Appendix X: Herring Storer Acoustic BSIA Environmental Noise Assessment

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LANDCORP

BOODARIE INDUSTRIAL ESTATE
SOUTH HEDLAND

ENVIRONMENTAL NOISE ASSESSMENT

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BOODARIE INDUSTRIAL ESTATE

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APPENDICIES

1. INTRODUCTION

LandCorp commissioned Herring Storer Acoustics to develop an acoustic model to predict noise emissions from the proposed Boodarie Industrial Estate. The Boodarie Industrial Park Estate is located approximately 5 km west of South Hedland. An indicative plan of the Estate is attached in Appendix A.

The objective of this study was to predict noise emissions from typical industries and determine the maximum noise level applicable to each "area" of the Estate that will comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* at the boundary of the proposed buffer.

The representative industry's sound power emissions are based on typical industry spectrum and are considered to be a conservative indication of the expected noise emissions. Generally, new industrial plants are designed to control noise emissions and minimise internal noise levels for occupational health reasons.

2. ACOUSTIC CRITERIA

The criteria used are in accordance with the *Environmental Protection (Noise) Regulations 1997 (as amended)*. These regulations stipulate maximum allowable external noise levels determined by the calculation of an influencing factor, which is then added to the base levels shown below. The influencing factor is calculated for the usage of land within the two circles, having a radii of 100m and 450m from the premises of concern. The baseline assigned noise levels for the different types of receivers and during the different periods of the day are listed in Table 2.1.

TABLE 2.1 - BASELINE ASSIGNED OUTDOOR NOISE LEVEL

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L_{A10}	L_{A1}	L_{Amax}
Within 15m of a noise sensitive premises building	0700 - 1900 hours Monday to Saturday	45	55	65
	0900 - 1900 hours Sunday and Public Holidays	40	50	65
	1900 - 2200 hours all days	40	50	55
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	35	45	55
Further than 15m from a noise sensitive premises building	All hours	60	75	80
Commercial premises	All hours	60	75	80
Industrial and utility premises	All hours	65	80	90

Note: The L_{A10} noise level is the noise that is exceeded for 10% of the time.
The L_{A1} noise level is the noise that is exceeded for 1% of the time.
The L_{Amax} noise level is the maximum noise level recorded.

For locations outside the industrial estate, the influencing factor at existing and possible future residence has been taken to be 0. Therefore, the assigned noise levels would be as listed in Table 2.1.

Under the Regulations it is also a requirement that noise from the site be free of annoying characteristics (tonality, modulation and impulsiveness) at other premises, defined below as per Regulation 9.

"impulsiveness" means a variation in the emission of a noise where the difference between L_{Apeak} and $L_{Amax\ Slow}$ is more than 15dB when determined for a single representative event;

"modulation" means a variation in the emission of noise that –
(a) is more than 3dB $L_{A\ Fast}$ or is more than 3dB $L_{A\ Fast}$ in any one-third octave band;
(b) is present for more at least 10% of the representative assessment period; and
(c) is regular, cyclic and audible;

"tonality" means 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.

Where the above characteristics are present and cannot be practicably removed, the adjustments as listed in Table 2.3 are made to the measured or predicted level at other premises.

TABLE 2.3 - ADJUSTMENTS TO MEASURED LEVELS

Where **tonality** is present	Where **modulation** is present	Where **impulsiveness** is present
+5 dB(A)	+5 dB(A)	+10 dB(A)

Note: These adjustments are cumulative to a maximum of 15 dB

With respect to residential receivers, the noise emissions may be tonal in characteristic, particularly under conditions where received noise levels are predicted to be above 35 dB(A). Under strong wind conditions, the generation of local noise from trees and the like will generally mask plant noise emissions and will most likely not have a measurable 'tonal' characteristic.

