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# Environmental Noise 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

*Prepared by: -*

Matthew Harwood MAAS
20th January 2021

# Document Control Page

| Revision | Author | Released By | Date |
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Shoalhaven Starches Pty. Ltd. commissioned Harwood Acoustics Pty. Ltd. to carry out an Environmental Noise Impact Assessment for a proposed modification to the Shoalhaven Starches Expansion Project (SSEP), approval reference 06_0228 at its facility at 160 Bolong Road, Bomaderry, NSW.

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

Accordingly, Harwood Acoustics Pty. Ltd. 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 Pty Ltd and may not be suitable for use beyond that scope.

Harwood Acoustics Pty. Ltd. undertakes no duty nor accepts any responsibility to any third party who may rely upon this report.



Advice and recommendations provided in this report are in relation to acoustical issues only. No claims of expertise are made, and no liability is accepted, in relation to issues falling outside the field of acoustical consulting. These may include, but are not limited to, structural and waterproofing considerations, fire rating or thermal rating. Relevant authorities and / or experts should be consulted regarding areas other than acoustics.

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## 1. INTRODUCTION AND SUMMARY

Shoalhaven Starches Pty. Ltd. is part of the Manildra Group of companies and its 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 plant 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 application / 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 of 30 MW each, providing a total power to the site of 60 MW and associated Heat Recovery Steam Generators (HRSG). The new gas fired co-generation plant will replace the previously approved gas fired and coal fired co-generators. In addition, Shoalhaven Starches also proposes to convert its existing coal fired boilers to gas.

This modification application also seeks approval for the relocation of the previously approved Dried Distillers Grain dryer # 6 (DDG # 6) and associated cooling towers of which there will be six.

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 (EPA) 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).

An initial Environmental Noise Assessment was prepared by Harwood Acoustics Pty. Ltd., reference 2103012E-R, dated 8 July 2021 (the July NIA) and was submitted with the initial application for the modification.

Subsequent to the submission of the application with the accompanying July NIA, in its letter reference DOC21/936070-6, dated 26/11/2021, the NSW EPA requested additional information and clarification in relation to the noise predictions therein.

A copy of the EPA's letter is appended to this revised report in Appendix A. This revision of the noise assessment addresses the EPA's comments therein, so far as is reasonably practicable.

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 were designed for the proposal to ensure existing overall noise levels from the operation of the facility are not increased by the introduction of the new plant and equipment. These noise level goals range from 23 dBA to 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 gas turbine plant were supplied by GE for the purpose of noise modelling. Noise data for the Heat Recovery Steam Generator (*HRSG*) component of the co-gen plant is based on a maximum noise level that was stipulated by GE to the HRSG supplier and that the supplier has confirmed will be met (i.e. not exceeded), as detailed in Section 4.1 of this Report. The co-gen plant will be located within a building of concrete construction.

Recommendations are made in Section 7 of this report to reduce the level of noise emission from the co-gen plant to within the design noise goals at all receptor locations, based on the noise data supplied by the manufacturer.

Recommendations include advice on the construction of building elements; providing target noise levels for the four discharge exhaust stacks that discharge externally from the building; restricting the total number of penetrations in the walls of the building for ventilation and installing acoustic louvres in those openings.

Recommendations are also made to ensure that the level of noise emission from the operation of DDG # 6 and the six cooling towers, in the proposed new locations, do not increase overall noise levels from the site. Recommendations include the stipulation of maximum allowable noise levels for the cooling towers and advice on the construction of the building housing the DDG plant and equipment.

Consideration is also given in Section 7 of this Report to the cumulative noise impacts arising from the co-gen plant in conjunction with other approved modifications either currently under construction or soon to commence construction along with existing noise levels from the overall operation of the existing Shoalhaven Starches facility.

The construction works for the co-gen plant 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.

Section 7.4 of this Report addresses and provides recommendations in relation to the potential for cumulative noise impacts from the construction of various projects simultaneously.

## 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, located to the north.

The nearest residential receptor locations to the proposal are at addresses and distances as follows:-

- Location 1 – Terara Road, Terara approximately 1000 metres to the south east,
- Location 2 – Riverview Road, Nowra approximately 845 metres to the south,
- Location 3 – Meroo Street / Tarawara Street, Bomaderry approximately 370 metres to the north west,
- Location 4 – Coomea Street, Bomaderry approximately 430 metres to the north west.

These locations are listed consistent 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 building to each receptor as a reference only. 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.

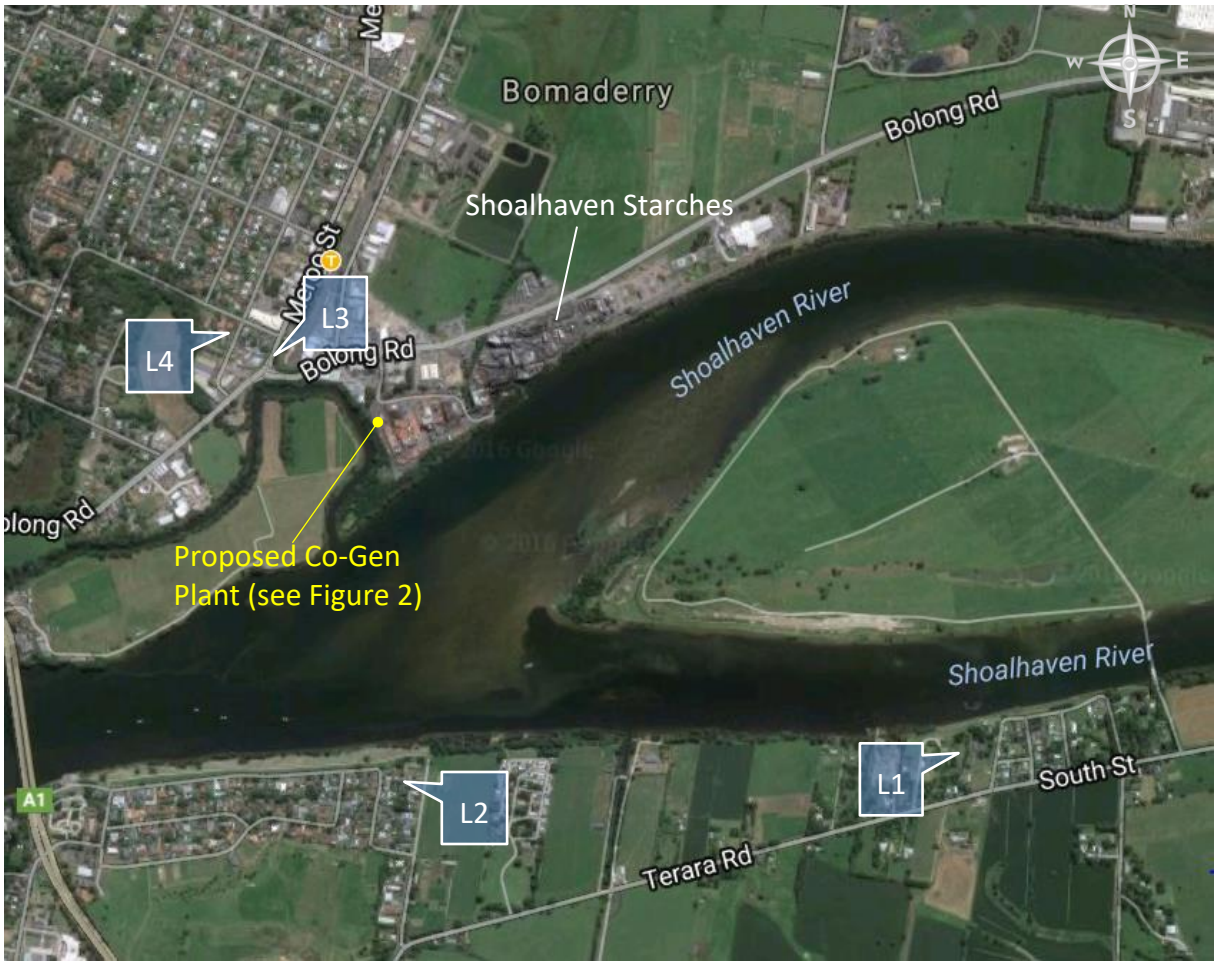


***Figure 1. Location Plan – Shoalhaven Starches, Bomaderry, NSW*** *(source: Google Maps ©)*

Figure 2 below shows the location of the co-gen plant in the 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 plant 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 of 30 MW each, providing a total power to the site of 60 MW. The new gas fired co-generation plant will replace the previously approved gas fired and coal fired co-generators. In addition, Shoalhaven Starches also propose to convert its 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 gas turbine were supplied by GE for the purpose of noise modelling. Noise data for the Heat Recovery Steam Generator (*HRSG*) component of the co-gen plant is based on a maximum noise level that has been stipulated by GE to the HRSG supplier and that the supplier has confirmed will be met (i.e. not exceeded), as detailed in Section 4.1 of this Report.

The co-gen plant will be located within a concrete building structure, or acoustically equivalent construction. The building housing the cogeneration plant and HRSGs will be approximately 62 metres long (north / south) by 45 metres wide (east / west) and 20.5 metres high.

At the southern end of the co-gen building will be separate building containing an enclosed substation and process area.

Floor plans and elevations of the proposed buildings are shown in Figures 4, 5 and 6 and full details can be seen in Architects Edmiston Jones Pty Ltd architectural drawings for Job No. 21-0054, dated 10/11/21, rev P2.

