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# Environmental Noise Impact Assessment Shoalhaven Starches

***Proposed Modification to Shoalhaven Starches Expansion Project  
06\_0228 – Proposed Modification to Approved Cogeneration  
Plant – Modification 23.***

At:-

160 Bolong Road,  
Bomaderry, NSW 2541

*Prepared for: -*

Shoalhaven Starches Pty Ltd  
C/- Cowman Stoddart Pty Ltd  
29-31 Kinghorn Street  
Nowra NSW 2541

Attention: Mr Stephen Richardson

Reference: 2103012E-R

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19<sup>th</sup> August 2021

# Document Control Page

Revision	Author	Released By	Date
Draft	MH	MH	01/05/2021
Draft 2	MH	MH	08/07/2021
Final	MH	MH	19/08/2021

Shoalhaven Starches Pty Ltd commissioned Harwood to carry out an Environmental Noise Impact Assessment for a proposed modification to the Shoalhaven Starches Expansion Project (SSEP), approval, reference 06\_0228 at their facility at 160 Bolong Road, Bomaderry, NSW.

This modification (Mod 23) relates to the installation of a gas fired co-generation plant to be constructed at the western end of the Shoalhaven Starches facility.

Accordingly, Harwood Acoustics has prepared this report for the exclusive use of the Client identified on the title page. The report is prepared in accordance with the brief and scope of works agreed between the Client and Harwood Acoustics and may not be suitable for use beyond that scope.

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## 1. INTRODUCTION AND SUMMARY

Shoalhaven Starches Pty Ltd is part of the Manildra Group of companies and their existing facility is located on the southern side of Bolong Road, Bomaderry, NSW, on the northern side of the Shoalhaven River. The surrounding area is a mix of commercial, industrial and residential premises. The nearest residences are located in the township of Bomaderry to the north-west and across the Shoalhaven River in Nowra to the south and Terara to the south-east.

In 2009 Shoalhaven Starches received Project Approval from the Minister for Planning (the Department) for the Shoalhaven Starches Expansion Project (SSEP), reference 06\_0228.

The approval made provision for a gas fired co-generation that would comprise two gas turbine generators that would deliver an anticipated net power output of 40 MW of power for the site.

Subsequently under Mod 16 the Independent Planning Commission approved an additional coal fired co-generation plant. This coal fired co-generation plant would generate a total of 15 MW of power for the site.

Neither the approved gas fired, nor coal fired co-generation plants have been constructed to date.

Following the original Project Approval, Shoalhaven Starches has obtained approval and / or are seeking approval for a range of modifications to the original SSEP comprising a range of additional developments that were not envisaged as part of the original Project Approval. It is forecasted that the electrical power load demand created by these and other additional works, subsequent to the original Project Approved development, will exceed the power supply capacity of the approved gas fired and coal fired co-generation plants.

Consequently, Shoalhaven Starches now propose to construct a new gas-fired co-generation plant which will consist of two natural gas turbines that will generate an anticipated power output each of 30 MW, providing a total power to the site of 60 MW. The new gas fired co-generation plant will replace the approved gas fired and coal fired co-generators. In addition Shoalhaven Starches also proposed to convert their existing coal fired boilers to gas as well.

The new gas fired co-generation plant (referred to henceforth as the co-gen plant) will be constructed at the western extent of the Site adjacent to Bomaderry Creek.

It is a requirement of the NSW Environment Protection Authority and Department of Planning, Infrastructure and Environment, that an Environmental Noise Impact Assessment of the proposed modification is prepared, in accordance with the NSW *Noise Policy for Industry* 2017 and *Interim Construction Noise Guideline* 2008.

Shoalhaven Starches operates under Environment Protection Licence Number 883 which sets noise limits for the overall operation of the complex.

Given the number of modifications and construction of new noise sources since the initial approval, the noise goals for any new plant are now set to a minimum 15 dB below the EPL noise limits in accordance with Shoalhaven Starches Noise Management Plan, originally prepared 31 October 2009 and revised 7 September 2010 under the Project Approval conditions for the SSEP.

Noise goals have been designed for the proposal to ensure existing noise levels from the operation of the facility are not increased by the introduction of the new plant and equipment. These range between 23 dBA and 27 dBA depending upon the residential receptor location. Receptor locations are derived from the EPL and are located in Nowra, Bomaderry and Terara as shown in Figure 1.

The co-gen plant will be supplied by GE Power (GE) and an itemised breakdown of the constituent components of the overall co-gen plant have been supplied by GE for the purpose of noise modelling. The co-gen plant will be located within a building structure of concrete wall and proprietary roof panelling system construction.

Recommendations are made in Section 6 of this report to reduce the level of noise emission from the co-gen plant to within the design noise goals.

These include advice on the construction of building elements; providing target noise levels for any discharge exhaust stacks that penetrate the roof of the building; restricting the total number of penetrations in the walls of the building for exhaust and installing acoustic louvres in those openings.

The construction works will consist of piling, pouring of concrete slabs for the buildings, the construction of the buildings and the installation of all plant and equipment.

