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GRIFFIN POWER PTY LTD

BLUEWATERS POWER STATION III & IV

Environmental Noise Impact Assessment

BY

HERRING STORER ACOUSTICS

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Bluewaters Power Station (III and IV)

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1.0 **INTRODUCTION**

Griffin Power Pty Ltd commissioned Herring Storer Acoustics (HSA) to undertake an acoustic study of the proposed Bluewaters Power Station expansion Phase III (Units III and IV) to ensure noise immission levels¹ comply with the requirements of the *Environmental Protection (Noise) Regulations 1997* (the Regulations) and the specific noise level limits set for the Coolangatta Industrial Estate.

The Plant is proposed to be located within the existing Coolangatta Estate approximately 4 km north east of the eastern edge of the Collie Township, Western Australia.

Bluewaters Units I and II are currently under construction within the Coolangatta Estate with Unit 1 due for completion in 2008. As part of this study the cumulative noise from all four units is considered for compliance with the regulatory criteria.

Detailed acoustic analysis has been carried out for Unit 1 during the design and construct process and the sound power levels thus derived form the basis of the acoustic assessment for all four stations.

2.0 **SUMMARY**

Modelling of noise propagation from four power station units within the Coolangatta Estate indicate that compliance with regulatory noise level limits is achieved. The predicted worst case level, at residences on the eastern fringe of the township of Collie, is 29 dB(A) which is below the applicable Regulatory criteria of 35 dB(A) and also complies with cumulative noise level requirements (effectively a 30 dB(A) limit) to not contribute significantly to an exceedance of the assigned noise level as a result of all industrial noise sources in the Collie Basin area.

The modelling also indicates that compliance with the specific noise level limits imposed for the boundary of the Coolangatta Estate (SCA) of 35 dB(A) will also be achieved.

In order to meet the noise level criterion, some engineered noise controls are required for the Bluewaters units II to IV (compared to unit I). These controls are most likely to be attenuators fitted to the cooling towers, cladding of the boiler burner section of the boiler structure and some acoustic shielding to the turbines and coal pulverisers, however detailed analysis and design will be made once BW I is commissioned and confirmation measurements made.

3.0 **METHODOLOGY**

Computer modelling was employed to predict the resultant levels at receiver locations based on topographical, atmospheric and equipment sound power level data.

The sound power levels of all significant items of the plant making up the power station have been determined using manufacturers supplied sound pressure levels and some measured levels of similar equipment. The detailed process of the latest sound power level determinations is set out in the HSA report *Reference 8500-4-04193-02 January 2008*. Detailed individual sound power level spectral data of all items of equipment is given in Appendix B.

¹ Immission – describes the influx of sound at a particular location from all sources under consideration.

The computer program SoundPlan 6.3 was used to predict the propagation of noise from the proposed Plant. Noise contour plots were produced to show overall noise immission levels generally in the area around the site. Single point calculations were made for individual locations to show the resultant noise level at individual noise sensitive premises or at the Coolangatta Estate Special Control Area (SCA) boundary.

Input data included:

- Ground topography - terrain type and contour information;
- Equipment sound power levels in octave bands; and
- Atmospheric conditions.

Propagation calculations were made for the worst-case scenario of atmospheric conditions, in accordance with the EPA Draft Guidance for Assessment of Environmental Factors No. 8 - Environmental Noise (June 1998) as follows:

- Pasquill Stability Factor **F** (Positive temperature gradient conditions)
- Wind Speed 3 metres per second

4.0 **CRITERIA**

Environmental noise in Western Australia is governed by the *Environmental Protection (Noise) Regulations 1997* (the Regulations). These regulations stipulate maximum allowable external noise levels at *Noise Sensitive, Commercial* and *Industrial* premises. A full description of the assessment process used in determining the appropriate criteria is given in Appendix A.

The nearest noise sensitive premise is located at the eastern edge of the Collie Township, approximately 5km southwest of the proposed site (Refer to the location plan in Figure 4.1). The applicable criterion at this location is as shown in Table 4.1.

TABLE 4.1 - Assigned Outdoor Noise Level

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L _A 10	L _A 1	L _A max
Residential	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

It is also a condition of the Regulations that there shall be no annoying characteristics in the noise immissions and that the noise must not contribute, in conjunction with other noise sources, to an exceedance of the assigned levels.