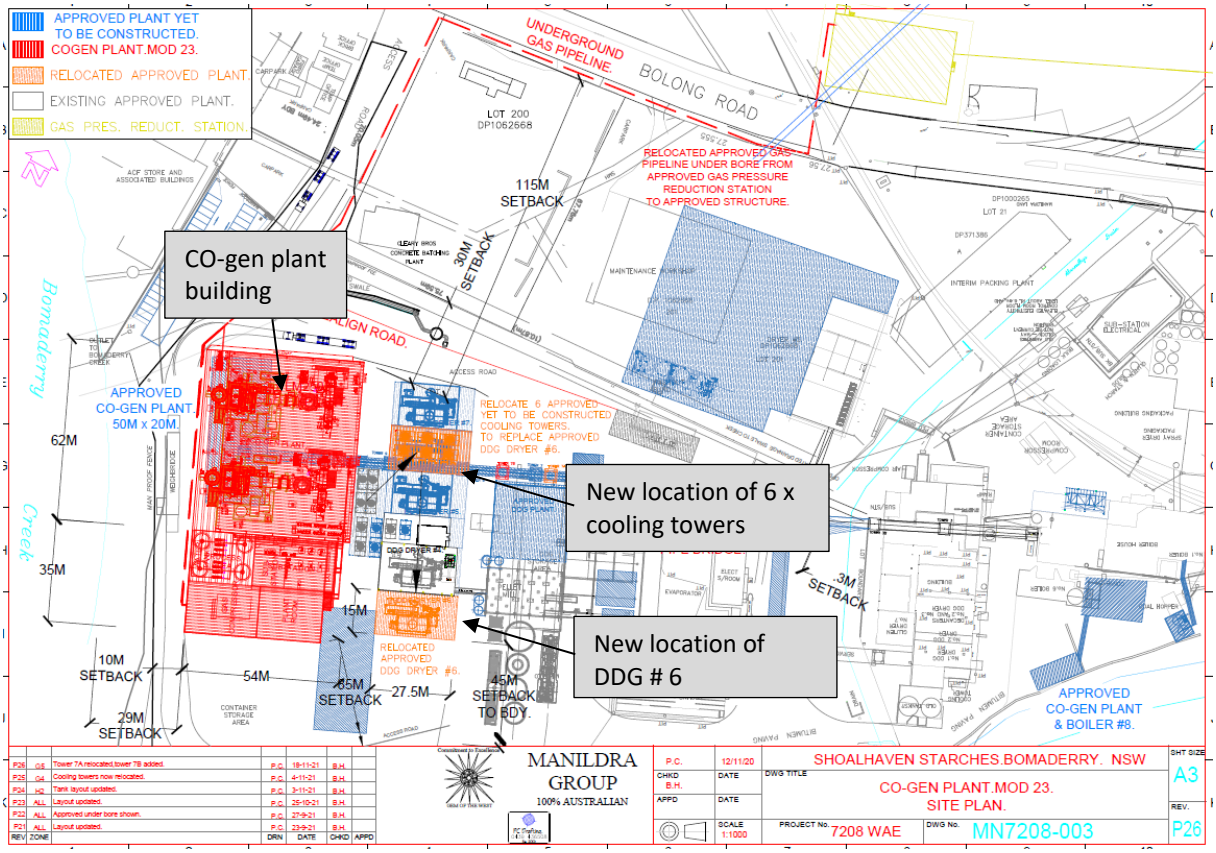


***Figure 3. Proposed Co-Gen Site Plan***

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

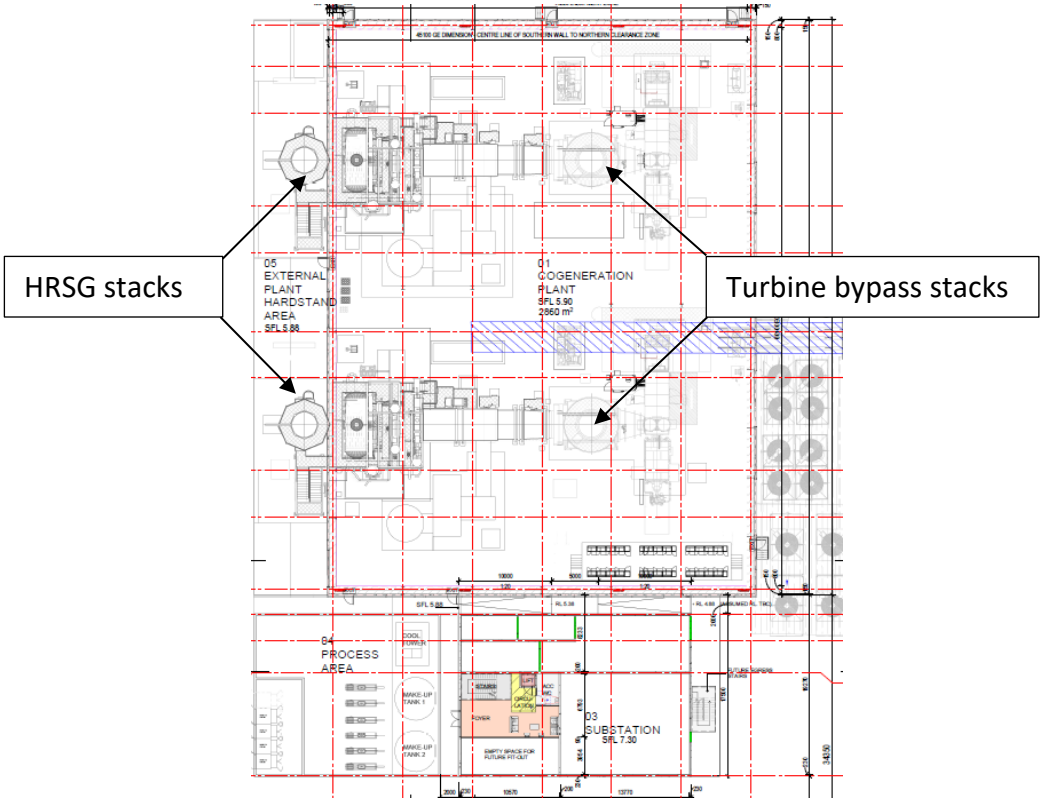


***Figure 4. Proposed Ground Floor Plan Overall***

*(source: Architects Edmiston Jones' architectural drawing AR002, Rev P2 for Job No. 21-0054, dated 10/11/21)*

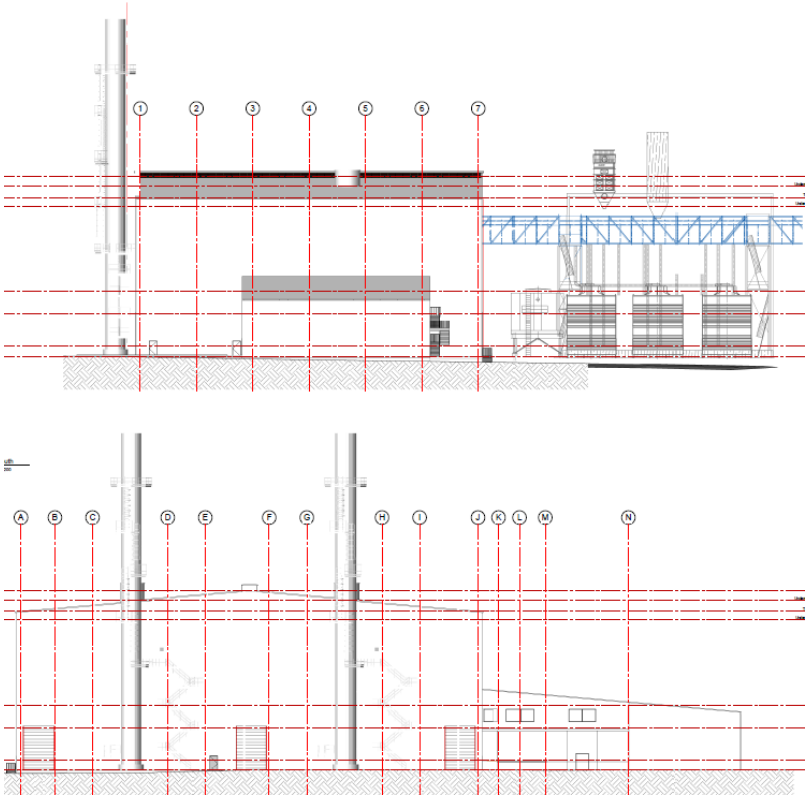

***Figure 5. South and West Building Elevations***

*(source: Architects Edmiston Jones' architectural drawing AR201, Rev P2 for Job No. 21-0054, dated 10/11/21)*

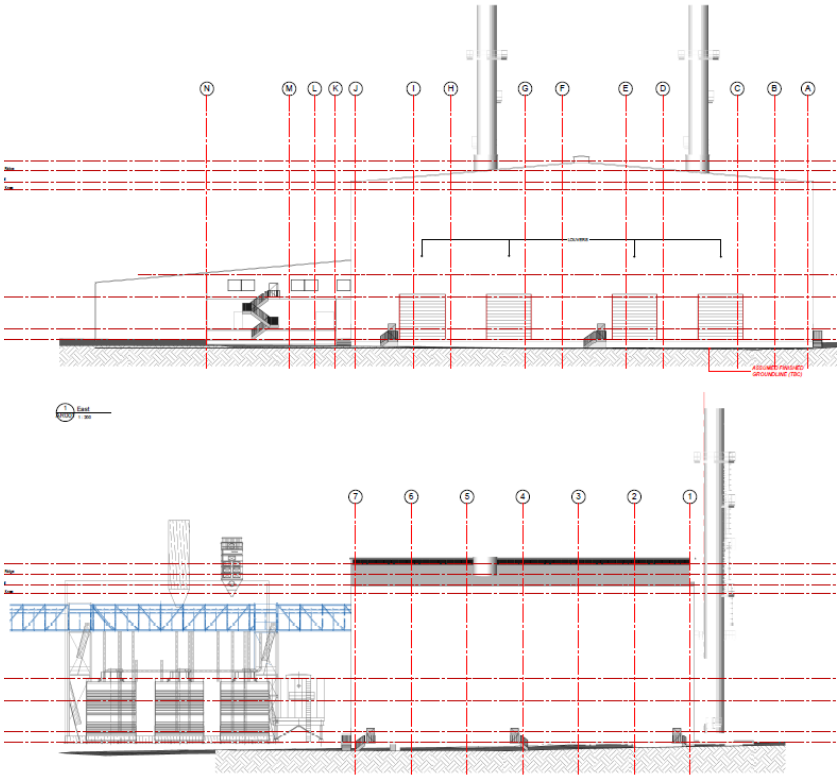

***Figure 6. North and East Building Elevations***

*(source: Architects Edmiston Jones' architectural drawing AR202, Rev P2 for Job No. 21-0054, dated 10/11/21)*

This modification also seeks approval for the relocation of approved Dried Distillers Grain (DDG) dryer # 6 (DDG # 6) and six previously approved cooling towers. It is proposed to relocate the six approved cooling towers to the location in which DDG # 6 was previously approved, as shown in Figure 3. DDG # 6 is then proposed to be relocated to the south on the southern side of the existing DDG # 4.

Harwood Acoustics Pty. Ltd. prepared an Environmental Noise Assessment for Modification 11 in October 2016, reference 1609010E-R, dated 27/10/2016 (the Mod 11 NIA). Modification 11 requested approval for a reduction in the number of approved DDG dryers from six (under Project Approval 06_0228) to four, as well as a slightly modified footprint to the dryers and the construction of two new bio filters. The Mod 11 NIA established noise levels for a DDG dryer and associated cooling towers. These noise levels are detailed in Section 4.1 of this Report and are used in this assessment to predict the level of noise emission from the proposed relocation of DDG # 6 and the six cooling towers.

## 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 incorporated 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 Modification Assessment Requirements*

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

Following submission of the initial noise impact assessment, dated July 2021, the NSW Environment Protection Authority (EPA) has requested additional information and clarification in relation to the predicted noise levels and assessment methodology. A copy of the its letter reference DOC21/936070-6, dated 26/11/2021 is provided in Appendix A.

## 3.2 NSW Environment Protection Authority's (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 (dated 31 October 2009) and then revised (dated 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 Environment 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 excess 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 was given in Section 6 of this Report to the potential for noise impact on residential receptors emanating from construction activities associated with the co-gen plant.

Recommendations are also provided in Section 7.4 of this Report to minimise the potential for cumulative noise impacts from construction activities associated with this project in the event that this occurs simultaneously with the construction of other projects at the Shoalhaven Starches facility.

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 many noise surveys in Nowra, Bomaderry and Terara and has found day time background noise levels range from 33 to 40 dBA depending on the location, as shown in Table 1 below.

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

| Location | Period / Time of Day | Rating Background Level ($L_{90}$) |
|---|---|---|
| 135 Terara Road, Terara March 2012 | Day (7 am to 6 pm) | **33 dBA** |
| 55 Terara Road, Terara February 2015 | Day (7 am to 6 pm) | **36 dBA** |
| Cambewarra Rd, Bomaderry July 2010 | Day (7 am to 6 pm) | **40 dBA** |
| Shoalhaven Village Caravan Park, Nowra March 2012 | Day (7 am to 6 pm) | **40 dBA** |

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 were used to determine the noise management levels as shown in Table 2 below.

**Table 2 $L_{eq}$ Noise Management Levels from Construction Activities**

| Receptor Location | Noise Management Level | How to Apply |
|---|---|---|
| Location 1 (Terara)<br><br>Location 2 (Nowra)<br><br>Locations 3 & 4 (Bomaderry) | **43 dBA** (33 + 10)<br><br>**50 dBA** (40 + 10)<br><br>**50 dBA** (40 + 10) | The noise affected level represents the point above which there may be some community reaction to noise.<br>▪ Where the predicted or measured $L_{Aeq\ (15\ min)}$ 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.<br>▪ 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. |
| | **Highly noise affected 75 dB(A)** | The highly noise affected level represents the point above which there may be strong community reaction to noise.<br>▪ 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:<br>1. 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)<br>2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. |

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

Construction Phase Noise Management Levels

- *43 dBA ($L_{eq,\ 15\ minute}$) at locations in Terara,*
- *48 dBA ($L_{eq,\ 15\ minute}$) at locations in Bomaderry, and*
- *50 BA ($L_{eq,\ 15\ minute}$) 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 cog-gen plant will be supplied by GE Power (hereafter GE) and comprise two LM2500 model gas turbines and the associated Heat Recovery Steam Generators (HRSG).