Calculations show that there is potential for the construction noise management levels set by the NSW EPA's *Interim Construction Noise Guideline* to be exceeded at some receptors on occasions during construction works. Construction works will be carried out during the day time hours only, as recommended in the Project Approval. Construction noise mitigation measures are included in the Construction Noise Management Plan that will be prepared by Shoalhaven Starches.

## 2. SITE AND DEVELOPMENT DESCRIPTION

### 2.1 Site Description

The Shoalhaven Starches complex is located on the southern side of Bolong Road across the Shoalhaven River from Nowra.

The area surrounding Shoalhaven Starches is a mix of commercial, industrial and residential premises with vacant land, owned by the Manildra Group, to the north.

The nearest residential receptor locations to the proposal are as follows:-

- Location 1 – Nobblers Lane, Terara approximately 1550 metres to the south east
- Location 2 – Riverview Road, Nowra approximately 820 metres to the south west,
- Location 3 – Merroo Street, Bomaderry approximately 385 metres to the north west,
- Location 4 – Coomea Street, Bomaderry approximately 455 metres to the north west.

Locations are listed in keeping with the order shown in Environment Protection Licence number 883, as detailed in Section 3.2 of this report.

Distances are based on the centre of the co-generation plant to each receptor as a reference only, as various noise producing aspects of the proposal are at varying distances from each receptor, as is considered in all calculations. The Shoalhaven Starches site and receptor locations are shown in Figure 1 along with some of the main components of the proposal.



**Figure 1. Location Plan – Shoalhaven Starches, Bomaderry, NSW** (source: Google Maps ©)

Figure 2 below shows the location of the co-gen plant in context of the overall Site in greater detail than Figure 1.



**Figure 2. Co-Gen Plant Location – Shoalhaven Starches, Bomaderry, NSW**

(source: Nearmap © and Shoalhaven Starches)

## 2.2 Description of Proposal

In 2009 Shoalhaven Starches received Project Approval from the Minister for Planning (the Department) for the Shoalhaven Starches Expansion Project (SSEP), reference 06\_0228.

The approval made provision for a gas fired co-generation that would comprise two gas turbine generators that would deliver an anticipated net power output of 40 MW of power for the site.

Subsequently under Mod 16 the Independent Planning Commission approved an additional coal fired co-generation plant. This coal fired co-generation plant would generate a total of 15 MW of power for the site.

Neither the approved gas fired, nor coal fired co-generation plants have been constructed to date.

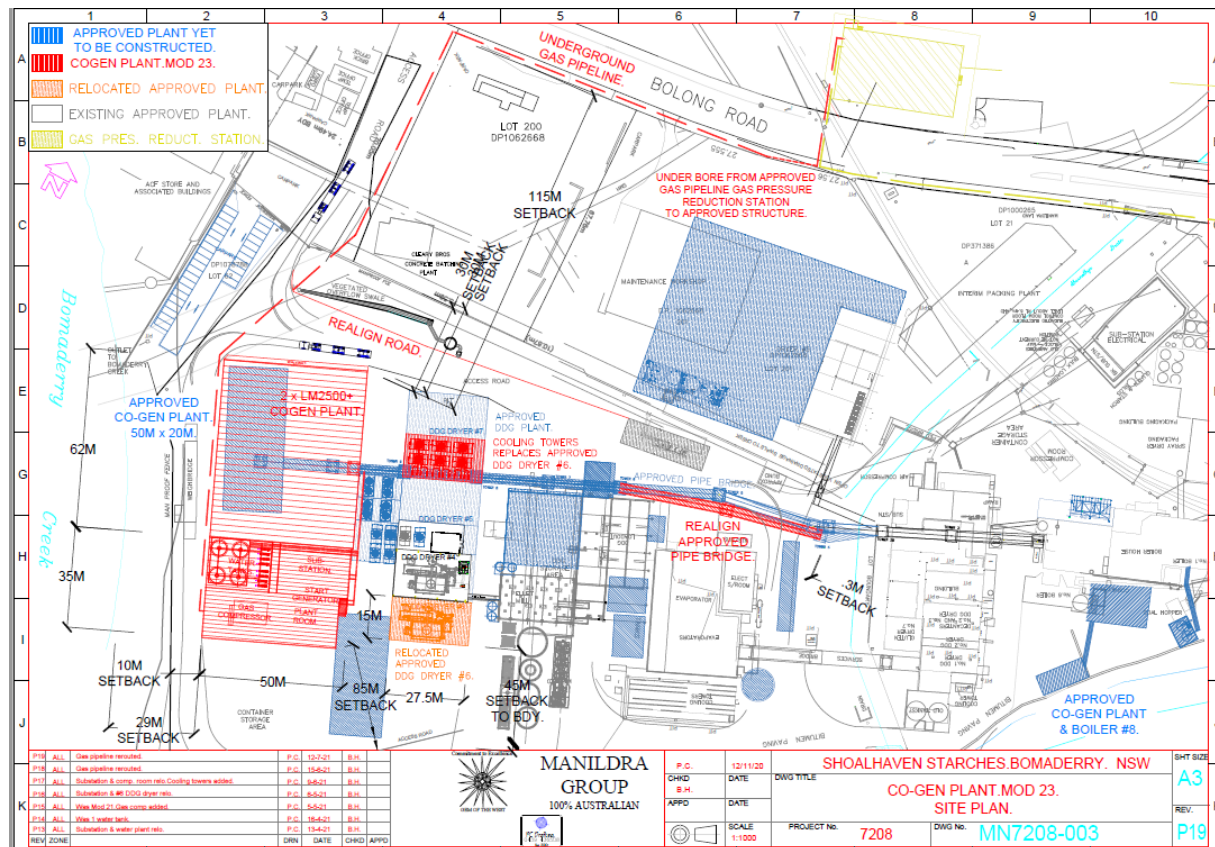
Following the original Project Approval, Shoalhaven Starches has obtained approval and / or are seeking approval for a range of modifications to the original SSEP comprising a range of additional developments that were not envisaged as part of the original Project Approval. It is forecasted that the electrical power load demand created by these and other additional works, subsequent to the original Project Approved development, will exceed the power supply capacity of the approved gas fired and coal fired co-generation plants.