For the case of an industrial estate such as Boodarie, it is expected that more than one individual industry will contribute to noise levels at noise sensitive premises surrounding the estate. Should the cumulative noise emission approach the 'assigned level' under the regulations, then the requirements of regulation 7 (2) apply. This sub-regulation is:

> *7. (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 as determined under subregulation (3) exceeds a value which is 5 dB below the assigned level at the point of reception.*

Thus, under the requirements of the *Environmental Protection (Noise) Regulations 1997* there are two criteria that can be used to achieve compliance with the Regulations. The first is the overall noise level received from all industries. In this case, if the overall noise level received at premises complies with the applicable assigned noise level, then noise

emissions from all industries would be deemed to comply with the requirements of the Regulations. However, if the overall noise level received at premises exceeds the applicable noise level, compliance will still be achieved if the noise received at a premises from an individual industry is at least 5 dB(A) below the applicable assigned noise level.

As it is likely that industries located within Boodarie Industrial Estate would operate for 24 hours per day each, the applicable criteria for compliance would be the assigned L_{A10} noise level for the night period, or 35 dB(A).

Note: The night period is between 2200 and 0700 hours Monday to Saturday (excluding Public Holidays) and 2200 and 0900 hours on Sundays and Public holidays.

Additional to noise received at a residence, noise emissions from each industry would need to comply with the assigned noise level at the boundary of the neighbouring industrial premises. Given the likely size of each industrial lot and consequently the distance to neighbouring industries, the "significantly contributing" component of the Regulations would not be applicable. Therefore, compliance would be achieved by the noise from each individual industry when received at the boundary of the neighbouring industry complying with the assigned L_{A10} noise level at all times of 65 dB(A). Noise received at the boundary of an industrial premises is likely to be tonal and the +5 dB(A) penalty for a tonal component would be applicable. Hence, to comply with the *Environmental Protection (Noise) Regulations 1997*, noise received at the boundary of a neighbouring industrial premises should not exceed 60 dB(A).

3. METHODOLOGY

Predictions of noise level propagation to surrounding areas were achieved utilising the computer program SoundPlan version 7.1. This program incorporates various parameters including source sound power levels, ground topography and atmospheric conditions in determining propagation of noise from the site. Using recognised algorithms (Concawe) the program calculates the sound levels at distances from the source resulting in noise levels at receiver locations.

Weather conditions for the modelling were generally in accordance with the Environmental Protection Authority's *"Draft Guidance for Assessment of Environmental Factors No.8 - Environmental Noise"* for the night period and as listed in Table 3.1.

TABLE 3.1 - WEATHER CONDITIONS

Condition	Night Period
Temperature	15 ^{o}C
Relative humidity	50%
Pasquil Stability Class	F
Wind speed	3 m/s

For the noise modelling, as used for the assessment of similar industrial estates, noise emissions from each industry was determined using two sources, the first noise source being representative of the plant, with the second source relating to noise emissions from a stack. For information, the plant noise sources were located at 5 metres above ground level, with the height of the stacks being:

Large Plant - 100 metres above ground;
Medium Plant - 60 metres above ground; and
Small Plant - 25 metres above ground.

Figure B1 shows the location of industries and related sound power noise levels used in the acoustic model.

We understand that the above industry mix is conservative in the context that it represents as noisy an assembly of industries as might eventuate in the fully developed Estate. We also note that the existing and proposed power stations located within the estate have been included in the noise model.

4. PREDICTED NOISE EMISSIONS

Noise emissions have been calculated for the proposed Boodarie Industrial Estate under night-time conditions of 3 m/s wind speed and Pasquil Stability class F as per the Department of Environment 'Draft 8' guidelines.

As there are two criteria that can be used to determine compliance, noise modelling was undertaken for the following two scenarios:

1. Overall total noise contours for all industries.
2. Combined maximum noise contours from individual industries.

The overall total noise contours for all industries (Scenario 1) is shown on Figure C1 in Appendix C. While the predicted maximum combined noise contour for the individual industries is shown on Figure C2 in Appendix C.