The HRSG components will be supplied by John Cockerill Australia, contracted by GE.

*LM2500 Gas Turbines Noise Levels*

An itemised breakdown of the constituent parts of the gas turbine components were supplied by GE and an attendant schedule of overall 'A' frequency weighted and octave band centre frequency near field sound pressure levels which are shown in Table 3. A noise map prepared and provided by GE representing the near field sound pressure levels around the LM2500 is shown in Figure 7.

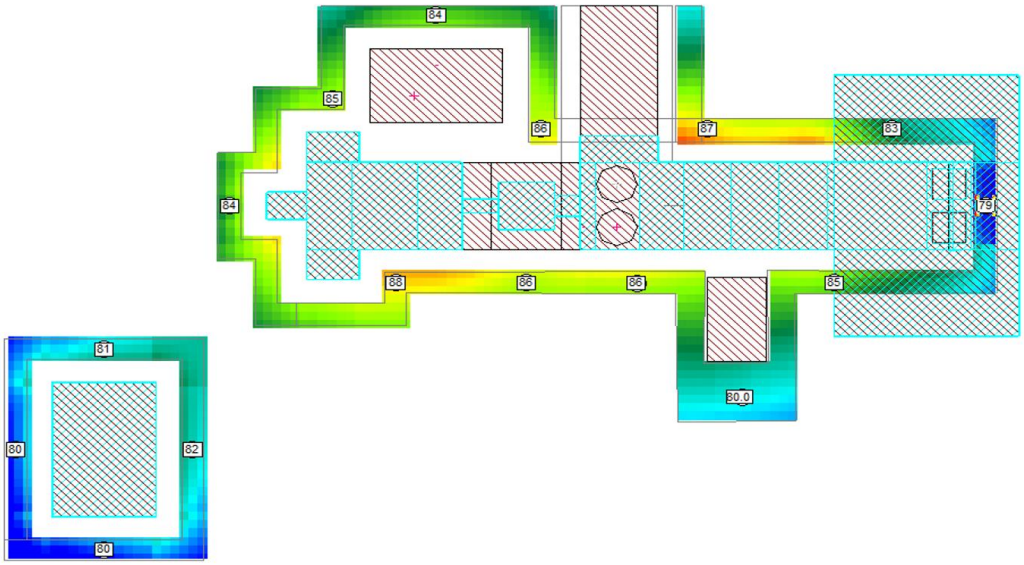


***Figure 7. Near Field Noise Map of LM2500 Gas Turbine***

*(source: General Electric (GE Power), Houston, USA)*

The noise map shown in Figure 7 above was reportedly produced by GE using *CadnaA* acoustical modelling software and a screen shot of that model is shown in Figure 8 below.

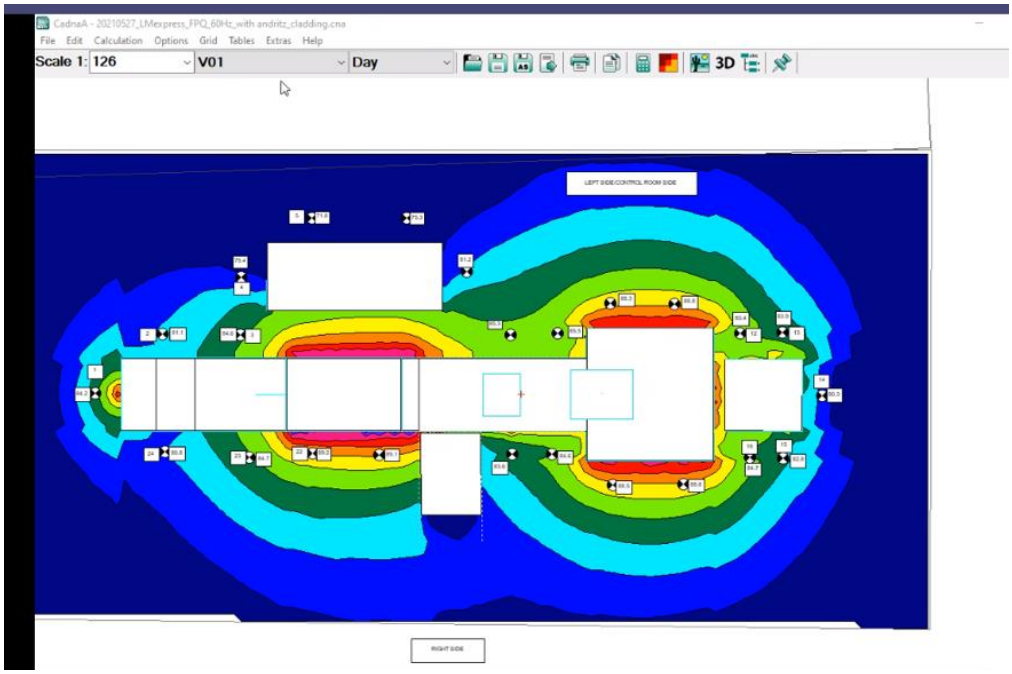


***Figure 8. Screenshot of GE CadnaA LM2500 Noise Model***

*(source: General Electric (GE Power), Houston, USA)*

The *CadnaA* software noise model prepared by GE is its intellectual property and consequently was not provided to Harwood Acoustics Pty. Ltd., however, the data from the model was provided in the form of the diagrammatical contour map / representation of the noise model shown in Figure 7 as well as the data provided in Table 3 below.

**Table 3 $L_{eq}$ Near Field Sound Pressure Levels – Plant and Equipment – Turbine Components LM2500 Classic (as supplied by GE)**

| Plant / Item of Equipment | Overall 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 |
| Gear box 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 |

One third octave band data is discussed further in Section 4.2.3 where an assessment of modifying factors is undertaken.

*HRSG*

The HRSGs capture heat from the gas turbine exhaust and generate steam. Details of the HRSGs are not finalised at this stage. GE is outsourcing the design and supply of the HRSG components to John Cockerill (Australia). GE has confirmed that the supplier will meet (i.e not exceed) a near field noise target of **85 dBA at 1 metre** at any point around the unit.

The suppliers noise level design goal of 85 dBA at 1 metre distant from any point around the HRSG plant, is equal to the noise goal of the LM2500 gas turbine. Therefore, for the purpose of noise modelling, the same noise levels as those provided in Table 3 for the LM2500 are attributed to the HRSG components in this assessment. Consideration was also given to measurements of existing boiler equipment at the Shoalhaven Starches facility for the assessment of modifying factor corrections in the absence of noise data from the supplier on the HRSGs.

*Exhaust Stacks*

Each of the HRSGs will have a heat exhaust stack and there is also a turbine bypass stack between each of the turbines and the generators. During typical operation the turbine bypass stacks will be closed and the heat from the turbines will exhaust via the HRSG stacks on the western side of the building (refer Figure 4).

When the HRSGs are down for maintenance the heat created by the turbines will exhaust via the turbine bypass stacks which penetrate the roof in the centre of the building (refer Figure 4). We are therefore instructed that at no time can all four bypass stacks operate simultaneously and that there will be, and can only ever be, two stacks operating at once, being typically both HRSG stacks or on occasion, one HRSG stack and one gas turbine bypass stack. It is not envisaged that both turbine bypass stacks operate simultaneously, as this means both HRSGs are offline and therefore there would be insufficient steam to operate the facility.

In any event, all of the exhaust stacks are to be designed 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 level is used in calculations in this assessment.

As such, any combination of two stacks operating simultaneously will result in the same noise level. The worst-case scenario acoustically is that both HRSG stacks operate simultaneously as these are the closest to the nearest receptors in Bomaderry. This is the scenario considered in the noise predictions in this assessment.

*DDG # 6 & Cooling Towers*

Table 4 below provides a schedule of overall 'A' frequency weighted sound power levels, in decibels re: 1 pW, of noise sources associated with the proposed modification. These sound power levels were provided by the client from the manufacturer's data for the Mod 11 NIA in 2016.

**Table 4 $L_{eq,\ 15\ minute}$ Sound Power Levels – Plant and Equipment**

| Description | $L_{eq,\ 15\ minute}$ Sound Power Level (dBA) |
|---|---|
| *DDG Dryer Components (Shoalhaven Starches' reference)* | |
| Condenser Tank Pump (40A103) | **80** |
| High Speed Mixer Motor (40R191) | **81** |
| Leakage Air Fan (40V261) | **71**[1] |
| Manual Condenser Pump (40P183) | **70** |
| Dryer Drive Motor (40D200) | **89** |
| Wet Scrubber Pump (40F120) | **80** |
| Vapour Fan (40V260) | **83**[1] |
| DDG Dryer Components Combined | **91** |
| Cooling tower (1 only) – low noise 'Baltimore' | **87** |

1. Housing / casing sound power level

It is advised that the DDG dryers are closed system and as such there are no external air intake or discharge outlets for the fans associated with each dryer. Consequently, the sound power levels used in calculations are based on the manufacturer's data for casing noise and not the sound power levels ascribed to the inlet or discharge side of either fan.

## 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 was calculated from the formula:-

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

Where:

- $Lp_2$ is the predicted noise level at the receiver,
- $Lp_1$ is the internal noise level,
- $R_w$ is the weighted sound reduction index of the building element (wall, roof, windows, openings, etc),
- S is the area of the building element ($m^2$),
- r is the distance between the receiver and the building element,
- DI is the directivity index of the façade.

For noise emanating from the four exhaust stacks (only <u>two</u> operating at any one time), the external noise level, as received at each receptor, was 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 other miscellaneous 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 worst-case 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 Tables 5 and 6 below for the co-gen plant and DDG # 6 respectively.

The predicted noise levels assume recommendations made in Section 7 of this report will have been implemented.

**Table 5 Predicted Noise Levels at Receptor Locations (Co-Gen Plant)**

| Noise Goal and Source / Description | Predicted Noise Level $L_{eq,\ 15\ minute}$ (dBA) as received at Receptor Location | | | |
|---|---|---|---|---|
| | Location 1 | Location 2 | Location 3 | Location 4 |
| **Design Noise Goal ($L_{eq,\ 15\ minute}$)** | **23** | **23** | **27** | **25** |
| Gas turbine LM2500 x 2 [1] | 19 | 19 | 24 | 23 |
| HRSG component x 2 | 14 | 14 | 19 | 18 |
| Exhaust stacks x 2 | 8 | 12 | 23 | 21 |
| **Combined** | **18** | **20** | **27** | **25** |
| Complies | Yes | Yes | Yes | Yes |

The calculations and predictions in Table 5 consider distance loss to each receptor as well as the following:-

- [1] includes a + 5 dB penalty for low frequency content (see Section 5),
- Construction of buildings as per recommendations made in Section 7.1 including the maximum allowable openings,
- Sound levels as detailed in Table 3 based on supplier's information.

**Table 6 Predicted Noise Levels at Receptor Locations (DDG # 6 & Cooling Towers)**

| Noise Goal and Source / Description | Predicted Noise Level $L_{eq,\ 15\ minute}$ (dBA) as received at Receptor Location | | | |
|---|---|---|---|---|
| | Location 1 | Location 2 | Location 3 | Location 4 |
| **Design Noise Goal ($L_{eq,\ 15\ minute}$)** | **23** | **23** | **27** | **25** |
| DDG # 6 | 15 | 19 | 19 | 13[1] |
| Cooling towers (6) | 5 | 21 | 14 | 13 |
| **Combined** | **15** | **23** | **20** | **16** |
| Complies | Yes | Yes | Yes | Yes |

The calculations and predictions in Table 6 consider distance loss to each receptor as well as the following:-

- [1] the reduction at receptor R4 from the DDG # 6 building is greater than that at R3 due to the completed shielding from the 20.5 metre high co-gen building compared with partial shielding from a lower roof height of the section above the substation at R3,
- Construction of the DDG # 6 building as per recommendations made in Section 7.2,
- Sound levels as detailed in Table 4 based on client's and supplier's information.