Consequently, Shoalhaven Starches now propose to construct a new gas-fired co-generation plant (the co-gen plant) which will consist of two natural gas turbines that will generate an anticipated power output each of 30 MW, providing a total power to the site of 60 MW. The new gas fired co-generation plant will replace the approved gas fired and coal fired co-generators. In addition, Shoalhaven Starches also proposed to convert their existing coal fired boilers to gas as well.



The co-gen plant will be constructed at the western extent of Shoalhaven Starches facility adjacent to Bomaderry Creek as shown in Figures 1 and 2 above and the proposed Site Plan provided in Figure 3 below.

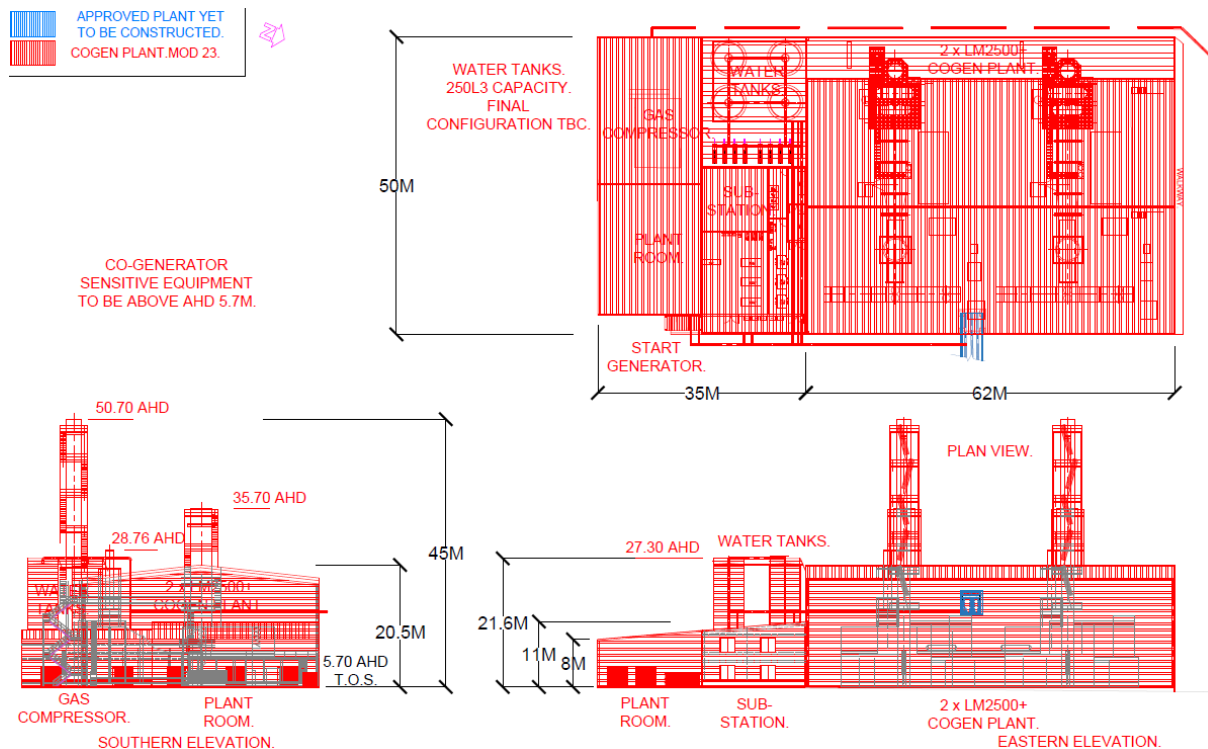
The co-gen plant will be supplied by GE Power (GE) and an itemised breakdown of the constituent components of the overall co-gen plant have been supplied by GE for the purpose of noise modelling. The co-gen plant will be located within a building structure of concrete wall and proprietary roof panelling system construction. The building will be approximately 97 metres long (north / south) by 50 metres wide (east / west) and increasing height from 8 metres at the western end to 20.5 metres at the eastern end. Floor plans and elevations of the proposed building are shown in Figure 4.



**Figure 3. Proposed CO-Gen Site Plan**

(source: Manildra Group's building design plans MN7208-003 for Project No. 7208, Rev P19 issued 12/07/2021)





**Figure 4. Proposed Building Plans**

(source: Manildra Group's building design plans MN7208-006 for Project No. 7208, Rev P11 issued 29/07/2021)

Details of the noise producing components of the overall plant and equipment for the co-gen plant is provided in Section 5 of this Report.