5. ASSESSMENT OF PREDICTED NOISE LEVELS

5.1 RESIDENTIAL PREMISES OR BOUNDARY BUFFER

The first criteria to be assessed under the Regulations is whether the overall total noise level from all industries complies with the L_{A10} night-time noise level of 35 dB(A). Figure C1 shows the proposed boundary of the buffer, indicating an exceedance of this criterion. Therefore, for this estate to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* noise emissions from each individual industry must NOT be "significantly contributing" to the noise received at the boundary of the buffer.

The maximum combined noise contour attached as Figure C2 indicates that, with the estate filled with industries as per Figure B1, noise emissions from the individual industries within the Estate, when received at the boundary of the proposed buffer, will comply with the "significantly contributing" requirement to not exceed 30 dB(A). Thus compliance with the requirements of the *Environmental Protection (Noise) Regulations 1997* would be achieved.

It should be noted that it is understood the noise emissions from the existing power station would be considered as NOT "significantly contributing". Therefore, noise emissions from this industry do not affect the acoustic requirements of any new industry locating to the Estate.

5.2 BOUNDARY OF INDUSTRIAL PREMISES

Additional to complying at the boundary of the industrial buffer, noise emissions from each industry also needs to comply with the assigned L_{A10} noise level of 65 dB(A) at the boundary of each industry.

Based on the sound power levels shown in Figure B1 in Appendix B, the distances from the each plants required to achieve compliance with the Regulations are listed in Table 5.1.

Table 5.1 – Distance Require to Achieve Compliance at Boundary of Industrial Premises

Industry Size (Sound Power Level (dB(A))	Distance to Comply with Regulatory Requirements (m)	
	Excluding +5 dB(A) penalty for Tonal Component	Including +5 dB(A) penalty for Tonal Component
Large (125 dB(A))	**280**	**500**
Medium (118 dB(A))	**125**	**225**
Small (110 dB(A))	**90**	**160**

We note that at the boundary of an industrial premises, noise received at that boundary from an industry is likely to be tonal and the +5 dB(A) penalty for a tonal component would need to be included in when determining the size of any lots for industrial premises.

We note that during the review of the *Environmental Protection (Noise) Regulations 1997* undertaken in 2000, it was proposed that the assigned noise levels at the boundary to industrial premises be increased. However, from the latest information provided regarding the revised Regulations, it is understood that an increase to assigned noise levels at an industrial boundary has been discounted and will not be included. Obviously if the allowable noise level at the boundary to industrial premises was increased then the distance to achieve compliance would be reduced, thus reducing the area that would need to be allocated to each individual industry.

6. DISCUSSION OF POTENTIAL NOISE IMPACT

6.1 RESIDENTIAL PREMISES OR BOUNDARY OF BUFFER

The overall noise from the fully developed estate would exceed the assigned L_{A10} nighttime noise level criterion. However, for an industrial estate such as Boodarie, compliance with this criterion is not necessary, provided the noise received from individual industries complies with the “significantly contributing” requirements of the Regulations. Thus, Figure C1 in Appendix C could be considered as for information only.

The results of the modelling displayed in Figure C2 show that the noise levels received at the boundary of the buffer zone from individual industries, comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* for the night period. That is noise received at the boundary of the buffer from each industry would be considered as NOT “significantly contributing” to the noise that would be received at a noise sensitive premises.

We note that by using the “significantly contributing” criteria for each industry and not allowing one or two industries to use up the “noise shed” (ie total 35 dB(A)) additional industries can be developed in the area, provided that they also comply with the “significantly contributing” requirements of the Regulations. In simple terms, for all industries locating in the vicinity of the Boodarie Industrial Estate, the applicable acoustic criteria at the boundary of the buffer of at any residential premises should be an L_{A10} of 30 dB(A).

Note: The above assumes that the industry would operate 24 hours per day and the assigned L_{A10} night-period noise level would be applicable.