Other criterion that is likely to be applicable is the criteria associated with conditions imposed on the Bluewaters I and II stages by the Environmental Protection Authority (EPA), as is summarised in Table 4.2:

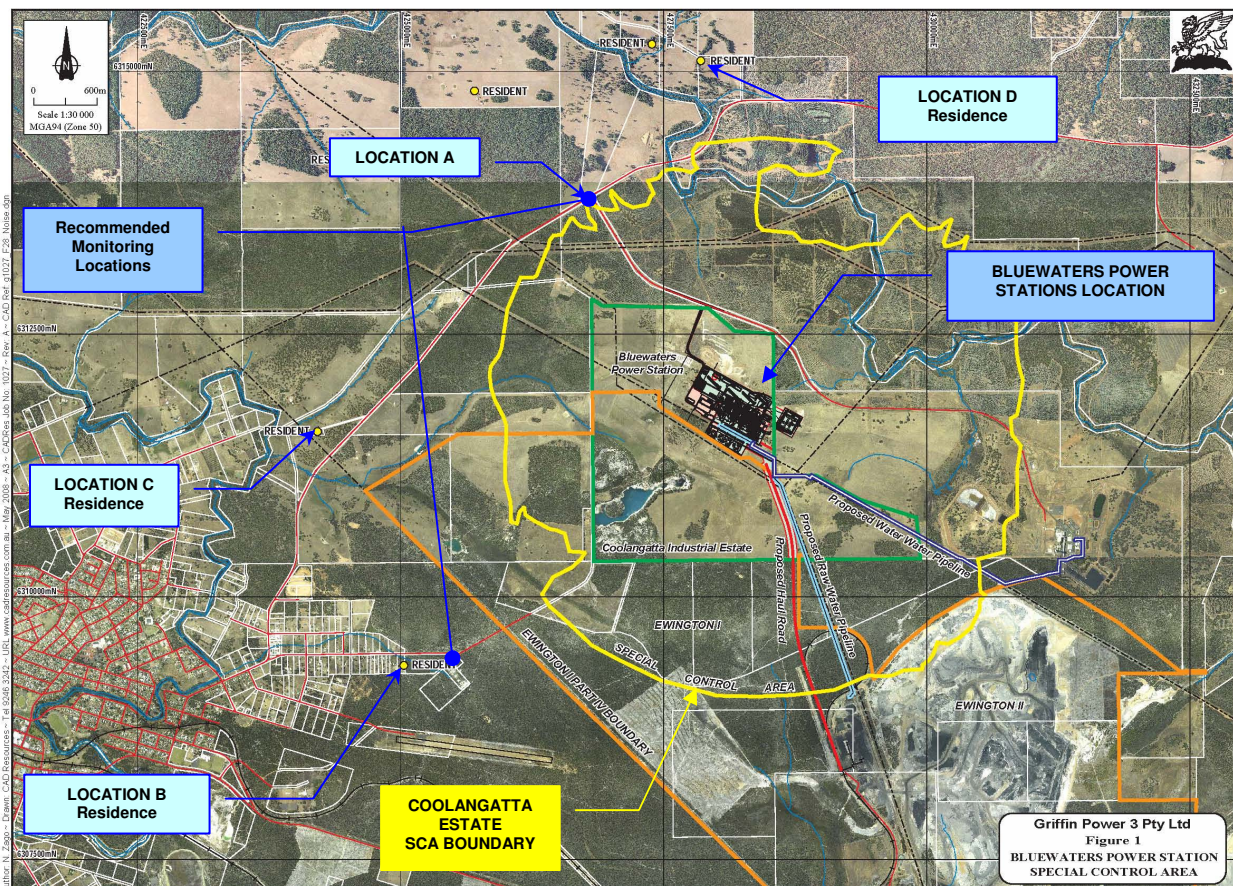
TABLE 4.2: Noise Legal Requirements for Bluewaters I

Legislation/Approval Document	Reference	Summary of Requirement
Environmental Protection (Noise) Regulations 1997	Regulations 7 and 8	Noise emission from any premises shall not exceed 35 dB(A) at night when received at a dwelling on the nearest noise sensitive premises.
Ministerial Statements 685 and 724	Key Proposal Characteristics Table	Each plant must individually achieve less than 60dB(A) at 150m from the plant and less than 29 dB(A) at the nearest residence in Collie.
Approved Structure Plan (with reference to "Special Control Area" documented in town planning scheme).	Section 13.8 Noise (pgs 70 – 71)	The cumulative noise emissions from the Coolangatta Industrial Estate should not exceed 35 dB(A) at the boundary of the Special Control Area along the Williams – Collie Road.