### 3. NOISE CRITERIA

This section outlines the noise guidelines applicable to this proposal and establishes the project specific noise goals.

#### 3.1 NSW Department of Planning and Environment

##### 3.1.1 Existing Project Approval

Project Approval for Application No. 06\_0228, provided by the Minister for Planning, dated January 2009, Schedule 2, 'Terms of Approval' states:-

*"Condition 2*

*The applicant shall carry out the development generally in accordance with the:*

- a) EA and associated site plans (see Appendix 2).*

*Condition 2A*

*The applicant shall carry out the development in accordance with the:*

- a) Statement of commitments,*
- b) Conditions of this consent, and*
- c) Revised statement of commitments for Appendix 6."*

The original Project Approval incorporates noise mitigation measures recommended in the 'Acoustical Assessment, Proposed Ethanol Upgrade, Shoalhaven Starches' – prepared by The

Acoustic Group Pty Ltd, ref 38.3849.R52:ZJM, dated 26 June 2008. This document forms part of the EA and statement of commitments and it is implicit that the noise control recommendations within this document are required to be implemented as part of the Project Approval.

Schedule 3, Conditions 11 to 14 inclusive of the Project Approval, also refer to noise emission and are summarised as follows:-

Condition 11 relates to restricted hours of construction activities. Condition 12 reiterates the noise limits contained with Environment Protection Licence 883. Condition 13 requires that all feasible and reasonable noise mitigation measures must be implemented during the construction phase of the project. Condition 14 required the preparation of a noise management plan (see Section 3.3 below).

### 3.1.2 Existing Project Approval

In response to a request for information relating to noise emission from the proposed modification, the NSW Department of Planning and Environment requires an assessment of the potential for noise impact.

## 3.2 NSW EPA's Environment Protection Licence

Shoalhaven Starches operates under Environment Protection Licence 883 issued by the NSW Environment Protection Authority.

Section L5 'Noise Limits' of the licence states:-

*"L5.1 the  $L_{Aeq (15min)}$ \* sound pressure level contribution generated from the premises must not exceed the following levels when measured at or near the boundary of any residential premises:*

- a) 38 dBA at locations in Terara on the south side of the Shoalhaven River,*
- b) 38 dBA at locations in Nowra on the south side of the Shoalhaven River,*
- c) 42 dBA at locations in Meroo Street, Bomaderry,*
- d) 40 dBA at other locations in Bomaderry."*

These noise limits apply to the overall operation of the Shoalhaven Starches complex.

## 3.3 Shoalhaven Starches Noise Management Plan

Previous approval for the Shoalhaven Starches Expansion Project, required the preparation of a Noise Management Plan for addressing and managing noise emission from the expansion project.

The Shoalhaven Starches Noise Management Plan originally prepared 31 October 2009 and revised 7 September 2010 addresses, among other things, acoustic criteria relating to the Shoalhaven Starches complex and any new developments. Section 3 of the plan lists noise limits from the Environmental Protection Licence as shown in Section 4.1 above and states:-

*"Compliance testing conducted on a regular basis on behalf of the Mill*

*[Shoalhaven Starches complex] has found noise emission from the premises satisfies the EPA criteria as a result of works on the Shoalhaven Starches site. In order to ensure that there is no increase in noise emission from the subject premises, with respect to the noise criteria nominated by the EPA in License Condition 6.3 [now 5.1],*

*the design goal for such additional plant should be at least 10 dB below the criteria nominated by the EPA.”*

Given the number of modifications subsequent to the original approval and location of new noise sources, it is recommended that the noise design goals are set to a minimum 15 dB below the EPL noise limits henceforth.

### **3.4 Construction Noise Criteria**

The NSW EPA published the *Interim Construction Noise Guideline* in July 2009. While some noise from construction sites is inevitable, the aim of the Guideline is to protect the majority of residences and other sensitive land uses from noise pollution most of the time.

The Guideline presents two ways of assessing construction noise impacts; the quantitative method and the qualitative method.

The quantitative method is generally suited to longer term construction projects and involves predicting noise levels from the construction phase and comparing them with noise management levels given in the guideline.

The qualitative method for assessing construction noise is a simplified way to identify the cause of potential noise impacts and may be used for short-term works, such as repair and maintenance projects of short duration.

In this instance the entire construction phase may take several months although significant noise producing aspects, such as piling, if required, will last a total of approximately two weeks. Consideration is given to the potential for noise impact from construction activities on residential receptors in Section 6 of this report.

Table 2 in Section 4 of the Guideline sets out noise management levels at affected residences and how they are to be applied during normal construction hours. The noise management level is derived from the rating background level (RBL) plus 10 dB in accordance with the Guideline. This level is considered to be the ‘noise affected level’ which represents the point above which there may be some community reaction to noise.

The author has carried out numerous noise surveys in Nowra, Bomaderry and Terara and has found daytime background noise levels range between 33 and 40 dBA depending on the location, as shown in Table 1 below.