### *4.2.3 Cumulative Noise Impacts*

In order to determine the potential for overall noise impacts from Sholahaven Starches Projects, consideration was given to current noise levels from the operation of the facility along with proposed modifications and modifications currently under construction.

Current overall noise levels from the operation of the facility have not been measured or assessed by Harwood Acoustics Pty. Ltd. However, Shoalhaven Starches is required to undertake annual noise compliance monitoring.

Noise compliance testing was carried out by the Acoustic Group Pty Ltd (TAG) in February 2021 and the results of the noise compliance testing have been supplied in report reference 51.3849.R89:MCC, dated 24 June 2021.

Therefore, for the purpose of considering cumulative noise impacts, the measured noise levels from the TAG February 2021 report were used as representing the existing level of noise emission from the overall facility at each of the respective receptor Locations. These are shown in Table 7 below along with the predicted noise levels for current, approved modifications. Existing noise levels and predicted noise levels are then combined (logarithmically summed) to predict future cumulative noise levels from the Shoalhaven Starches facility. The future combined noise levels are then compared with the Environment Protection Licence Noise Limits to determine the potential for compliance.

**Table 7 Predicted Cumulative Noise Levels at Receptor Locations**

| **Noise Foal and Source / Description** | **Predicted Noise Level $L_{eq,\ 15\ minute}$ (dBA) as received at Receptor Locations** | | | |
|---|---|---|---|---|
| | **Location 1** | **Location 2** | **Location 3** | **Location 4** |
| **EPL Noise Limit ($L_{eq,\ 15\ minute}$)** | **38** | **38** | **42** | **40** |
| Existing Facility Noise Levels as at Feb 2021 (per TAG Report)[1] | 34 | 36 | <41[2] | <37[2] |
| *Predicted Noise from New and Future Modifications* | | | | |
| Mod 23 – Cogeneration plant | 18 | 20 | 27 | 25 |
| DDG # 6 & associated cooling towers | 15 | 23 | 20 | 16 |
| DDG # 5 (no associated cooling towers) | 15 | 15 | 14 | <10 |
| Mod 21 & Mod 9 – Packing plant | 28 | 28 | 32 | 30 |
| Mod 16/17 – GD 8 | 23 | 23 | 27 | 25 |
| Mod 16/17 – SPB | 23 | 23 | 27 | 25 |
| Mod 19 – Beveridge grade ethanol | 17 | 20 | 22 | 23 |
| New Mods combined | 31 | 32 | 35 | 33 |
| **Plus existing noise (row 2 in this table)** | **36** | **37** | **42** | **39** |
| **EPL Noise Limit ($L_{eq,\ 15\ minute}$) repeated** | **38** | **38** | **42** | **40** |
| **Complies** | **Yes** | **Yes** | **Yes** | **Yes** |

Notes:-

1. As quoted from Acoustic Group Pty Ltd (TAG) report reference 51.3849.R89:MCC, dated 24 June 2021,
2. 41 and 37 respectively used as a worst-case scenario (rather than 'less than').

## 5. MODIFYING FACTOR ADJUSTMENT ANALYSIS

In order to address the EPAs comment in relation to modifying factor corrections that may be applicable to the co-gen plant, GE representatives visited a facility at the university of Texas, USA to undertake noise measurements of a reportedly similar LM2500 gas turbine model.

Noise measurements inside and outside of the masonry building housing the LM2500 gas turbine. Figure 9 below shows the $L_{eq}$, short-term one-third octave band spectra provided by GE of a measurement within the building in the reverberant field.

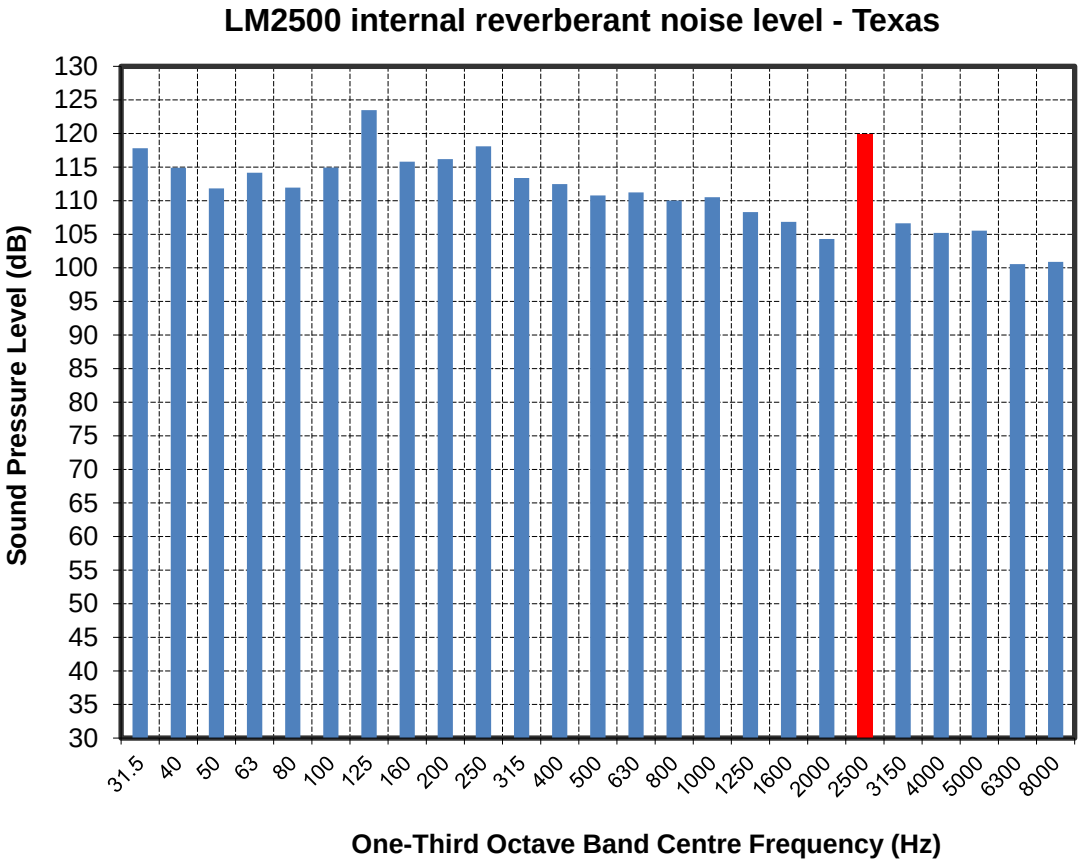


***Figure 9. One-Third Octave Band Spectrum LM2500 Inside Reverberant Field***

*(source: General Electric (GE Power), Houston, USA)*

It was reported by GE that there was other high noise level plant and equipment located within the building that affected the overall level of noise with respect to the high noise levels recorded. GE have confirmed that the LM2500 unit to be supplied to Shoalhaven Starches for this project will achieve (i.e. not exceed) the noise rating of 85 dBA at 1 metre from any location around the entire plant.

Notwithstanding this, and the higher noise levels provided as shown in Figure 9, there is a tonal component at the one-third octave band center frequency of 2500 Hz.

Figure 10 below shows the measurement locations outside the building as being immediately adjacent to standard weather louvre openings and the other being at a distance from the masonry wall without openings. Figures 11 and 12 show the $L_{eq}$, short-term one-third octave band centre frequency spectra for each of these measurements respectively, provided by GE.