6.2 BOUNDARY OF INDUSTRIAL PREMISES

Additional to complying at the industrial buffer, noise emissions from each industry would need to comply with the assigned L_{A10} noise level of 65 dB(A) at the boundary of each industry.

The need to comply with the assigned L_{A10} noise level of 65 dB(A) at the boundary of a neighbouring industrial premises and the size of the lots require to contain some of the industries may prove to be a considerable constraint on the number of industries that can be accommodated within the Estate. This could be especially the case, as noise received at the boundary of an industrial is likely to be tonal and sizing of each lot would need to take this into account.

We note that if the assigned noise level at the boundary of an industrial premises was increase, or at least the requirement of the adjustment for annoying characteristics was removed, then the lot sizes would be reduced, thus allowing a larger number of industries to be accommodated with the industrial estate.

7. BOODARIE INDUSTRIAL ESTATE FUTURE REQUIREMENTS

The requirements of the *Environmental Protection (Noise) Regulations 1997* will apply to each industry that locates within the Boodarie Industrial Estate. While there is no obligation to impose a special noise requirement on such industry, to minimise the risk of breaching the *Environmental Protection (Noise) Regulations 1997* it would be prudent to require developments with significant noise emissions to provide an acoustic assessment by a ‘competent’ acoustic consultant prior to development approval. This assessment and any associated noise modelling should be provided to Landcorp, allowing a comprehensive cumulative noise model to be developed and updated as new industries move into the industrial park. When each new industry commences operation, verification measurements should be taken of sound power emissions and/or of received noise at the buffer boundary.

8. CONCLUSION

Landcorp commissioned Herring Storer Acoustics to develop an acoustic model to predict noise emissions from the proposed Boodarie Industrial Estate.

Typical industries with a range of noise emissions have been modelled to represent a fully developed Boodarie Industrial Estate. The modelling demonstrates that a generous mix of noisy industries can be accommodated in the estate

This assessment shows allowable maximum sound power levels applicable to each industry if the estate was filled to capacity with a range of industries. While the overall combined noise emissions from the estate would exceed the assigned L_{A10} night time noise level of 35 dB(A), compliance with the Regulations would, as shown in Figure C2 in Appendix C, still be achieved with noise emissions from individual industries complying with the “significantly contributing” requirements of the Regulations. Thus, to comply, noise emissions from each industry when received at the boundary of the buffer zone needs to achieve an L_{A10} noise level of 30 dB(A).