**Table 1 Rating Background Levels – Nowra, Terara and Bomaderry, NSW**

Location	Time of Day	Rating Background Level (L <sub>90</sub> )
135 Terara Road, Terara March 2012	Day (7 am to 6 pm)	<b>33 dBA</b>
55 Terara Road, Nowra February 2015	Day (7 am to 6 pm)	<b>36 dBA</b>
Cambewarra Rd, Bomaderry July 2010	Day (7 am to 6 pm)	<b>40 dBA</b>
Shoalhaven Village Caravan Park, Nowra March 2012	Day (7 am to 6 pm)	<b>40 dBA</b>

For the purpose of determining the potential for community reaction to noise emission from construction activities, previously measured background noise levels in the vicinity of each receptor location have been used to determine the noise management levels as shown in Table 2 below.

**Table 2 L<sub>eq</sub> Noise Management Levels from Construction Activities**

Receptor Location	Noise Management Level	How to Apply
Location 1 (Terara)	<b>43 dBA</b> (33 + 10)	<p>The noise affected level represents the point above which there may be some community reaction to noise.</p> <ul style="list-style-type: none"> <li>Where the predicted or measured L<sub>Aeq</sub> (15 min) noise level is greater than the noise affected level, the proponent should apply all feasible and reasonable* work practices to meet the noise affected level.</li> <li>The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.</li> </ul>
Location 2 (Nowra)	<b>50 dBA</b> (40 + 10)	
Locations 3 & 4 (Bomaderry)	<b>48 dBA</b> (38 + 10)	
	<b>Highly noise affected</b> <b>75 dB(A)</b>	<p>The highly noise affected level represents the point above which there may be strong community reaction to noise.</p> <ul style="list-style-type: none"> <li>Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: <ol style="list-style-type: none"> <li>times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences)</li> <li>if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.</li> </ol> </li> </ul>

\* Section 6, “work practices” of The *Interim Construction Noise Guideline*, states:- “there are no prescribed noise controls for construction works. Instead, all feasible and reasonable work practices should be implemented to minimise noise impacts.

*This approach gives construction site managers and construction workers the greatest flexibility to manage noise”.*

Definitions of the terms feasible and reasonable are given in Section 1.4 of the Guideline.

The ‘highly noise affected’ level of 75 dBA represents the point above which there may be strong community reaction to noise. This level is provided in the Guideline and is not based on the RBL.

### **3.5 Project Specific Noise Goals**

The most relevant criteria are as follows:-

Operational Phase (Environment Protection Licence noise limits less **15 dB**) -

- 23 dBA ( $L_{eq, 15 \text{ minute}}$ ) at locations in Terara on the south side of the Shoalhaven River,
- 23 dBA ( $L_{eq, 15 \text{ minute}}$ ) at locations in Nowra on the south side of the Shoalhaven River,
- 27 dBA ( $L_{eq, 15 \text{ minute}}$ ) at locations in Meroo Street, Bomaderry,
- 25 dBA ( $L_{eq, 15 \text{ minute}}$ ) at other locations in Bomaderry.

Construction Phase Noise Management Levels

- 43 dBA ( $L_{eq, 15 \text{ minute}}$ ) at locations in Terara,
- 48 dBA ( $L_{eq, 15 \text{ minute}}$ ) at locations in Bomaderry, and
- 50 BA ( $L_{eq, 15 \text{ minute}}$ ) at locations in Nowra.

The criteria are to be assessed at the most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the most-affected point within 30 metres of the residence. For upper floors, the noise is assessed outside the nearest window.

## 4. CO-GEN PLANT NOISE EMISSION

### 4.1 Co-Gen Plant and Equipment Source Noise Levels

The co-gen plant will be supplied by GE Power (GE) and for the purpose of noise modelling the overall co-gen plant has been broken down in to three components:-

- the Turbines (2),
- the heat recovery steam generators (HRSG) (2), and
- the heat exhaust stacks (4).

#### Turbines

An itemised breakdown of the constituent parts of the Turbine components have been supplied by GE and a schedule of octave band and overall 'A' frequency weighted near field sound pressure levels is shown in Table 3.

#### HRSG

The heat recovery steam generator captures heat from the gas turbine exhaust and generates steam. Details of the HRSG are not finalised at this stage, however the supplier has stipulated that it will be able to meet a near field noise target of **88 dBA at 1 metre** at any point around the unit, at 1.5 metres above ground level.

#### Exhaust Stacks

Each of the heat recovery steam generators will have a heat exhaust stack and there is also a bypass stack between each of the turbines and the generators. When the generators are down for maintenance the heat created by the turbines will exhaust via the bypass stack.

The supplier has stipulated that noise controls will be provided for each of the four exhaust stacks to achieve a **sound power level** ( $L_w$ ) at the discharge outlet of no more than **88 dBA**. This is equivalent to approximately 80 dBA at 1 metre from the outlet of each duct and this is used in calculations in this assessment.

The Turbines and the HRSG plant will be located within a purpose-built building and the exhaust stacks will penetrate the roof.