***Figure 10. Photographs of the External Measurement Locations (LM2500 unit, Texas, USA) - Supplied by GE.***

*(source: General Electric (GE Power), Houston, USA)*

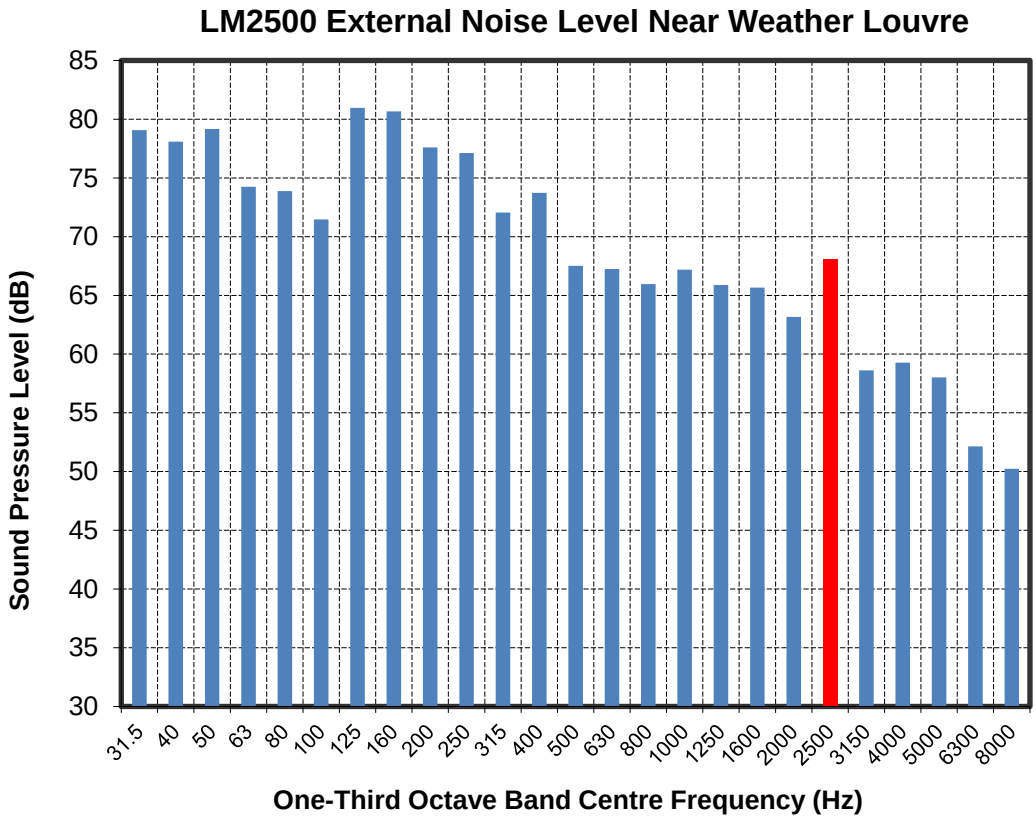


***Figure 11. One-Third Octave Band Spectrum LM2500 Outside Louvre Opening***

*(source: General Electric (GE Power), Houston, USA)*

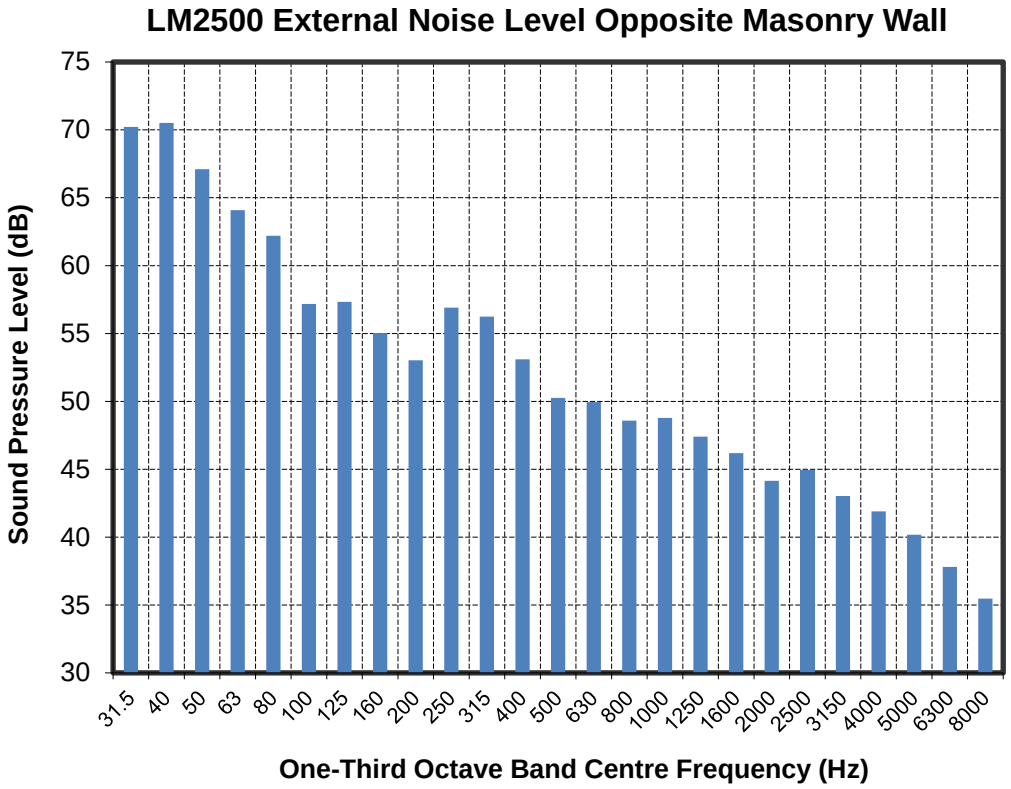


***Figure 12. One-Third Octave Band Spectrum LM2500 Outside Masonry Wall***

*(source: General Electric (GE Power), Houston, USA)*

**Discussion**

The tonal component at the one-third octave band center frequency of 2500 Hz which is evident within the building (Figure 9) is still evident immediately outside the weather louvred building openings (refer Figure 11).

However, there are no tonal components in the spectrum provided for the measurement outside the masonry wall (refer Figure 12).

Mid to higher frequencies are readily attenuated by masonry building elements as will be the case in this instance and, based on the data supplied by GE, it is not expected that the LM2500 will exhibit tonality at the receptor locations in Bomaderry, Nowra or Terara.

Whilst there is no one-third octave band or octave band centre frequency noise data available for the HRSG equipment, Harwood Acoustics Pty. Ltd. has undertaken several noise surveys of the existing boilers and associated equipment at the Shoalhaven Starches Site. Figures 13 and 14 below show typical one-third octave band centre frequency spectra for the existing boiler equipment.

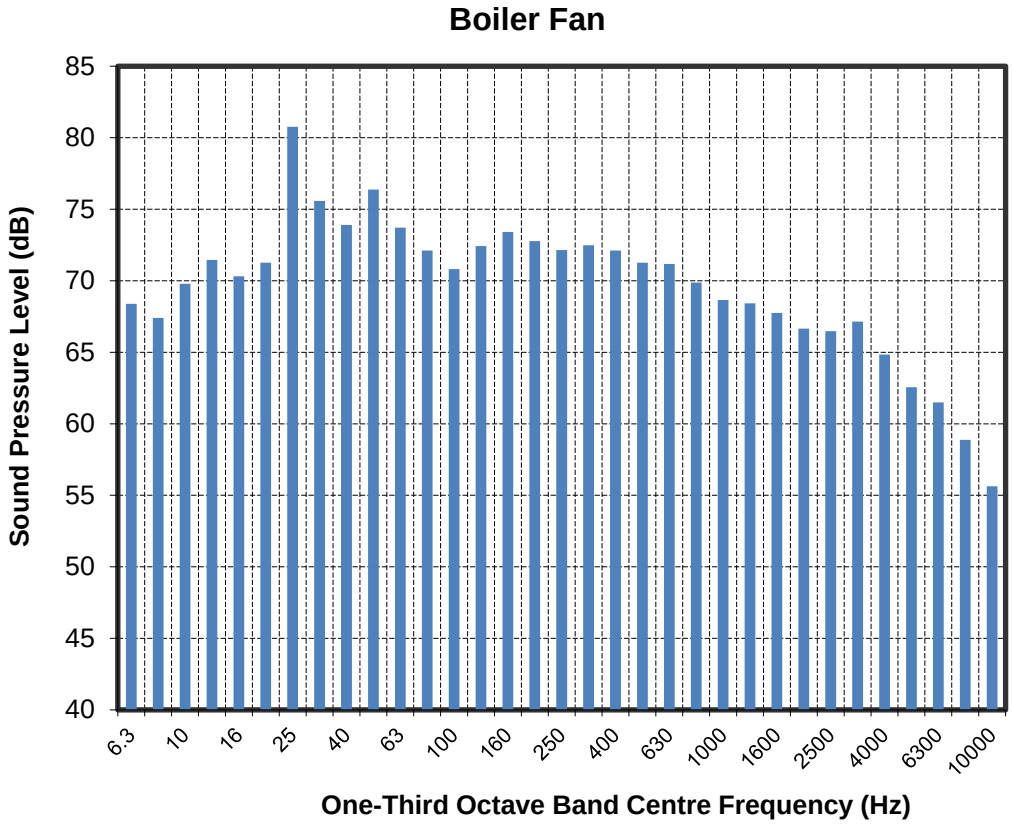


***Figure 13. One-Third Octave Band Spectrum Boiler Fan***

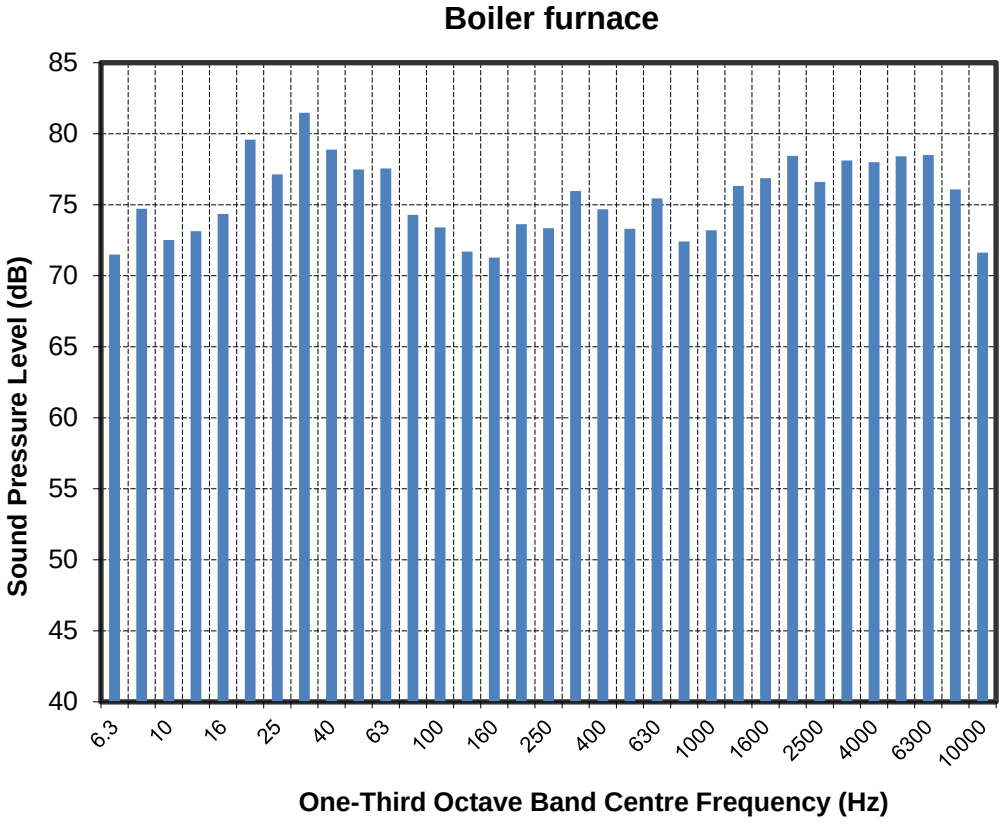


***Figure 14. One-Third Octave Band Spectrum Boiler Furnace***

The existing on-site boiler equipment does not display tonal characteristics. This equipment may be considered similar to the HRSG equipment which is to be installed as part of the cogeneration plant.

Given that the new LM2500 gas turbines and associated HRSG equipment will be located within an enclosed masonry building without acoustically untreated openings, it is reasonable to assume that the noise emissions, as received at distant receptor locations, will not display tonal characteristics requiring modifying factor corrections.

Further to this, GE has committed to ensure that there will not be any tonal components to the noise generated by the equipment to be installed.

Figure 15 below shows the $L_{eq}$, short-term one-third octave band centre frequency spectra measured by Harwood Acoustics Pty. Ltd. at the Shoalhaven Starches facility for the cooling tower associated with DDG # 4.

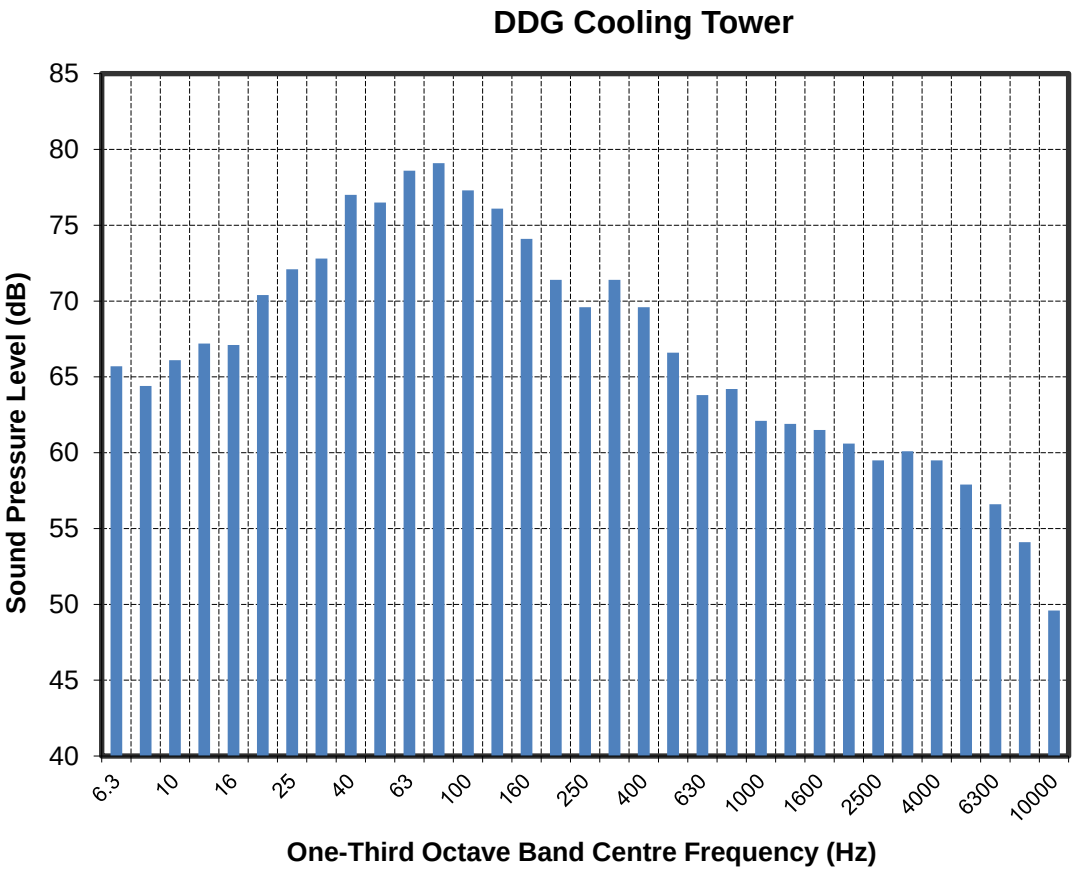


***Figure 15. One-Third Octave Band Spectrum Boiler Furnace***

The DDG dryer cooling tower does not display tonal characteristics.