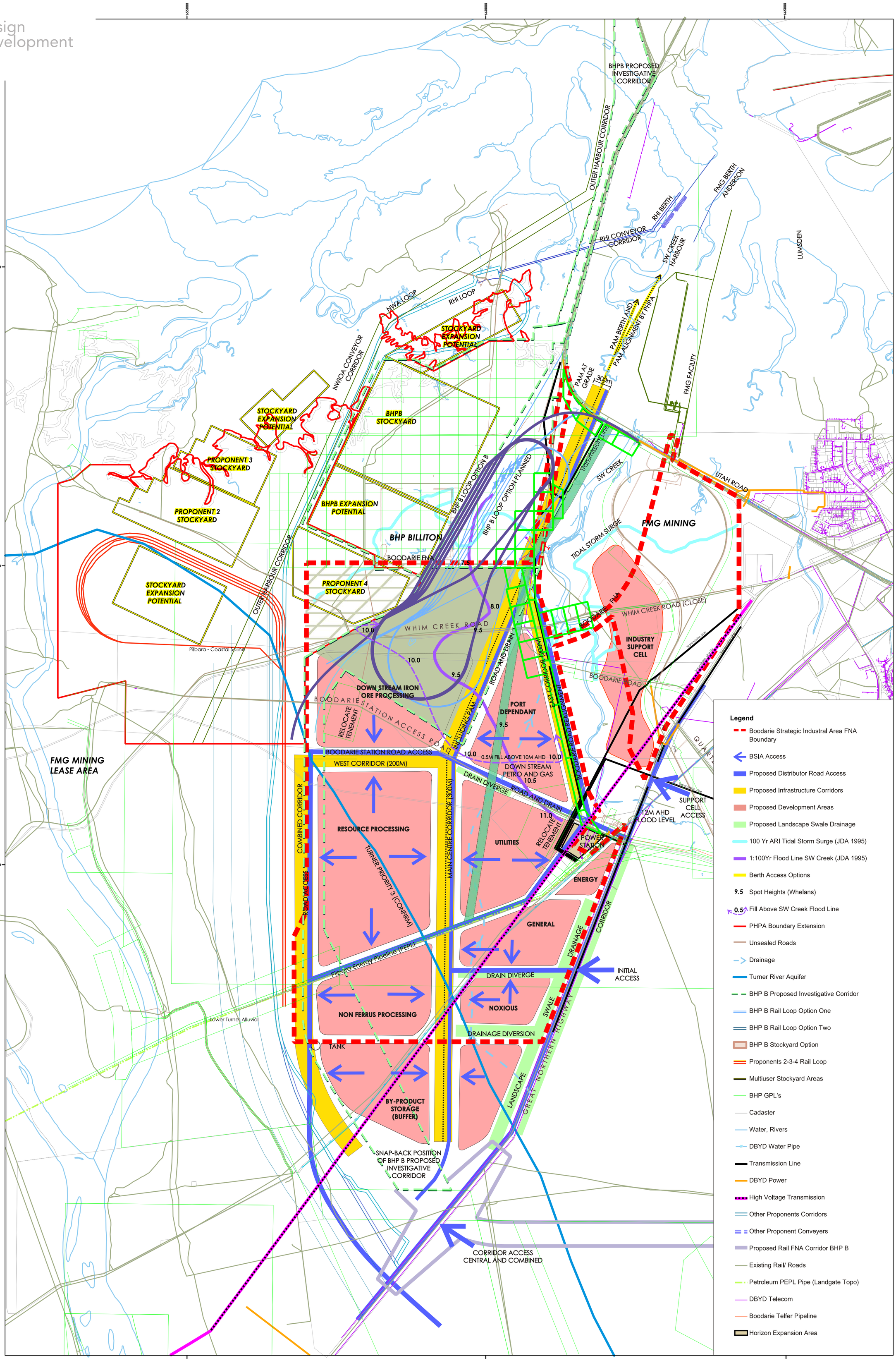
Additionally, it is noted that noise emissions from the existing and proposed new power stations have been included in the noise model. Noise emissions from these power stations would also be considered as NOT “significantly contributing” to the noise received at the boundary. Thus, the requirements outlined above are valid and no adjustments in the allowable noise levels need to be made for future industries.

Finally, we note that the concept plan attached in Appendix A shows possible expansion for iron ore facilities and / or stockpiles. Based on the philosophy outlined above, compliance for these premises would also be achieved by complying with the “significantly contributing” requirements of the Regulation, or achieve an L_{A10} noise level of 30 dB(A) at the boundary to the buffer zone and/ or any other residential premises.

