction
- orientation of trommels to minimise noise emissions towards sensitive premises
- installation of more acoustic baffles on loaders
- ensuring that mining loaders do not leave the mine pit afterhours (except in an emergency)
- strict time restrictions for operation of heavy earthmoving equipment (in particular, later starting times in the mornings in potentially sensitive areas)
- dividing the earthmoving fleet into different operating areas wherever possible
- restricting HMC haulage times to 7am-7pm Monday to Saturday.

9.6 PREDICTED ENVIRONMENTAL OUTCOME

The modelling and assessment of the potential noise emissions from the proposed minesite, conducted by a recognised specialist, has identified all potentially significant noise impacts, as per the first EPA objective for noise. Analysis of the results of the noise modelling indicates that the proposal will comply with noise criteria under most operating conditions. Under worst case conditions and assuming that tonality is present, noise criteria are exceeded at some locations for some scenarios by as much as 6 dB(A). Modelling shows that Noise Regulations can be satisfied during these conditions by reducing equipment levels.

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A draft Noise Management Plan has been prepared that includes contingency measures that can be implemented to further reduce noise emissions under the scenarios identified as being at risk. Such measures include the reduction in the number of heavy earthmoving equipment operating during such periods. Given the conservative nature of the modelling, the very limited time that such conditions are likely to be in evidence and the availability of effective controls, the Proponent believes that compliance with the Noise Regulations will be achievable, as per the EPA's second objective for noise.

The noise assessment considered a number of scenarios, including the construction of noise bunds, to ensure the final proposal was the quietest reasonably achievable. Recommendations arising from the assessment and other noise management controls consistent with industry best practice have been incorporated into the draft Noise Management Plan, which also includes monitoring and review measures to assist in continual improvement of noise performance. These measures are considered to satisfy the third EPA objective for noise.

9.6.1 Residual risk

While the Proponent believes it can operate the Happy Valley Proposal in accordance with the Noise Regulations and satisfy the management objectives of the EPA, it recognises that noise emissions and their management will constrain the activities of the Proponent and potentially those of surrounding residences. Accordingly, the Proponent will continue to pursue civil agreements with the neighbouring residences, in regards to noise.

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Table 9-7 EIA Summary table – Noise emissions

Environmental Objective	Potential Impact	Management Commitment
<p>The proposal can be managed to ensure that compliance with the <i>Environmental Protection (Noise) Regulations 1997</i> and/or with relevant acceptable standards is substantially achieved</p>	<p>It has been predicted that the Proposal has the potential to breach the Noise Regulations at neighbouring premises, under worst case conditions (Happy Valley North only).</p>	<p>A draft Noise Management Plan has been prepared to address this objective, with specific management commitments as follows.</p> <p>Acoustic bund walls will be constructed at the north ends of the northern pit (6 m) and the southern pit (8 m), for the purposes of attenuating noise emissions, as per the noise model. Outer wall of southern overburden stockpile will be raised to form an acoustic barrier for shielding later work behind barrier.</p> <p>Construction activities, including acoustic bunds, limited to 7am – 7pm Monday to Saturday, not including public holidays.</p> <p>Mine layout will be such to minimise emissions from static sources:</p> <ul style="list-style-type: none"> - orientation of wet plant will be such that unclad side is directed away from sensitive premises - placement of trommels and feed hopper units will occur in such a way as to minimise noise impacts on surrounding neighbours - ramp gradients for access to hopper units to be kept to a practical minimum - placement of stockpiles will, wherever possible consider potential mitigating effects on noise emissions. <p>Mine scheduling will consider noise emissions and climatic factors:</p> <ul style="list-style-type: none"> - after hours operations (7pm – 7am) in areas that affect residents, mobile mining equipment will be limited to front-end loaders working in the mine pit - these limitations will remain in effect until 9am on Sunday and Public Holidays (except in emergencies) - real-time monitor(s) will be established in appropriate locations (based on risk) and triggers will be developed for noise levels (based on modelling results) - equipment levels will be reduced further under worst case conditions, as per the noise model and monitoring results. <p>'Noise Agreements' will be sought with surrounding residences.</p>
<p>The proposal will be designed and managed in accordance with the "continuous improvement" and "as low as reasonably practicable" principles as outlined in the Act</p>	<p>Noise emissions from heavy haulage vehicles have the potential to be a significant noise source for residences located near haulage routes.</p>	<p>Haulage operations will be managed under the Noise Management Plan, with the following constraints:</p> <ul style="list-style-type: none"> - haulage times will be restricted to 7am – 7pm Monday to Saturday and 9am and 7pm on Sunday and public holidays - transport contractors will comply with Australian Design Standards for noise suppression - speed limits on internal roads is limited to 30km/h for HMC haulage - all contract drivers will undergo environmental and safety training - internal roads will be maintained to a satisfactory standard.