**Table 3** **L<sub>eq</sub> Near Field Sound Pressure Levels – Plant and Equipment – Turbine Components LM2500 Classic (as supplied by GE)**

Plant item	dBA	Sound Pressure Levels (dB) at Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
Air filter inlet faces	79	87	88	78	74	69	75	65	51
Air filter house casing	85	92	94	83	79	75	79	72	62
Air inlet plenum	86	92	95	86	82	78	77	76	66
Turbine Enclosure	86	91	98	85	81	77	74	77	64
Turbine combustion inlet	88	93	101	86	81	77	74	75	62
Turbine exhaust inlet	84	91	97	84	77	76	72	69	62
Turbine vent outlet	85	92	98	84	79	76	73	74	63
Coupling guard to TE	84	89	96	82	80	77	73	73	61
Coupling guard to GE	86	90	97	85	81	78	74	78	68
Gear box	87	93	93	87	82	80	81	78	72
GB Shaft	83	89	89	81	77	74	78	71	64
Generator enclosure	82	91	94	82	77	71	69	66	56
Generator cooling	82	91	94	82	78	71	70	67	56
Generator Exciter	80	90	91	81	76	69	68	63	53
Generator lube oil	80	90	92	81	77	69	66	62	52
Side Exhaust ex joint	80	86	90	79	75	71	73	69	58

## 4.2 Noise Level Predictions

### 4.2.1 Modelling Equations

For all items of plant and equipment located within the proposed building, the level of noise emission has been calculated from the formula:-

$$Lp_2 = Lp_1 - R_w + 10 \log_{10} S - 20 \log_{10} r - 14 + DI \text{ dBA}$$

Where:

- L<sub>p2</sub> is the predicted noise level at the receiver,
- L<sub>p1</sub> is the internal noise level,
- R<sub>w</sub> is the weighted sound reduction index of the building element (wall, roof, windows, openings, etc),
- S is the area of the building element (m<sup>2</sup>),
- r is the distance between the receiver and the building element,
- DI is the directivity index of the façade.

For noise emission emanating from the four exhaust stacks (2 operating at any one time), the external noise level at each receptor has been calculated from the formula:-

$$L_{eq} = L_w + Dc - A$$

Where:

- $L_w$  is the sound power level of the noise source;
- $Dc$  is directivity correction; and
- $A$  is the attenuation that occurs during the propagation from source to receiver.

The term  $A$  in the equation includes attenuation from geometric divergence (distance loss), atmospheric absorption, ground absorption, barrier effects and miscellaneous other effects.

This model derives from the International Standard ISO 9613-2 (1996(E)) '*Acoustic – Attenuation of sound during propagation outdoors Part 2 General method of calculation*'.

The method described in the Standard is general in the sense that it may be applied to a wide variety of noise sources, and covers the major mechanism of sound attenuation. The method allows for propagation conditions with the wind blowing from the source to the receiver.

The equations for calculating downwind sound pressure level, including the equations for attenuation... are the average for meteorological conditions within these limits.

These equations also hold, equivalently, for average propagation under well-developed moderate ground-based temperature inversion, such as commonly occurs on clear, calm nights.

#### 4.2.2 Predicted Noise Levels

Predicted noise levels at each receptor location are shown in Table 4 below.

The predicted noise levels assume recommendations made in Section 6 of this report have been implemented.

**Table 4 Predicted Noise Levels at Receptor Locations**

Description	Predicted Noise Level $L_{eq, 15 \text{ minute}}$ (dBA) at Receptor Location			
	Location 1	Location 2	Location 3	Location 4
<b>Design Noise Goal (<math>L_{eq, 15 \text{ minute}}</math>)</b>	<b>23</b>	<b>23</b>	<b>27</b>	<b>25</b>
Turbine and HRSG plant within building	16	21	24	23
Exhaust stacks	<5	15	25	22
<b>Combined</b>	<b>16</b>	<b>22</b>	<b>27</b>	<b>25</b>
Complies	Yes	Yes	Yes	Yes

The calculations and predictions in Table 4 consider distance loss to each receptor as well as the following:-

- Construction of buildings as per recommendations made in Section 6.1 including the maximum allowable exhaust openings,
- Sound levels as detailed in Table 3 based on suppliers information,
- Ground absorption to receptor R1 only.

#### 4.2.3 Modifying Factor Assessment

Table 5 below shows the predicted level of noise emission from the co-gen plant at the nearest receptor in Bomaderry (R3) in terms of the octave band and overall A frequency weighted sound pressure levels from the co-gen building component.

**Table 5 Predicted  $L_{eq}$  Sound Pressure Levels – Co-Gen Plant Building at R3**

Plant item	dBA	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
Co-gen plant building	24	38	39	22	12	8	<5	<5	<5

A preliminary assessment of the potential for low frequency noise is conducted by comparing the predicted A frequency weighted and C frequency weighted noise levels, as is required by the *Noise Policy for Industry* 2017 Fact Sheet C. The difference in A weighted and C weighted levels for the spectrum in Table 5 is **17 dB**.

A correction to the predicted noise level is to be applied where the difference in the predicted A weighted and C weighted noise levels is greater than 15 dB. A comparison of the one-third octave noise levels with the prescribed base levels is required to be undertaken only when the difference between the overall A and C weighted levels exceeds 15 dB.

Whilst that is the case in this instance, there is no one-third octave band data available to carry out the assessment.