APPENDIX A

Boodarie Industrial Estate – Strategy Plan

urban | design
plan | development



boodarie concept plan B
october 2011 edition

section A-A
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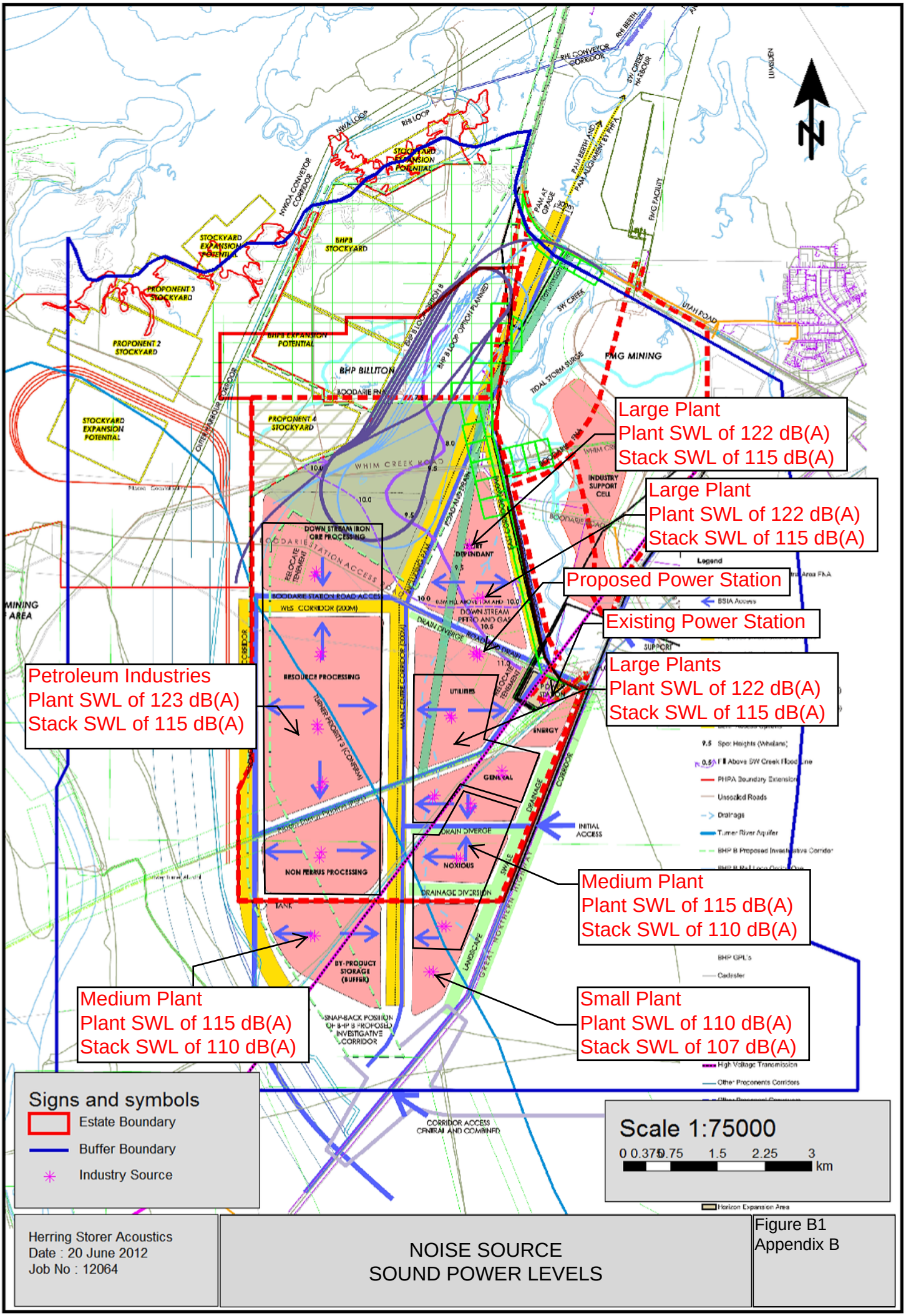
Sources: Whelans mapping, PHPA, BHP Billiton and GH