The most critical of the above criteria will be the requirement to not exceed 35 dB(A) at the SCA boundary as a result of all noise sources within the Coolangatta Estate (Bluewaters I, II, III and IV).

The target noise level, for the worst case night period, at residential locations, due to four power station units, is 30 dB(A).

**Figure 4.1
 Site Plan – Plant and Residential Locations**



5.0 RESULTS

Determined sound power level spectral data of all items of equipment are given in Appendix B.

The determined total overall sound power level of one power station is as follows:

Table 5.1 –Power Station Sound Power Levels, dB

Power Station Units	Octave Band Centre Frequency, Hz							Overall dB(A)
	63	125	250	500	1k	2k	4k	
BW II to IV	128.3	126.2	117.3	110.3	106.7	105.4	105.6	116.1
BW I	133.8	127.5	119.2	112.8	110.6	109.8	110.3	119.2

Resultant noise immission level predictions for worst case propagation conditions, at relevant noise sensitive locations and the SCA boundary are shown in Table 5.1.

**Table 5.2 – Noise Immission Levels (dB(A))
 BW I through IV**

Location	Predicted Level Worst Case Conditions	Assigned Level (Target Level)
Location A SCA Boundary	34	35
Location B Residence	29	30
Location C Residence	28	30

Noise contour plots for worst-case propagation conditions to the south west, west and north, are shown in Figures 5.1 to 5.3.

**Figure 5.1
 Predicted Noise Contours for Worst Case Propagation to the south west
 Four Power Station Units**

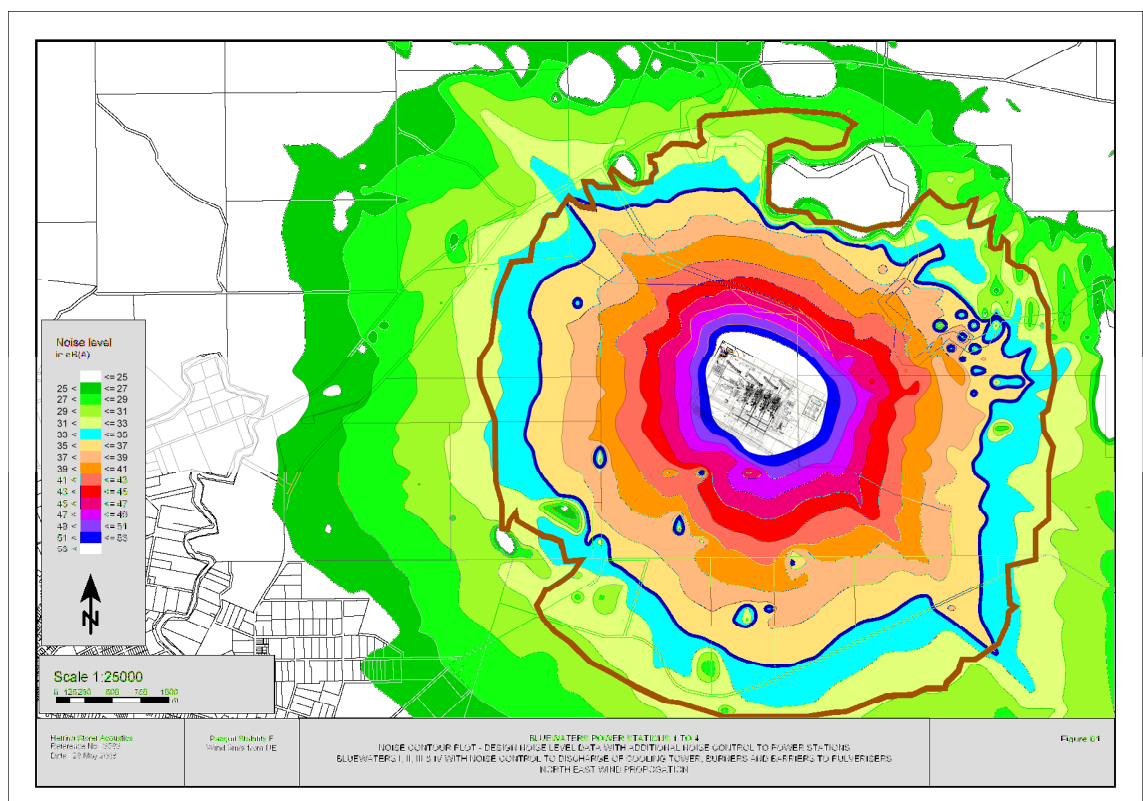


Figure 5.2
Predicted Noise Contours for Worst Case Propagation to the west
Four Power Station Units