*Low frequency noise assessment*

To date there is insufficient data and information available from the manufacturer to undertake a detailed assessment of the potential for low frequency noise. The one-third octave band data provided by GE from the Texas University measurements does not contain levels below 31.5 Hz.

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.

As a worst-case scenario, therefore, a 5 dB penalty is applied to the predicted noise levels for the turbine equipment in this assessment as shown in Table 5.

## 6. 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 8 below shows a schedule of sound power levels for typical construction equipment.

**Table 8 Typical Construction Equipment – $L_{eq}$ Sound Power Levels**

| Equipment / 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 9 below shows the predicted level of potential noise emission from construction activities at each of the receptor locations.

**Table 9 Predicted Noise Levels at Receptor Locations – Construction Phase**

| Noise Goal / Activity / Description | Predicted Noise Level $L_{eq,\ 15\ minute}$ (dBA) as received at Receptor Locations | | | |
|---|---|---|---|---|
| | Location 1 | Location 2 | Location 3 | Location 4 |
| **Noise Design Goal ($L_{eq,\ 15\ minute}$)** | **43** | **50** | **48** | **48** |
| 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 exceeds by 1 dB (if hammer piling) | No exceeds by 4 to 10 dB | No exceeds by 3 to 9 dB |

There is potential for construction noise design goals to be exceeded 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 reducing construction noise as received at receptors R3 and R4 are provided in Section 7 below.

## 7. RECOMMENDED NOISE CONTROLS

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

### 7.1 Buildings Construction

*Walls*

- All external walls of the co-gen plant building will be constructed using 170 mm (minimum) thick 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 42, with minimum R ratings of:-
  - 31 dB at 63 Hz, and
  - 35 dB at 125 Hz.
- For example, 75 mm (minimum) thick concrete,
- Or approved equivalent

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

*Fresh Air Penetrations*

It is proposed to install a roof ridge line air intake for passive ventilation. The opening along the roof ridge must face to the east only and not exceed a total of 31 $m^2$ (i.e. 62 metres x 500 mm high) and be fitted with acoustic louvres the minimum transmission losses shown in Table 10 below:-

**Table 10 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* | 3 | 8 | 16 | 21 | 27 | 27 | 24 | 21 |

* Based on NAP Silentflo 600 H Line

There should be no more than an additional 10 $m^2$ of fresh air openings located in the eastern façade only of the building and are to be fitted with acoustic louvres with the minimum transmission losses shown in Table 10.

Any proposed or required additional penetrations will require greater noise attenuation such that the acoustical performance of the wall or roof is not compromised. If required, this will be addressed, so far as is reasonably practicable, at the preconstruction noise design report stage, in accordance with Condition 14M.

### 7.2 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.

### 7.3 Access Doors

Large access doors (other than pedestrian doors) in the eastern façade will not exceed a total of 144 $m^2$ (i.e. 6 m x 6 m x 4 doors).

- The doors should achieve a minimum $R_w$ rating of 29, with minimum R ratings of:-
  - 12 dB at 63 Hz, and
  - 15 dB at 125 Hz.
- For example:-
- 0.55 mm (minimum) thick *custom orb* on both sides of a 50 mm (minimum) steel stud, or
- 6 mm (minimum) thick compressed fibre cement sheet,
- Or approved equivalent.

The construction details of the access panel / doors will be finalised prior to commencement of construction.

All pedestrian doors are to be of 40 mm (minimum) thick solid core timber construction.

If maintenance access doors are required to be located in the western, southern or northern facades of the building, these doors will need to be constructed to ensure that the acoustical integrity of the overall wall is not compromised or undermined.

Any proposed or required additional penetrations will require greater noise attenuation such that the acoustical performance of the wall or roof is not compromised. If required, this will be addressed, so far as is reasonably practicable, at the preconstruction noise design report stage in accordance with Condition 14M.

### 7.4 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 (CNVMP) 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.

It is worth noting that the potential predicted exceedances of the construction noise objectives during the Mod 23 construction works will occur (potentially) only during the impact piling phase which will last approximately 4 weeks.

Shoalhaven Starches standard CNVMP includes processes for notifying affected residences of the timing and duration of piling works and includes provision for periods of respite.

*Cumulative construction noise impacts from multiple projects*

A number of current modifications are underway at the Shoalhaven Starches facility with other works due to commence in 2022.

A time line of construction activities is as follows:-

- MOD 16/17 Specialty Products Building, incl. Product Dryer 9 – due for completion by end of **April 2022** (piling activities completed),
- MOD 16/17 Gluten Dryer 8 – due for completion by end of **October 2022** (piling activities completed),
- MOD 19 Beverage Grade Ethanol Plant – due for completion by end of **May 2022** (piling activities completed),
- MOD 21 Packing Plant – due for completion by end of **December 2022** (stage 1 piling activities completed), Stage 2 piling works are anticipated to commence in June 2022 which will occur for 2 to 3 days,

- MOD 23 Co-Gen Plant – **March 2022 to December 2022** (piling activities due April 2022)

As can be seen from the predicted noise levels in Table 8, the greatest noise impacts will occur during the piling works. There is no potential for piling works to occur simultaneously with other projects as these are all complete.

Shoalhaven Starches construction noise and management plan will be updated following approval to ensure that all construction works across the facility are appropriately staged, where necessary, to avoid cumulative impacts.

This will be necessary once Mod 21 and Mod 23 are approved as both locations are close to the receptors in Bomaderry. Once the approvals are received and the schedule for construction activities are finalised the management plan will be updated to address cumulative noise impacts.

## 8. 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 was undertaken. This assessment includes noise impacts from the proposed relocation of approved DDG # 6 and associated cooling towers.

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 for the overall operation of the facility, as prescribed in Environment Protection Licence 883, continue to be complied with at all receptors.

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.

This Revision A report, dated 20 January, 2022, supersedes any / all previous versions.

**Matthew Harwood**, MAAS

Principal Acoustical Consultant

Attachments:-

Important Note and Disclaimer
Appendix A – Modifying Factor Adjustments – EPA Fact Sheet C
Appendix B – Transmission loss data for building materials used in this assessment
Appendix C – NSW Environment Protection Authority request for additional information letter

***Important Note***

*All products and materials suggested by Harwood Acoustics Pty Ltd are selected for its 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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*All noise predictions in this assessment are based on the noise level data supplied by either Shoalhaven Starches or the various manufacturers of plant or equipment, or from direct noise measurements of existing plant and equipment that is stipulated to be similar to, and equivalent to, that which is to be installed in this project, as advised by the client.*

*In this assessment all noise predictions for the entire cogeneration plant are based on the sound pressure levels supplied by GE for the LM2500 gas turbine unit and GE's confirmation that the same levels will be met for the HRSG units. Specifically, an energy average sound pressure level that does not exceed 85 dBA at 1 metre from any location around the plant. All noise control recommendations are predicated on those source noise levels. Any increase in actual source noise levels because of, for example, but not necessarily limited to, alternative or additional equipment to that stated, alternative operating conditions or operational scenarios, may result in higher than predicted noise levels at any receptor locations. Harwood Acoustics Pty Ltd therefore accepts no responsibility or liability for any noncompliance with regulatory noise limits as a result of changes to GE's stated sound pressure levels.*

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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 (*ISO1996.2-2007 – Annex D*). | Level of one-third octave band exceeds the level of the adjacent bands on both sides by:<br>• 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz<br>• 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz<br>• 15 dB or more if the centre frequency of the band containing the tone is in the range 25–125 Hz. | 5 dB | Third octave measurements should be undertaken using unweighted or Z-weighted measurements. **Note:** Narrow-band analysis using the reference method in *ISO1996-2:2007, Annex C* 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:<br>• 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<br>• 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. | 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 **night-time only**. |
| 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[2] (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.*

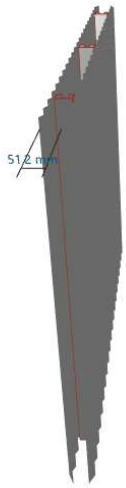
*2. Where a source emits tonal and low-frequency noise, only one 5-dB correction should be applied if the tone is in the low-frequency range, that is, at or below 160 Hz.*

*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.*

# Sound Insulation Prediction (v9.0.23)


Margin of error is generally within Rw ±3 dB
Harwood Acoustics Pty Ltd - Key No. 5053
Job Name:
Job No.: Initials:Windows PC
Date:12/01/2022
File Name:

Notes:




**Rw 29 dB**
C -2 dB
Ctr -6 dB

Mass-air-mass resonant frequency = =172 Hz

Panel Size = 2.7 m x 4.0 m

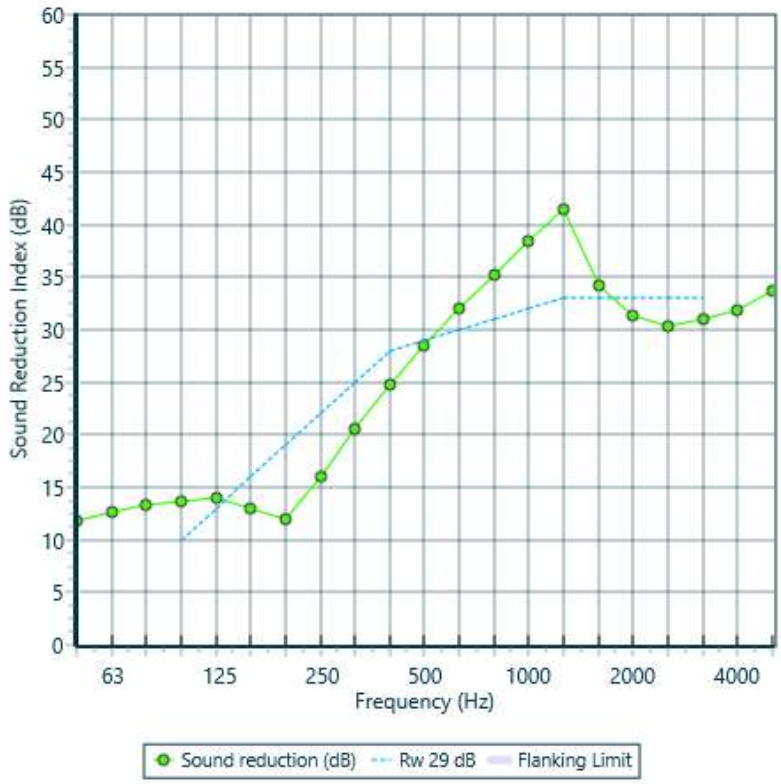
Partition surface mass = 9.46 kg/m²

## System description

Panel 1 : 1 x 0.6 mm Custom Orb (0.55mm)

Frame: Steel Stud (0.55mm) (50 mm x 38 mm ), Stud spacing 600 mm ; Cavity Width 50 mm
Panel 2 : 1 x 0.6 mm Custom Orb (0.55mm)

| freq.(Hz) | R(dB) | R(dB) |
|---|---|---|
| 50 | 12 | |
| 63 | 13 | 12 |
| 80 | 13 | |
| 100 | 14 | |
| 125 | 14 | 13 |
| 160 | 13 | |
| 200 | 12 | |
| 250 | 16 | 15 |
| 315 | 21 | |
| 400 | 25 | |
| 500 | 29 | 27 |
| 630 | 32 | |
| 800 | 35 | |
| 1000 | 38 | 38 |
| 1250 | 42 | |
| 1600 | 34 | |
| 2000 | 31 | 32 |
| 2500 | 30 | |
| 3150 | 31 | |
| 4000 | 32 | 32 |
| 5000 | 34 | |