APPENDIX B

Source Sound Power Levels



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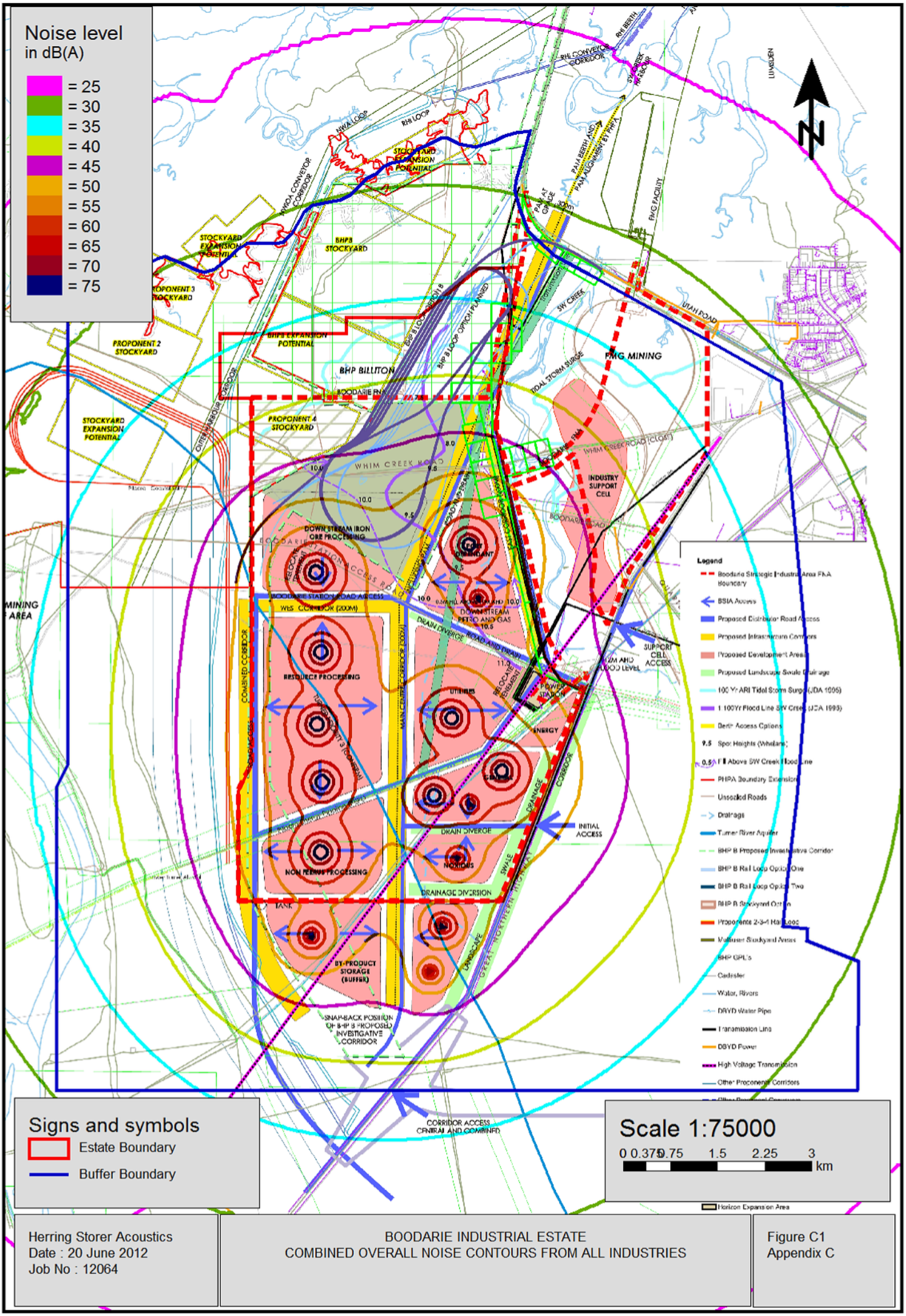
NOISE SOURCE
SOUND POWER LEVELS

Figure B1
Appendix B

APPENDIX C

Noise Contours

Figure C1 – Combined Cumulative Noise Contours
Figure C2 – Combined Maximum Noise Contours of Each Industry