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Happy Valley Titanium Minerals Project

Environmental Objective	Potential Impact	Management Commitment
	Noise emissions may occasionally vary from those sources and characteristics used in the noise model.	The draft Noise Management Plan has been prepared to address: <ul style="list-style-type: none"> - staff responsibilities and training - monitoring of activity levels, weather conditions and noise levels (at boundary or at receiving premises) - neighbour consultation commitments and complaint response procedures - noise performance of existing and new equipment, including audible safety devices - auditing, review and reporting of performance.

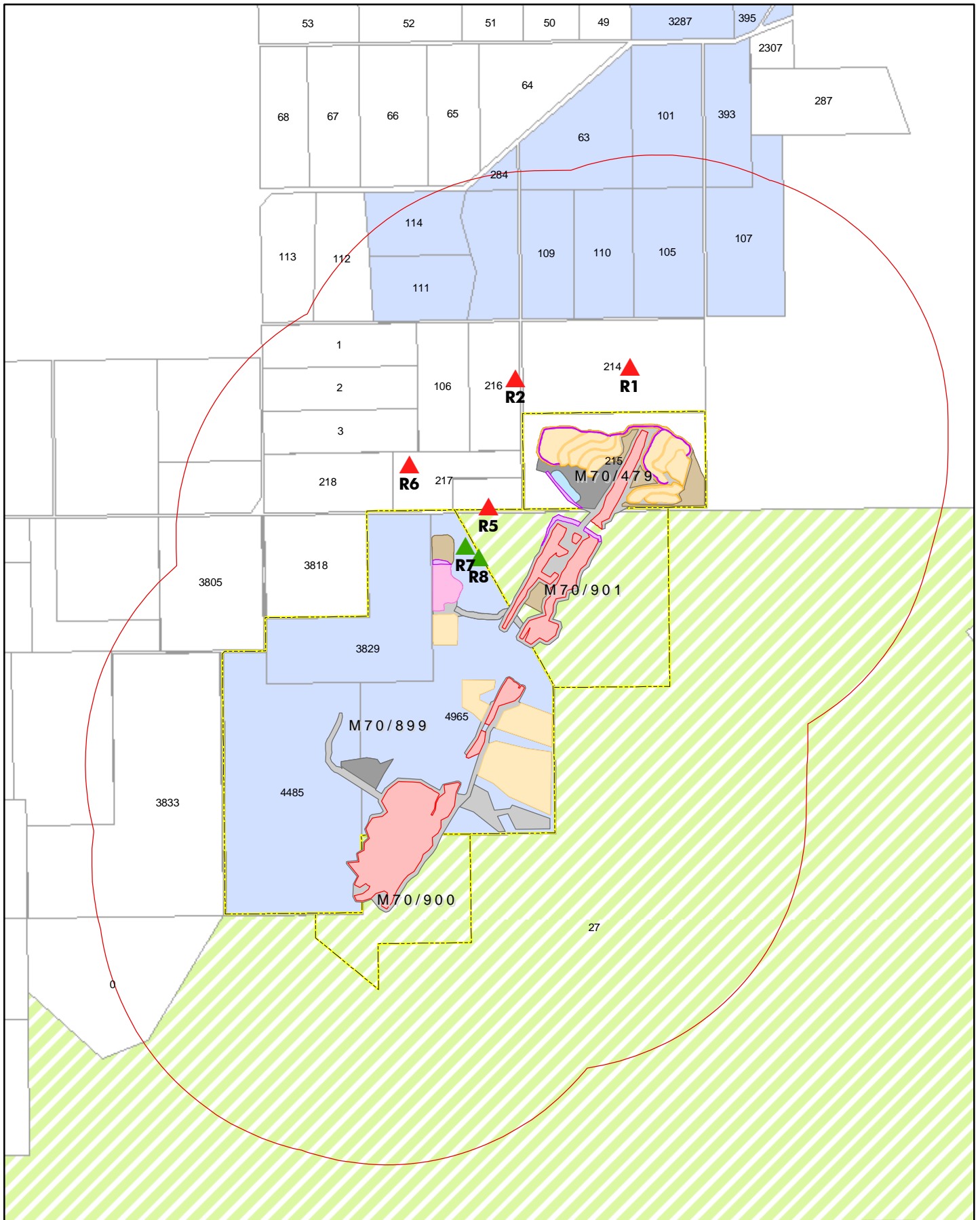
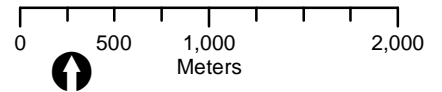


Figure 9-1:
Location of sensitive premises relative to the project.