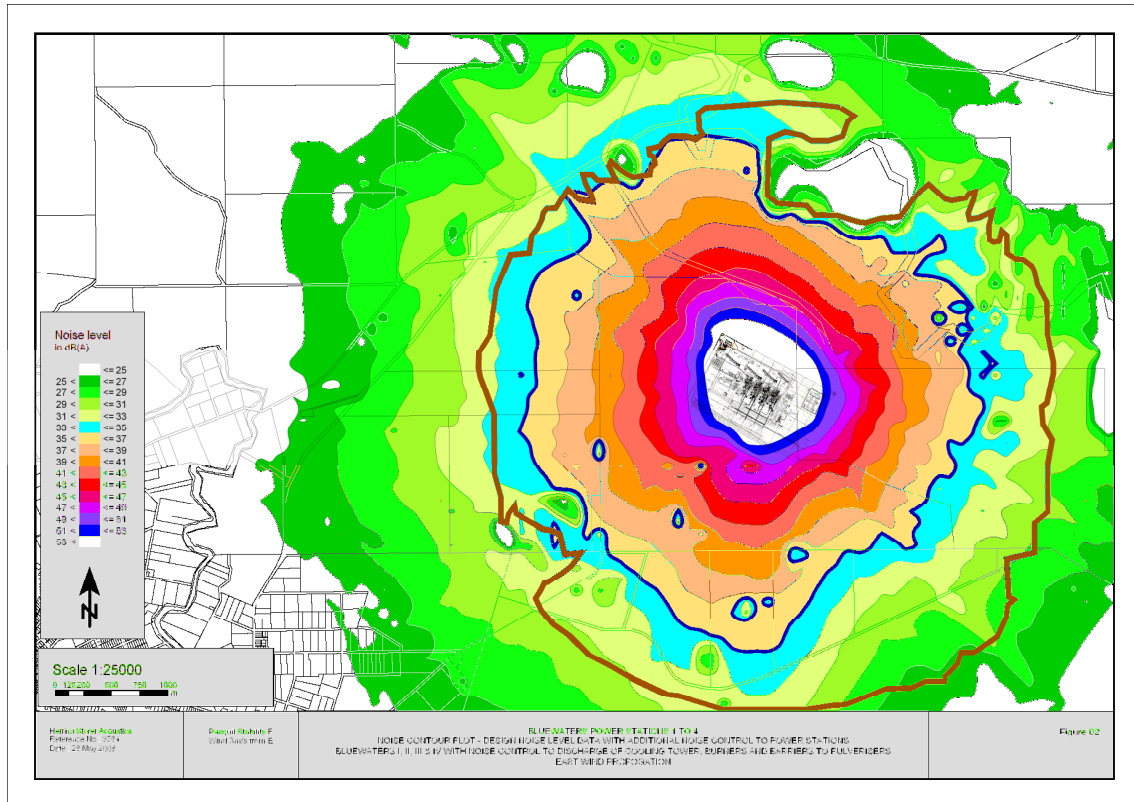
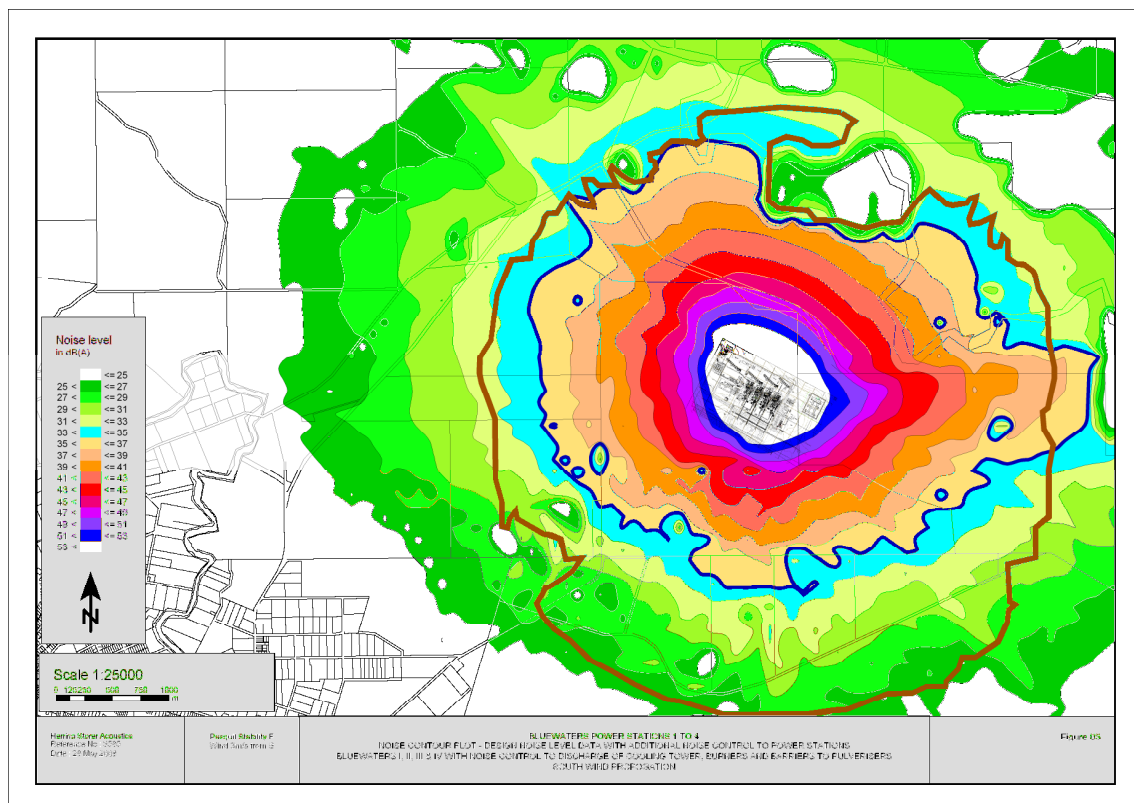