# Sound Insulation Prediction (v9.0.23)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within Rw ±3 dB
Harwood Acoustics Pty Ltd - Key No. 5053
Job Name:
Job No.: Initials:Windows PC
Date:12/01/2022
File Name:

Notes:


Rw 29 dB
C -1 dB
Ctr -4 dB

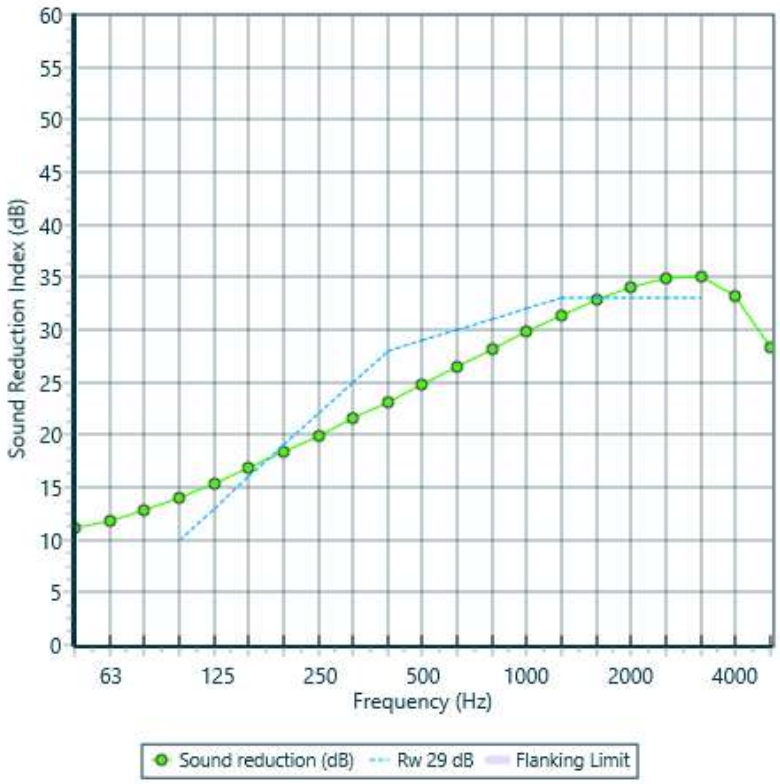
Panel Size = 2.7 m x 4.0 m

Partition surface mass = 9.36 kg/m²

## System description

Panel 1 : 1 x 6 mm Fibre Cement

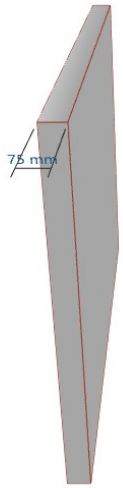
| freq.(Hz) | R(dB) | R(dB) |
|---|---|---|
| 50 | 11 | |
| 63 | 12 | 12 |
| 80 | 13 | |
| 100 | 14 | |
| 125 | 15 | 15 |
| 160 | 17 | |
| 200 | 18 | |
| 250 | 20 | 20 |
| 315 | 22 | |
| 400 | 23 | |
| 500 | 25 | 25 |
| 630 | 26 | |
| 800 | 28 | |
| 1000 | 30 | 30 |
| 1250 | 31 | |
| 1600 | 33 | |
| 2000 | 34 | 34 |
| 2500 | 35 | |
| 3150 | 35 | |
| 4000 | 33 | 31 |
| 5000 | 28 | |



# Sound Insulation Prediction (v9.0.23)


Margin of error is generally within Rw ±3 dB
Harwood Acoustics Pty Ltd - Key No. 5053
Job Name:
Job No.: Initials:Windows PC
Date:12/01/2022
File Name:

Notes:




Rw 46 dB
C -1 dB
Ctr -3 dB

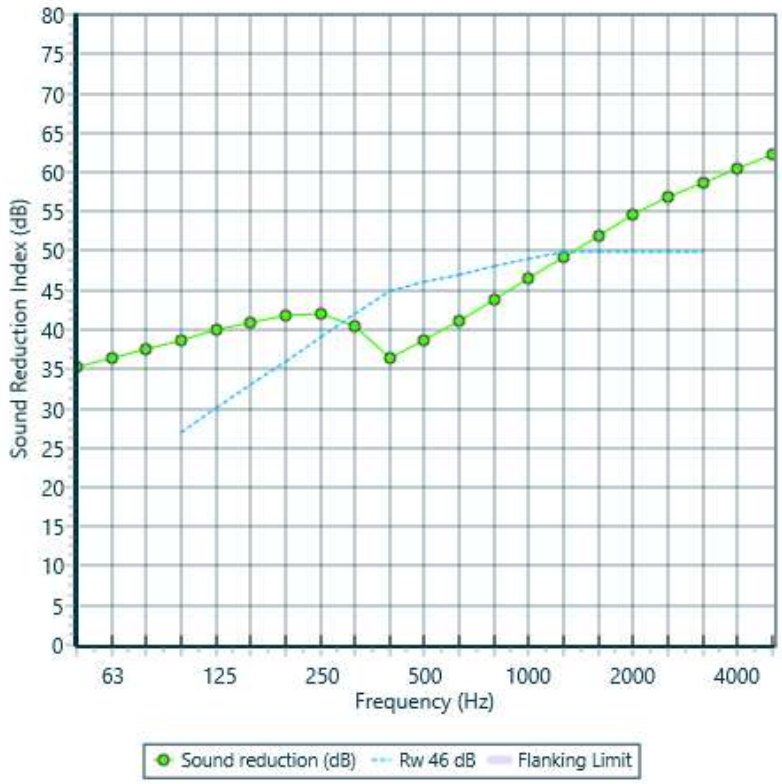
Panel Size = 2.7 m x 4.0 m

Partition surface mass = 176 kg/m²

## System description

Panel 1 : 1 x 75 mm Concrete

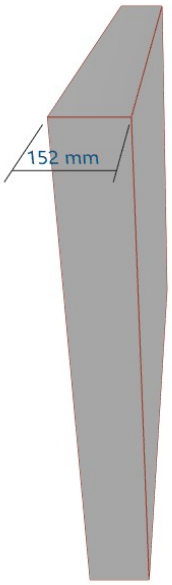
| freq.(Hz) | R(dB) | R(dB) |
|---|---|---|
| 50 | 35 | |
| 63 | 36 | 36 |
| 80 | 38 | |
| 100 | 39 | |
| 125 | 40 | 40 |
| 160 | 41 | |
| 200 | 42 | |
| 250 | 42 | 41 |
| 315 | 40 | |
| 400 | 36 | |
| 500 | 39 | 38 |
| 630 | 41 | |
| 800 | 44 | |
| 1000 | 47 | 46 |
| 1250 | 49 | |
| 1600 | 52 | |
| 2000 | 55 | 54 |
| 2500 | 57 | |
| 3150 | 59 | |
| 4000 | 60 | 60 |
| 5000 | 62 | |



# Sound Insulation Prediction (v9.0.23)

Program copyright Marshall Day Acoustics 2017
Margin of error is generally within Rw ±3 dB
- Key No. 5053
Job Name:
Job No.: Initials:Windows PC
Date:12/01/2022
File Name:

Notes:




**Rw 55 dB**
C -1 dB
Ctr -5 dB

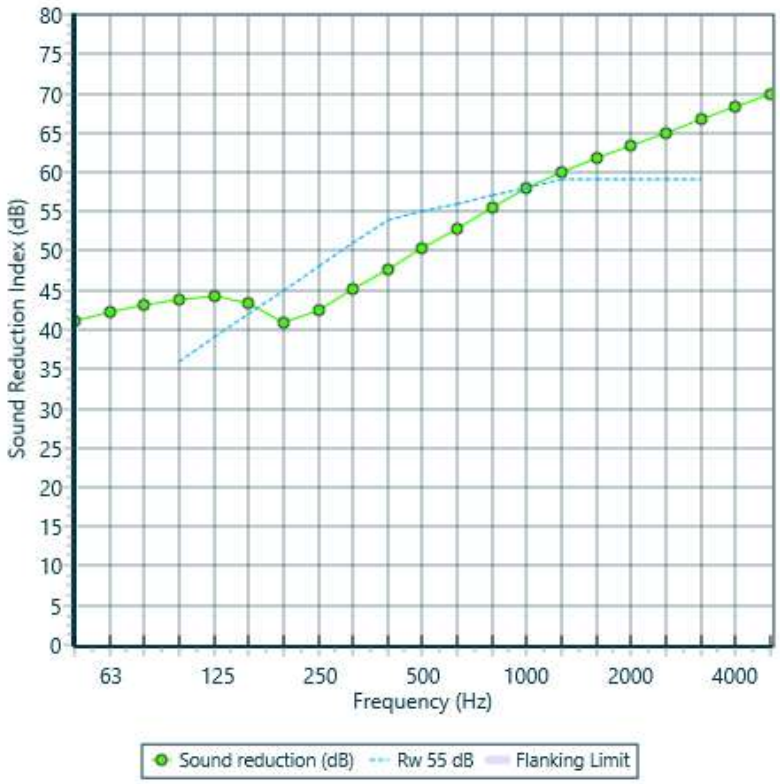
Panel Size = 2.7 m x 4.0 m

Partition surface mass = 357 kg/m²

## System description

Panel 1 : 1 x 152.4 mm Concrete

| freq.(Hz) | R(dB) | R(dB) |
|---|---|---|
| 50 | 41 | |
| 63 | 42 | 42 |
| 80 | 43 | |
| 100 | 44 | |
| 125 | 44 | 44 |
| 160 | 43 | |
| 200 | 41 | |
| 250 | 43 | 42 |
| 315 | 45 | |
| 400 | 48 | |
| 500 | 50 | 50 |
| 630 | 53 | |
| 800 | 55 | |
| 1000 | 58 | 57 |
| 1250 | 60 | |
| 1600 | 62 | |
| 2000 | 63 | 63 |
| 2500 | 65 | |
| 3150 | 67 | |
| 4000 | 68 | 68 |
| 5000 | 70 | |



DOC21/936070-6

Ms Deana Burn
Locked Bag 5022
Parramatta NSW 2124

Email: deana.burn@planning.nsw.gov.au

Dear Ms Burn

**Shoalhaven Starches – MP06_0228 Mod 23 – Gas Fired Co-generation Plant – EPA Comments**

Thank you for the request for advice, requesting the review by the NSW Environment Protection Authority (EPA) of the Statement of Environmental Effects (SEE) for the proposed modification (MP06_0228-Mod-23) at 160 Bolong Road, Bomaderry.

The EPA has reviewed the following documents:

- *Statement of Environmental Effects – Proposed Modification to Approved Gas Fired Co-generation Plant* – Cowman Stoddart Pty Ltd – 2 September 2021
- *Environmental Noise Impact Assessment Shoalhaven Starches – Proposed Modification to Shoalhaven Starches Expansion Project 06_0228 – Proposed Modification to Approved Cogeneration Plant – Modification 23* – Harwood Acoustics Acoustical Consulting – 19 August 2021
- *Shoalhaven Starches Modification 23 – Air Quality Assessment* – GHD Pty Ltd – 1 September 2021

The EPA understands the proposal is for:

- Construction of a 60MW gas fired co-generation plant, to replace the approved but not yet constructed 40MW gas fired co-generation plant and 15MW coal fired co-generation plant;
- Construction of four water tanks at the southern end of the gas fired co-generation building;
- Construction of a gas compressor at the southern end of the gas fired co-generation building;
- Construction of a new electrical sub-station;
- Relocation of the approved but not yet constructed No. 6 DDG Dryer;
- Conversion of the existing coal fired boilers to gas powered.

The premises are subject to Environment Protection Licence No. 883 under section 43 of the *Protection of the Environment Operations Act 1997* (POEO Act) for Agricultural Processing, Chemical Production, and Chemical Storage under clauses 2, 8 and 9 respectively of Schedule 1 of the POEO Act.