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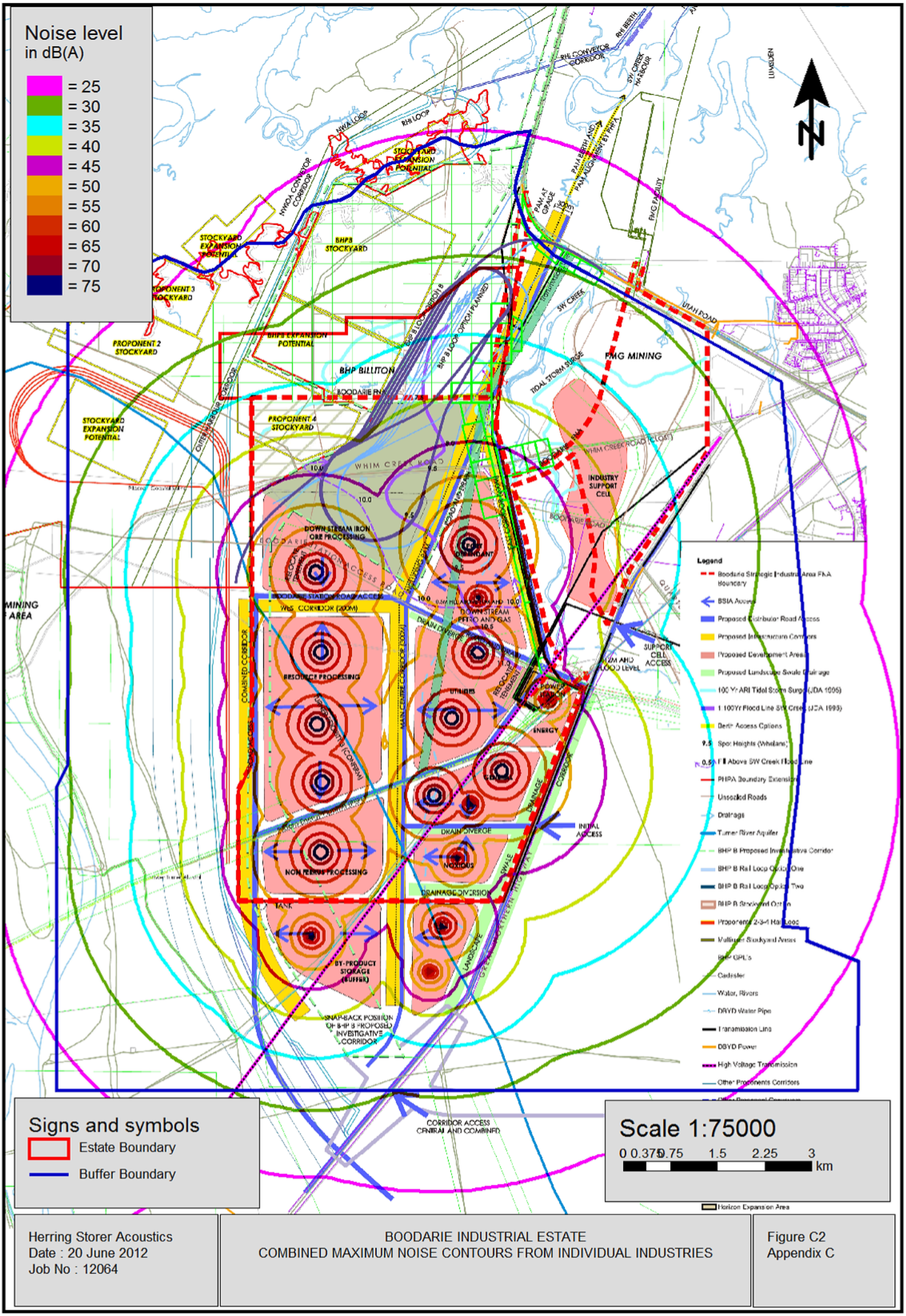
BOODARIE INDUSTRIAL ESTATE
COMBINED OVERALL NOISE CONTOURS FROM ALL INDUSTRIES

Figure C1
Appendix C



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BOODARIE INDUSTRIAL ESTATE
COMBINED MAXIMUM NOISE CONTOURS FROM INDIVIDUAL INDUSTRIES

Figure C2
Appendix C