As can be seen in Table 3 of this Report, there are significant amounts of sound energy at the octave band frequencies centred on 63 and 125 Hz for a number of components in the Turbine system. However, the spectral component of other noise sources such as the HRSG plant and its heat exhaust stack are unknown at this stage.

Also, given the predicted level of noise at the closest receptors in Bomaderry (being 25 to 27 dBA), it cannot be determined whether the level of noise emission as received at the nearest receptors will display low frequency characteristics. There is certainly potential for this to be the case and if it were the case then up to a 5 dB penalty would be applied to the predicted noise levels.

A further detailed assessment will be undertaken during the noise design verification stage, once additional noise data is available for the HRSG components of the plant. In the event that a penalty is required to be applied for low frequency noise, then additional noise controls will be required to ensure that the overall noise levels from the Site remain within the EPL noise limits.

It is worth noting that the predicted level of noise emission from the cogeneration plant will be well below the EPL noise limits at all receptor locations even with a penalty applied for the modifying factor corrections. As such, any reduction in noise that may be required to ensure cumulative noise levels remain within those noise limits, may be achieved through reductions of other items of plant and equipment at the Shoalhaven Starches facility.

## 5. CONSTRUCTION NOISE EMISSION

The construction works will consist of piling, pouring of concrete slabs for the buildings, construction of the building and the installation of all plant and equipment.

Table 6 below shows a schedule of sound power levels for typical construction equipment.

**Table 6 Typical Construction Equipment –  $L_{eq}$  Sound Power Levels**

Description	$L_{eq}$ Sound Power Level (dBA)
Auger Piling (CFA Rig)	113
Hammer or Driven Piling	118
Mobile Crane (Diesel)	110
30 Tonne Excavator	110
Concrete Truck / Pump	105
Dump Truck	110
Grinder	105
Power Saw	101

Table 7 below shows the predicted level of potential noise emission from construction activities at each of the receptor locations.

**Table 7 Predicted Noise Levels at Receptor Locations – Construction Phase**

Description	Predicted Noise Level $L_{eq, 15 \text{ minute}}$ (dBA) at Receptor Locations			
	Location 1	Location 2	Location 3	Location 4
<b>Noise Design Goal (<math>L_{eq, 15 \text{ minute}}</math>)</b>	<b>43</b>	<b>50</b>	<b>48</b>	<b>48</b>
With hammer piling	41	51	58	57
With auger piling	38	48	55	53
Construction activity (no piling)	35	45	52	51
Complies	Yes	No + 1 dB (if hammer piling)	No + 4 to 10 dB	No + 3 to 9 dB

There is potential for noise construction noise design goals to be exceed at receptors R2, R3 and R4 on occasion.

The exceedence of 1 dB predicted at receptor R2 may only occur if hammer piling is undertaken.

Recommendations relating to receptors R3 and R4 are provided in Section 6.3 below.

## 6. RECOMMENDED NOISE CONTROLS

The predicted noise levels detailed in Section 4.2.2 of this Report assume that the following noise control measures have been implemented and continue to be adhered to.

### 6.1 Buildings Construction

#### *Walls*

- All external walls of the co-gen plant building will be constructed using 150 mm thick (minimum) tilt up concrete panels or in situ concrete which will be acceptable,

#### *Roof / Ceiling*

- The roof of the building should achieve a minimum  $R_w$  rating of 45, with minimum R ratings of:-
  - 26 dB at 63 Hz, and
  - 28 dB at 125 Hz.
- Example roof construction materials may include:-
  - Hebel power panel, OR
  - Masonry (100 mm concrete slab), OR
  - Corrugated sheet steel with 10 mm thick sound rated plasterboard (or 9 mm thick fibre cement sheet) below with R 3.0 (minimum) polyester or glaswool insulation in the cavity, OR
  - Any proprietary roof system meeting the minimum acoustical performance requirements,
- Any and all penetrations in the roof should be acoustically sealed.

The construction details of the roof system will be finalised prior to commencement of construction.

#### *Exhaust Penetrations*

There should be no acoustically untreated penetrations in the roof of the building.

Penetrations in the roof for the four (4) exhaust stacks is discussed in Section 6.2 below.

Penetrations for passive exhaust may be located in the eastern wall of the building, providing that they do not exceed a total of **40 m<sup>2</sup>** and that any and all penetrations are fitted with acoustic louvres with the minimum insertion losses shown in Table 8 below:-

**Table 8 Example Acoustic Louvre Sound Transmission Loss**

Description	Minimum Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Acoustic Louvre*	5	10	14	22	27	25	21	17

\* Based on Fantech SBL2 louvre

## 6.2 Exhaust Duct Roof Penetrations

The supplier has stipulated that each of the four (4) exhaust stacks that will penetrate the building roof will not exceed a sound power level at the stack outlet of 88 dBA, which equates to an energy average sound pressure level ( $L_{eq}$ ) of **70 dBA** when measured at 3 metres from the outlet.

The construction of the stack or duct must also be such that it does not undermine the acoustical integrity and performance of the roof at the penetration. For example the breakout noise from the exhaust stack walls must be a minimum 10 dB less than that at the outlet.

A final assessment will be undertaken at the Noise Design Verification stage, once the details of all proposed exhaust stacks are finalised.