Figure 5.1
Predicted Noise Contours for Worst Case Propagation to the north
Four Power Station Units



6.0 **CUMULATIVE NOISE**

It is a requirement of the Regulations that the noise immission levels associated with the proposed Power Station units do not contribute to an exceedance of the assigned levels in conjunction with any other noise sources at noise sensitive premises. Compliance in this respect, when there are multiple noise sources all contributing to an exceedance, is considered to be achieved if the source of interest (Coolangatta Estate) is 5 dB(A) below the assigned level. That is each source in the Collie basin could have a resultant level of 30 dB(A) at residential locations (for the most critical night time period).

Notwithstanding the above, Griffin has undertaken an assessment of all major industrial noise sources in the Collie Basin (relative to the Collie Township and other residences) with the objective that the total noise level should not exceed 35 dB(A). The target noise immission levels at Collie east as defined from the assessment for Griffin sources, are as follows:

To ensure cumulative noise from all noise sources in the Collie Basin area comply with the regulatory requirements a total noise immission level of 30 dB(A) has been set at the Collie East location (Location B) for all of the Power Station operations.

7.0 **DISCUSSION**

The Bluewaters I power station unit has been designed to achieve a noise immission level of 30 dB(A) at the SCA boundary. Current detailed analysis (HSA *Reference 8500-4-04193-02*) of the partly constructed station indicates the target levels will be achieved although it may be necessary to apply noise attenuation to the cooling tower discharge.

Four units at the rate of the BW I sound power level would result in at cumulative level of 36 dB(A) at the SCA boundary, exceeding the allowable criteria by 1 dB(A). Accordingly it is necessary to reduce the noise emission of units II, III and IV to the equivalent of 28 dB(A) each at the SCA boundary (Sound Power Levels shown in Table 5.1).

Modelling of the four unit noise propagation indicate some locations on the SCA boundary may exceed the 35 dB(A) criteria due to directivity of several sources and the topography of the site. This is particularly evident to the west of the Coolangatta Estate and based on source contributions at this location, further attenuation has been applied to cooling towers, turbine enclosures and pulverisers. The resultant noise contour plots for the critical propagation directions of north, west and south west are shown in Figures 5.1 to 5.3.

The attenuation proposal has been deemed practicable by the station manufacturers and results in the four proposed stations complying with the 35 dB(A) criteria at the SCA boundary and the target 30 dB(A) at residential locations.

8.0 **SPECIFICATION & COMPLIANCE MONITORING**

To ensure the total noise emission levels are not exceeded, the sound power level details listed in this report will form the basis of the procurement specification.

Measurements made during the commissioning of BW I will allow confirmation of the sound power levels, directivity and the rate of propagation to the surrounding areas and hence refinement of the attenuation specification for BW III to IV.

Monitoring of noise immission levels will be conducted before, and during commissioning and on an ongoing basis thereafter. Griffin has established an automatic directional noise monitor in Palmer Road on the eastern edge of the Collie Township. This system will provide accurate data, in accordance with the regulatory parameters, of the contribution of all sources in the Collie basin at this location.