Legend

- | | | | | |
|------------------|---------------------|--------------|------------|------------|
| Bemax owned | 2km buffer | Disturbance | Noise Bund | Plant Site |
| Private | Tenement Boundaries | Fines | OB | TS |
| Bemax Properties | | Fines (Wall) | Pit | Water Dam |
| State Forest | | | | |

Datum: GDA 1994 MGA Zone 50
 Drawn: DH
 Date: 9/4/09



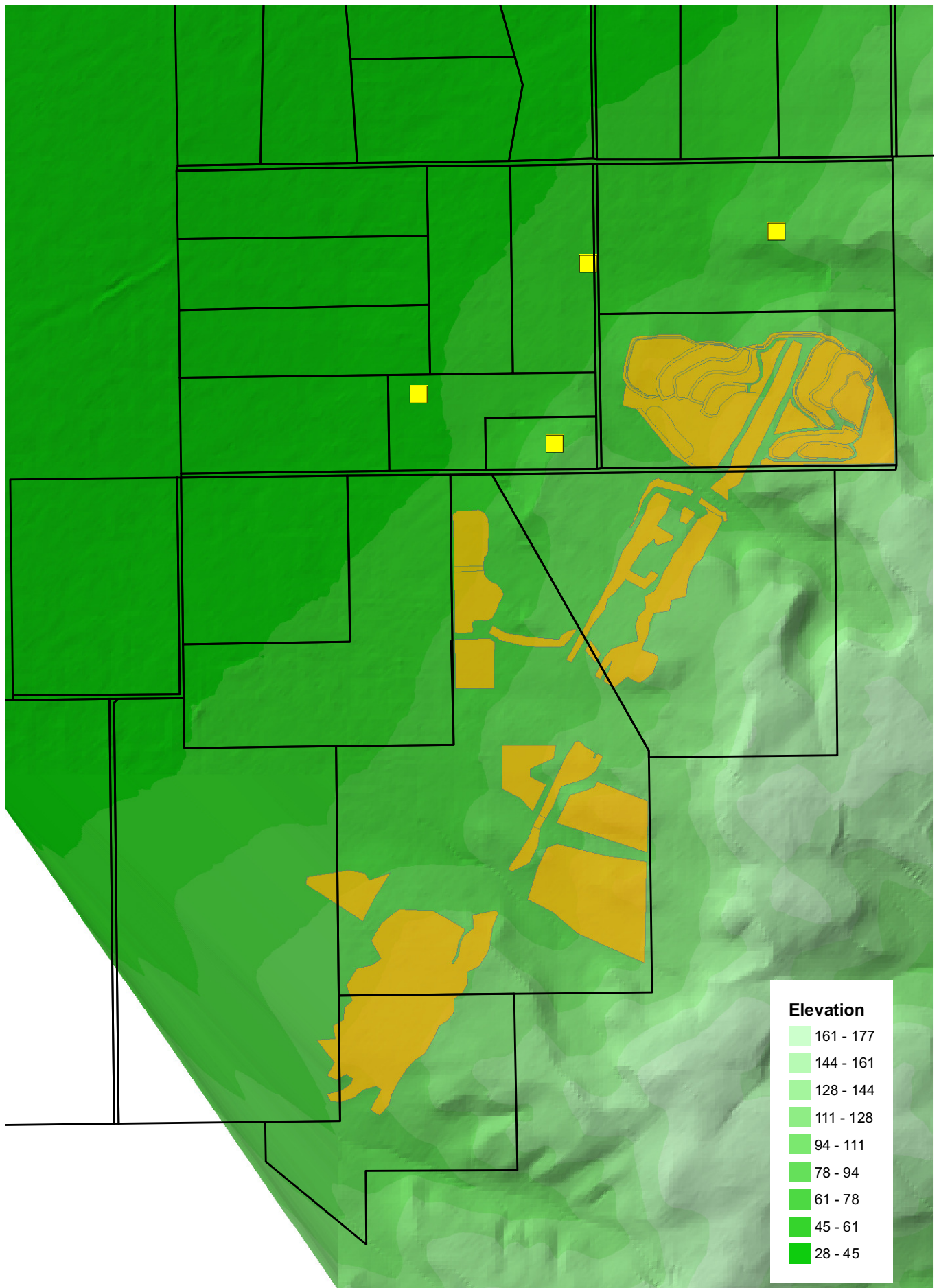




Figure 9-2 Topography of Happy Valley area

 Noise Receptors
 Happy Valley Proposal

0 0.5 1 2

 Kilometers


 1:25,000 at A4



	2010				2011				2012				2013			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Clearing	Complete minesite															
Topsoil stripping		Northern infrastructure area				Southern stockpile area	North pit, west pit, part east pit				Remainder east pit					
Construction				Northern noise bund, northern fines dams, wash water dam, plant site, roads				South noise bund, south fines dams								
Overburden removal							North pit	West pit, north end east pit				Remainder east pit				
Mining								North pit				North end east pit	Remainder east pit			
									West pit			South end east pit				