## 6.3 Construction Noise

The Project Approval prescribes allowable operation hours for construction activities in Clause 11 and Clause 13, which states:-

*“During construction, the Applicant shall implement all reasonable and feasible measures to minimise the construction noise impacts of the project development.”*

Given the proximity of the co-gen plant to the township of Bomaderry, there is potential for noise goals to be exceeded at receptors R3 and R4 during a variety of works, most notably during piling activity.

Augur (CFA) or bored or rotary piling should be adopted over driven piling where practicable. Additional construction noise mitigation measures and management practises will be detailed in the Construction Noise Management Plan that will be prepared by Shoalhaven Starches in accordance with NSW EPA’s Interim Construction Noise Guideline and to satisfy Condition 13 of the Project Approval if required.



## 7. CONCLUSION

An assessment of the potential noise impact from the proposed construction and operation of a 60 MW gas fired co-generation plant to be installed at Shoalhaven Starches facility on Bolong Road, Bomaderry, NSW has been undertaken.

Noise control recommendations are made in Section 6 of this Report to reduce the level of noise emission from the co-gen plant to within site specific noise design goals at all receptor locations.

The noise design goals are established to ensure that the noise limits prescribed in Environment Protection Licence 883 continue to be met at all receptors from the overall operation of the facility.

The level of noise emission from the construction phase of the may exceed the noise management levels set by the NSW EPA's *Interim Construction Noise Guideline* at receptors in Bomaderry on some occasions.

Construction noise mitigation measures are included in the Construction Safety & Environmental Management Plan prepared by Shoalhaven Starches.



**Matthew Harwood**, MAAS

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Attachments:-

Important Note

Appendix A – Modifying Factor Adjustments – EPA Fact Sheet C

**Important Note**

*All products and materials suggested by Harwood Acoustics are selected for their acoustical properties only. Recommendations made in this report are intended to resolve acoustical problems only, therefore all other properties such as aesthetics, air flows, chemical, corrosion, combustion, construction details, decomposition, expansion, fire rating, fumes, grout or tile cracking, loading, shrinkage, smoke, exhaust etc. are outside Harwood Acoustic's field of expertise and **must** be checked with the supplier or suitably qualified specialist before purchase.*

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## Modifying Factor Corrections (EPA 2017)

## Appendix A

**Table C1 Modifying Factor Corrections** (from Table C.1 of the NSW Noise Policy for Industry 2017)

Factor	Assessment/ Measurement	When to Apply	Correction	Comments
Tonal Noise	One-third octave band analysis using the objective method for assessing the audibility of tones in noise – simplified method ( <i>ISO1996-2:2007 – Annex D</i> ).	Level of one-third octave band exceeds the level of the adjacent bands on both sides by: <ul style="list-style-type: none"> <li>• 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz</li> <li>• 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz</li> <li>• 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz.</li> </ul>	5 dB	Third octave measurements should be undertaken using unweighted or Z-weighted measurements. <b>Note:</b> Narrow-band analysis using the reference method in <i>ISO1996-2:2007, Annex C</i> may be required by the consent/regulatory authority where it appears that a tone is not being adequately identified, e.g. where it appears that the tonal energy is at or close to the third octave band limits of contiguous bands.
Low Frequency Noise	Measurement of source contribution C-weighted and A-weighted level and one-third octave measurements in the range 10–160 Hz	Measure/assess source contribution C- and A-weighted Leq,T levels over same time period. Correction to be applied where the C minus A level is 15 dB or more and: <ul style="list-style-type: none"> <li>• where any of the one-third octave noise levels in Table C2 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period</li> <li>• where any of the one-third octave noise levels in Table C2 are exceeded by more than 5 dB and cannot be mitigated, a 5-dB(A) positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2-dB(A) positive adjustment applies for the daytime period.</li> </ul>	2 or 5 dB	A difference of 15 dB or more between C- and A-weighted measurements identifies the potential for an unbalance spectrum and potential increased annoyance. The values in Table C2 are derived from Moorhouse (2011) for DEFRA fluctuating low-frequency noise criteria with corrections to reflect external assessment locations.

**Table C1 Modifying Factor Corrections** (from Table C.1 of the NSW Noise Policy for Industry 2017) *Cont...*

Factor	Assessment/ Measurement	When to Apply	Correction	Comments
Intermittent Noise	Subjectively Assessed but should be assisted with measurement to gauge the extent of change in noise level.	The source noise heard at the receiver varies by more than 5 dB(A) and the intermittent nature of the noise is clearly audible.	5 dB	Adjustment to be applied for <b>night-time only</b> .
Duration	Single-event noise duration may range from 1.5 m to 2.5 h	One event in any 24-hour period	0 to -20dBA	The acceptable noise trigger level may be increased by an adjustment depending on duration of noise (see Table C.3)
Maximum adjustment	Refer to individual modifying factors	Where two or more modifying factors are indicated	Maximum correction of 10 dBA <sup>2</sup> (excluding duration correction)	

**Notes:**

1. Corrections to be added to the measured or predicted levels, except in the case of duration where the adjustment is to be made to the criterion.
2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.
3. Where narrow-band analysis using the reference method is required, as outlined in column 5, the correction will be determined by the ISO1996-2:2007 standard.