Any noise monitoring at the site will be developed in conjunction with DEC to ensure timing, location and the frequency of measurements adequately captures any potential noise impacts.

For: **HERRING STORER ACOUSTICS**

Lynton Storer

13 March 2008

Checked
T. Reynolds

Appendix A
Environmental Noise Criterion

CRITERIA

Environmental noise in Western Australia is governed by the *Environmental Protection (Noise) Regulations 1997*. These regulations stipulate maximum allowable external noise levels, at 'Noise Sensitive, Commercial or Industrial' premises by reference to Table 1 as shown below. The assigned or allowable level within 15 metres of any noise sensitive premise is determined by the calculation of an influencing factor (IF), which is then added to the base levels as shown in Table 1. The influencing factor is calculated for the usage of land within two circles, having a radius of 100 metre and 450 metres from the premises of concern, using factors set out in Schedule 3 of the Regulations.

TABLE 1 - BASELINE ASSIGNED OUTDOOR NOISE LEVEL

Premises Receiving Noise	Time of Day	Assigned Level (dB)		
		L _A 10	L _A 1	L _A max
Noise sensitive premises at locations within 15 metres of a building directly associated with a noise sensitive use	0700 - 1900 hours Monday to Saturday	45 + IF	55 + F	65 + IF
	0900 - 1900 hours Sunday and Public Holidays	40 + IF	50 + IF	65 + IF
	1900 - 2200 hours all days	40 + IF	50 + IF	55 + IF
	2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	35 + IF	45 + IF	55 + IF
Noise sensitive premises at locations further than 15 metres 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

The above levels are conditional on no annoying characteristics existing in the noise of concern, such as tonality, amplitude modulation or impulsiveness. If such characteristics exist and cannot be practicably removed then any measured level is adjusted according to Table 2 below.

Table 2- ADJUSTMENTS TO MEASURED LEVELS

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

Where the noise emission is music, then any measured level is adjusted according to Table 3 below.

TABLE 3 - ADJUSTMENTS TO MEASURED LEVELS WHERE NOISE EMISSION IS MUSIC

Where impulsiveness is not present	Where impulsiveness is present
+10 dB(A)	+15 dB(A)

Annoying characteristics are defined as an intrusive or dominant characteristic as follows:

- “impulsiveness”** means a variation in the emission of a noise where the difference between L_{Apeak} and $L_{Amax Slow}$ is more than 15 dB when determined for a single representative event;
- “modulation”** means a variation in the emission of noise that –
- any
- (a) is more than 3dB $L_{A Fast}$ or is more than 3 dB $L_{A Fast}$ in 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 3dB 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 8dB at any time when the sound pressure levels are determined as $L_{A Slow}$ levels.

Cumulative Noise

Noise emitted from any premises must not cause, or significantly contribute to a level of noise that exceeds the above-described assigned levels. A noise immission is taken to “significantly contribute to” a level of noise if the noise immission level exceeds a value which is 5 dB below the assigned level. That is, if a noise of interest contributes to an exceedance of the assigned level at a receiver point, then the noise immission level must be reduced until the overall level is less than or equal to the assigned level or is 5 dB(A) below the assigned level.

Nomenclature:

“influencing factor” in relation to noise received at noise sensitive premises, means the influencing factor determined under Schedule 3 of the Regulations;

“ L_{Amax} assigned level” means an assigned level which, measured as a $L_{A Slow}$ value, is not to be exceeded at any time;

“ L_{A1} assigned level” means an assigned level which, measured as a $L_{A Slow}$ value, is not to be exceeded for more than 1% of the representative assessment period;

“ L_{A10} assigned level” means an assigned level which, measured as an $L_{A Slow}$ value, is not to be exceeded for than 10% of representative assessment period.

Noise Immission indicates the level of noise ingress at any location or receiver point.

Noise Emission indicates the level of noise emitted from any premises.