Happy Valley Environmental Review
 PROPOSED OPERATIONS SCHEDULE FOR HAPPY VALLEY NORTH

FIGURE 9-3

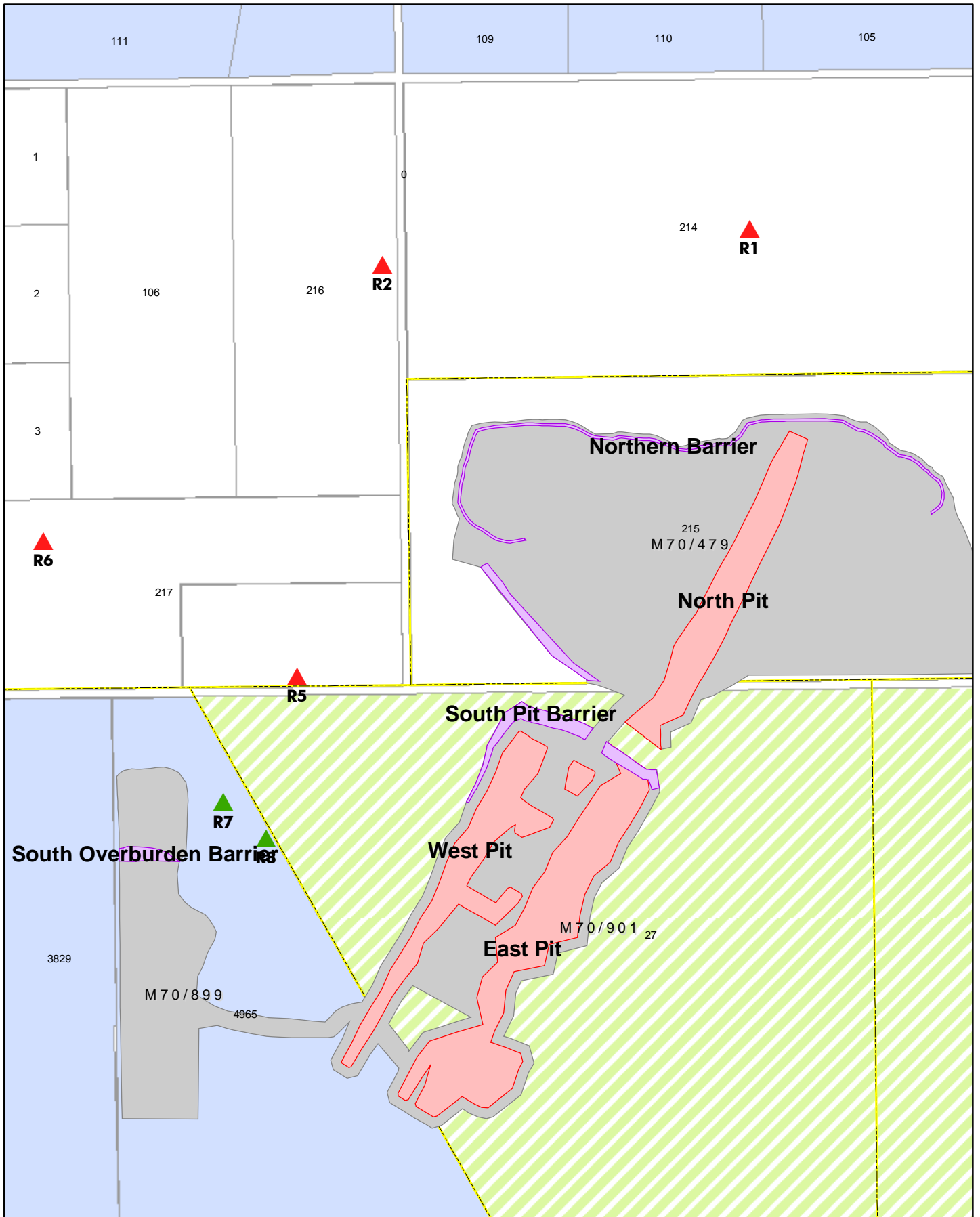
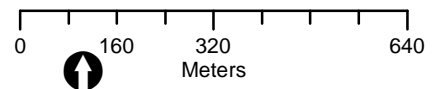


Figure 9-4:
Location of acoustic barriers - Happy Valley North.



Datum: GDA 1994 MGA Zone 50
 Drawn: BJ
 Date: 07/04/09

Legend

- ▲ Bemax owned
- ▲ Private
- Bemax Properties
- State Forest
- Disturbance
- Noise bund
- Tenement Boundaries
- Pit