Appendix B

Equipment Sound Power levels and Source Prediction Rankings at the SCA Boundary

Bluewaters II to IV Individual Sound Power Levels (dB Linear)

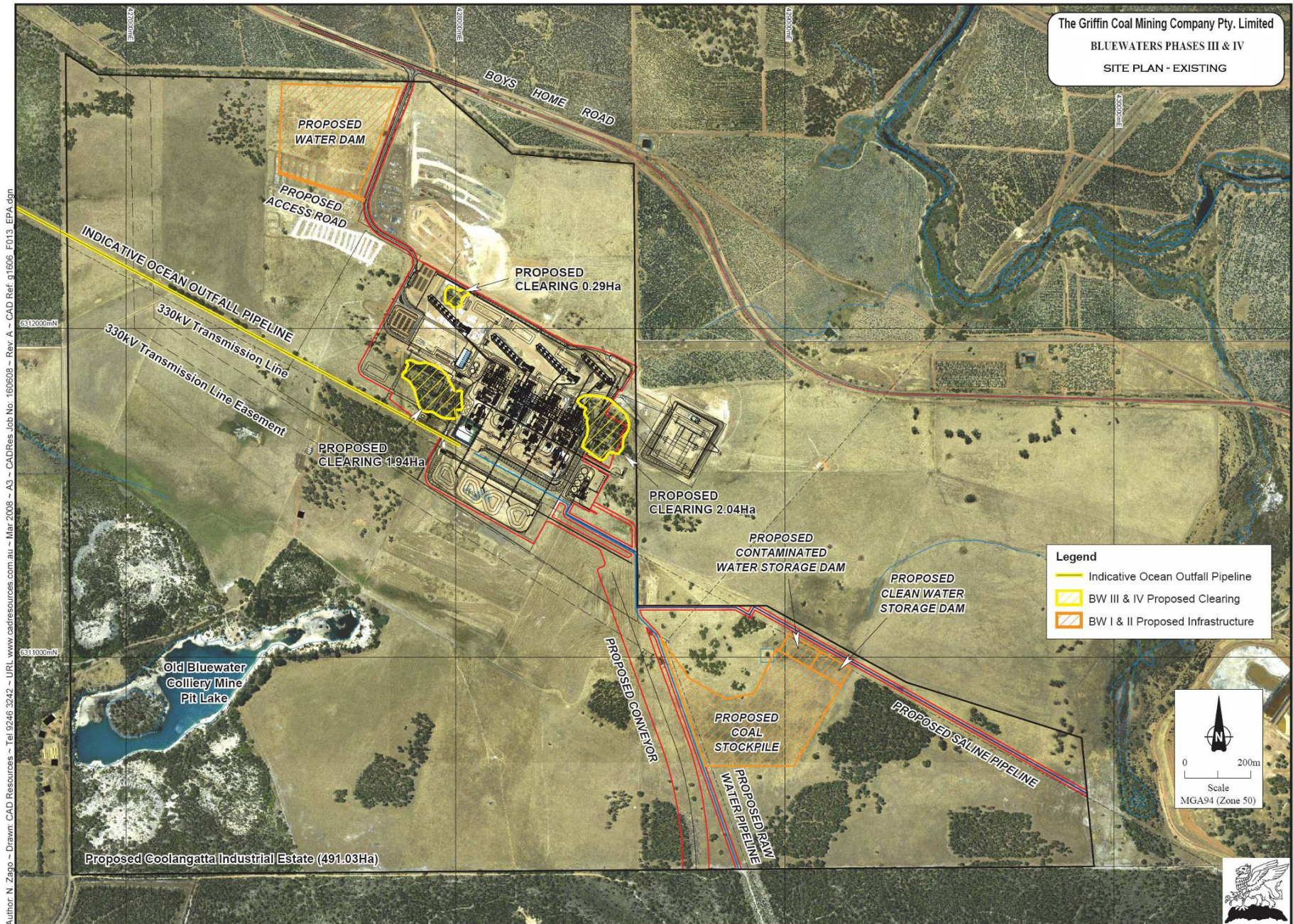
Element name	dB(A)	Octave Band Centre Frequency (Hz)								dB Linear
		63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz	
Cooling Tower (Discharge)	103.9	109.0	109.0	105.0	102.0	99.0	91.0	87.0	83.0	113.3
Cooling Tower (Side)	108.2	111.0	107.0	105.0	99.0	100.0	101.0	102.0	101.0	114.3
Cooling Tower (Side)	108.2	111.0	107.0	105.0	99.0	100.0	101.0	102.0	101.0	114.3
Pulveriser	100.8	96.2	97.1	101.6	100.2	95.0	89.8	84.0	74.1	105.9
Pulveriser	100.8	96.2	97.1	101.6	100.2	95.0	89.8	84.0	74.1	105.9
Pulveriser	100.8	96.2	97.1	101.6	100.2	95.0	89.8	84.0	74.1	105.9
Pulveriser	100.8	96.2	97.1	101.6	100.2	95.0	89.8	84.0	74.1	105.9
Steam turbine	111.6	124.2	125.6	114.6	103.2	85.0	76.8	66.0	61.1	128.2
Vent Outlet	93.6	112.2	108.1	88.6	86.2	73.0	40.8	39.0	33.1	113.6
Turbine Air Intake	89.9	107.2	105.1	86.6	63.2	41.0	33.8	42.0	58.1	109.3
Boiler Burner	97.9	120.2	108.1	97.6	90.2	87.0	82.8	78.0	72.1	120.5
Boiler Burner	97.9	120.2	108.1	97.6	90.2	87.0	82.8	78.0	72.1	120.5
Boiler Burner	97.9	120.2	108.1	97.6	90.2	87.0	82.8	78.0	72.1	120.5
ID Fan Casing	101.3	104.0	100.0	108.0	97.0	90.0	88.0	80.0	73.0	110.2
FD Fan Outlet	93.5	110.2	106.1	92.6	84.2	82.0	78.8	82.0	83.1	111.7
IDF Outlet	84.7	96.0	98.0	77.0	71.0	75.0	71.0	75.0	76.0	100.2
Boiler Feed Pump	96.0	108.0	98.0	93.0	90.0	89.0	89.0	88.0	86.0	108.8
Boiler Feed Pump	96.0	108.0	98.0	93.0	90.0	89.0	89.0	88.0	86.0	108.8
Boiler Feed Pump	96.0	108.0	98.0	93.0	90.0	89.0	89.0	88.0	86.0	108.8
Boiler Feed Pump	96.0	108.0	98.0	93.0	90.0	89.0	89.0	88.0	86.0	108.8
TOTAL	116.1	128.3	126.2	117.3	110.3	106.7	105.4	105.6	104.4	130.7

NOISE SOURCE RANKINGS dB(A)

LOCATION A (SCA Boundary)	TOTAL 33.5
Cooling Tower Unit 4 (Discharge)	22.6
Blue 4 - Steam Turbine	22.0
Blue 1 - Steam Turbine	21.8
Blue 4 - Cooling Tower Side 2	21.6
Blue 2 - Steam Turbine	21.5
Cooling Tower Unit 1 (Discharge Attenuat	21.4
Blue 3 - Steam Turbine	21.2
Cooling Tower Unit 2 (Discharge)	20.8
Blue 1 - Cooling Tower Side 2	20.3
Cooling Tower Unit 3 (Discharge)	20.2
Blue 2 - Cooling Tower Side 2	19.7
Blue 3 - Cooling Tower Side 2	19.0
Blue 4 - ID Fan Casing	18.1
Blue 4 - CR side Burner 25m	17.5
Blue 4 - CR side 16m Burner	17.2
Blue 4 - CR side Burner 13m	17.1
Blue 1 - CR side Burner 25m	17.1
Blue 3 - CR side Burner 25m	16.3
Blue 1 - CR side 16m Burner	15.9
Blue 1 - CR side Burner 13m	15.6
Blue 3 - CR side 16m Burner	15.2
Blue 3 - CR side Burner 13m	14.8
Blue 2 - CR side Burner 25m	14.1
Blue 4 - FDF Outlet	13.5
Blue 1 - FDF Outlet	13.2
Blue 2 - FDF Outlet	12.8
Blue 3 - FDF Outlet	12.4
Blue 4 - Boiler Feed Pumps 1	10.5
Blue 4 - Boiler Feed Pump 2	10.4
Blue 4 - boiler Feed Pump 3	10.4
Blue 4 - Boiler Feed Pump 4	10.4
Blue 3 Cooling Tower (Side 1)	9.5
Blue 2 Cooling Tower (Side 1)	8.0
Blue 4 Cooling Tower (Side 1)	7.5
Blue 1 Cooling Tower (Side 1)	7.3
Blue 2 - CR side 16m Burner	7.0
Blue 4 - Vent Out	6.9
Blue 1 - Vent Out	6.6
Blue 2 - Vent Out	6.3
Blue 3 - Vent Out	6.0
Blue 2 - CR side Burner 13m	5.1
Blue 4 - IDF Outlet	4.1
Blue 1 - IDF Outlet	3.7
Blue 2 - IDF Outlet	3.4
Blue 3 - IDF Outlet	3.0
Blue 4 - Turbine Air Intake	0.9
Blue 1 - Turbine Air Intake	0.6
Blue 2 - Turbine Air Intake	0.4
Blue 3 - Turbine Air Intake	0.1

Appendix C

Plant Layout



Appendix D

Noise Contour Plots

NOISE CONTOUR PLOT