The EPA has reviewed the SEE, Noise Impact Assessment (NIA), and Air Quality Impact Assessment (AQIA) and notes that it does not provide the information required by the EPA. As such, the EPA requests additional information to be able to assess the proposal. The EPA's comments, recommendations, and requested information is detailed in Attachment A.

If you have any questions or wish to discuss, please contact Amanda Fletcher on (02) 6229 7002 or via email at info@epa.nsw.gov.au.

Yours sincerely

26/11/2021

**JANINE GOODWIN**
**Unit Head**
**Regulatory Operations Regional**

**Attachment A**

## Noise

### 1. Matters to be addressed prior to determination

#### a. Inadequate assessment of operational noise impacts

In the EPA's experience, co-generation plants have demonstrated to be difficult to attenuate the annoying characteristics. These types of plants can generate significant low frequency noise and other characteristics such as tonality and intermittency. The NIA indicates from a basic assessment in Section 4.2.3 that there is potential for low frequency noise from the proposed Shoalhaven Starches co-generation plant and the potential for noise limits to be exceeded if the plant is approved and built.

The EPA does not consider it appropriate to state that at this stage the proponent doesn't have the data to make a full and proper assessment in accordance with the *Noise Policy for Industry* (NPfI, EPA 2017). There is data and information available on co-generation plants; the onus is on the proponent to obtain that information and present a full and detailed worst-case assessment of the potential noise impact from the proposed modification, in accordance with the NPfI.

With the limited information provided in the NIA, the EPA is unable to understand the potential impact from Mod 23. The EPA requests that a more detailed assessment of the proposal is prepared, and includes the following information:

- To better understand the predicted noise levels at the receivers, the EPA would prefer that the NIA utilise noise modelling software, but as a minimum the EPA requires full and justified one-third octave spectral data for:
    - all sources proposed inside the buildings;
    - space averaged sound pressure levels including reverberation times;
    - the performance of the building fabric; and
    - the attenuation losses to the receivers

  which are then summed to provide an overall A weighted level.

- The one-third octave data should also be used to determine any low frequency or tonal characteristics. The fans and steam generators have potential to generate tonality. Intermittency from auxiliary equipment should also be assessed, as well as a statement on the potential for emergency pressure releases or similar.

  The assessment of modifying factors should be conducted in accordance with Fact Sheet C of the NPfI. The assessment must be quantitative and any calculations relied on to determine the presence (or not) of modifying factors must be included in the report. An example method for determining low frequency noise was published in Acoustics Australia and can be found here: https://doi.org/10.1007/s40857-020-00199-x

- The NIA should also clearly state what operating scenarios have been assumed – for example full working power or other modes. The EPA notes that the NIA states in Section 4.2.1 that 2 of the 4 exhaust stacks are assumed to be operating at any one time, the proponent needs to assess a worst-case operating scenario.

  The EPA also notes that Mod 23 includes the relocation of the No. 6 DDG dryer further to the south of the site. The noise impact from the new location of this noise source does not appear to have been assessed. The NIA for Mod 23 includes a number of noise sources that do not appear to have been assessed in the NIA. The

NIA needs to include all sources of noise proposed as part of the modification, not only the co-generation plant.
Where modelling software is used, the model should include the existing and approved sources at the premises to capture the total premises noise emission. The EPA requests the NIA include a noise contour map to clearly present the impacts at all surrounding receivers.

- The reduction of noise from another part of the site to accommodate the annoying characteristics of this proposed modification is not considered acceptable. The overall site noise reduction may serve to make the annoying characteristics more prominent.

  The EPA considers that further assessment of feasible and reasonable mitigation to reduce the annoying characteristics is required. The application of the low frequency noise penalty (or any other annoying characteristics) is only in the case where the annoying characteristics cannot be mitigated, as per Fact Sheet C of the NPfI.

**b. Inadequate information on construction noise impacts**

The NIA is lacking on the details in the construction noise assessment. The EPA is unable to sufficiently assess the potential noise impact from construction and requests further details including:

- The proposed duration of construction and the hours of construction. Any construction proposed outside standard hours will need to be sufficiently justified as per the guidance in the *Interim Construction Noise Guideline* (DECC 2009).

- A cumulative construction noise assessment from current construction works on the site in conjunction with the construction schedule for the proposed Mod 23. The EPA notes that the Shoalhaven Starches premises is undergoing numerous modifications which are either currently under construction or proposed to be under construction.

  The NIA should include a thorough and detailed assessment of the location, sources and noise level from existing construction works where they overlap with the proposed Mod 23 works. For transparency and clarity, the NIA should also include a detailed schedule of works to make it clear what activities will be occurring and when, for what modification and in what area of the site.

- The details of the likely duration of the predicted exceedance of the criteria and mitigation to manage those exceedances. The NIA defers assessment of feasible and reasonable mitigation to the preparation of a Construction Noise Management Plan, however it is not clear if and what mitigation can be implemented to reduce impact from highly noisy activities such as piling and what level of impact will remain after the implementation of those noise mitigation/management measures.

**Air Quality**

**2. Matters to be addressed prior to determination**

**a. Supporting evidence on change in emissions from current approved operations not provided**

Section 3.11.2 of the AQIA states that "*The proposal is expected to have a neutral impact on odour and a positive impact on combustion emission compared against the previous modification (Mod 21). The reduction in combustion emissions (compared with*

*Mod 21) is attributed to conversion of boilers from coal to gas which typically has lower emissions"*. Whilst, the conversion of boilers from coal to gas could reduce particular air pollution emissions, the proposed modification seeks approval for an increase in power generating capacity from current approved operations. The modification seeks approval for a 60 MW cogeneration plant to replace existing approved power generation plant with a combined capacity of 55 MW.

The EPA recommends the proponent provide supporting evidence to support the claim that combustion emissions would decrease from current operations. In providing this information a comparison of particulate, oxides of nitrogen (NOx) and volatile organic compounds (VOC's) emissions for current and proposed operations should be provided. Emission estimates must be robustly justified for the comparison.

**b. Assessment has not accounted for existing combustion sources**

Section 8.1.1 of the AQIA states "*Use of boilers 1, 2, 3 and 8 are on standby duty as part of Mod 23 only boiler 5/6 would be active*". The dispersion modelling for the proposed modification has considered emissions from existing boiler 5/6. As such the EPA interprets that the other boilers not included in the impact assessment (1, 2, 3 and 8) would be decommissioned and no longer utilised at the premises.

However, no further description of the proposed operating regime has been provided to confirm if this interpretation is accurate. If existing boilers are to remain and utilised at the premises, the quantitative assessment must take these sources into consideration. Additionally, Section 3.11.2 of the AQIA states that existing coal fired boilers will be converted to gas, however it does not describe which coal fired boilers will be converted to gas.

The EPA recommends the proponent provide further information on:

i. Which coal fired combustion units will be converted to gas, and clarify if all existing coal fired combustion units will be converted to gas
ii. The proposed use of existing combustion units under the proposed modification
iii. Where existing combustion units are proposed to remain and utilised at the premises, they must be accounted for in a revised Air Quality Impact Assessment.

**c. Basis for the discharge parameters and emission estimates for the proposed gas fired cogeneration plant not provided, described or justified**

*Discharge parameters*

Table 8.2 of the AQIA provides an emission inventory for combustion emissions and discharge parameters (stack height, velocity etc) for various sources. However, the AQIA does not describe or include supporting information on the basis for the discharge parameters adopted for the proposed gas fired cogeneration plant.

As per the *Approved Methods for Modelling and Assessment of Air Pollutants in NSW* (the Approved Methods), the EPA's preferred methods for assessing proposed sources is manufacture's design specifications. The AQIA does not include manufactures design specifications for the proposed gas fired cogeneration plant or describe the basis for the adopted discharge parameters for the gas fired cogeneration plant.

*Emission estimates*

Table 8.2 of the AQIA provides an emission inventory for combustion pollutants including emission estimates for the proposed gas fired cogeneration plant. However, the AQIA does not:

i. Describe how emission estimates have been derived

ii. Include supporting calculations for derivation of any emission estimates
iii. Justify the adopted emission rates, including demonstration that emission estimates represent reasonable worst-case emissions

As per the Approved Methods, the EPA's preferred methods for assessing proposed sources is manufacture's design specifications and/or emission guarantees.

The EPA recommends the proponent provide manufactures design specifications and/or emission guarantees for the proposed cogeneration plant and demonstrate that the AQIA is based on the proposed design.

**d. Assessment of compliance with the prescribed concentrations contained in the Clean Air Regulation not provided**

Table 8.2 of the AQIA presents an emission inventory for products of combustion. A NOx emission rate of 7.2 g/s is presented in Table 8.2 for each of the natural gas cogeneration units. An exhaust flow at actual conditions of 103 $m^3/s$ is also presented.

Based on the discharge parameters (exhaust temperature, and exhaust flow) presented in Table 8.2 the EPA estimate an NOx discharge concentration of 96 $mg/m^3$. This estimate is significantly greater than the NOx discharge concentration of 39 $mg/Nm^3$ presented in Table 8. As such there appears to be potential errors in the emission estimate, and hence the EPA are not in a position to understand the quantum of emissions that have been accounted for in the dispersion modelling.

Additionally, the *Protection of the Environment Operations (Clean Air) Regulation 2021* (Clean Air Regulation) prescribes maximum allowable discharge concentrations for specific plant and activities. The Clean Air Regulation specifies a NOx discharge concentration of 70 $mg/m^3$ for any turbine operating on gas, being a turbine, used in connection with an electricity generating system with a capacity of 30 MW or more.

The AQIA does not include a demonstration that the prescribed concentrations contained in the Clean Air Regulation can be achieved. The estimated NOx discharge concentration of 96 $mg/m^3$, discussed above, is greater than the prescribed concentration of 70 $mg/m^3$ contained in the Clean Air Regulation.

The EPA recommends the proponent revise the AQIA to:
i. transparently describe and demonstrate that emission estimates are correct and representative of the proposal.
ii. Demonstrate that compliance with the Clean Air Regulation will be achieved

**e. Emission estimates for existing Coal fired boiler not described or justified**

Air pollutant emissions for Boiler 5/6 have been included within the quantitative assessment, however the AQIA provides limited information on how emissions have been derived. Given the limited information, the AQIA does not justify that the quantitative assessment is representative of reasonable worst-case emission.

The EPA recommends the proponent provide further information on the derivation of emission estimates for Boiler 5/6 and justify that the quantitative assessment is representative of reasonable worst-case emissions.

**f. Robust assessment of VOCs not included**

The AQIA includes emission estimates for VOC's and a quantitative assessment of VOCs, however the AQIA does not:
i. Include an assessment of speciated VOC's

ii. Reference the impact assessment criteria for speciated VOCs, for conducting the assessment of potential impacts
iii. Include emission estimates of speciated VOCs for the proposed cogeneration plant. Table 8.2 of the AQIA implies there are no VOC emissions from the proposed cogeneration plant

The EPA recommends the proponent revise the AQIA to include a robust assessment of speciated VOCs.

**g. Assessment of annual average particulates not included**

The AQIA does not include an assessment of cumulative annual average impacts for TSP, $PM_{10}$ and $PM_{2.5}$. Only incremental results at sensitive receptors are presented in Table 8.3.

The EPA recommends the proponent revise the AQIA to include cumulative assessment of annual average particulate matter impacts at sensitive receptors. If exceedances of annual average impact assessment criteria are predicted, the assessment must be revised to include additional mitigation measures

**h. Assessment predicts exceedances of 24-hour $PM_{10}$ and 24-hour $PM_{2.5}$**

The AQIA predicts 3 additional exceedances of $PM_{10}$ (24 hour) and $PM_{2.5}$ (24 hour) at commercial receptor C6. The AQIA does not provide further analysis on the predicted exceedances, including but not limited to source contribution analysis, and identification of additional mitigation measures.

The EPA recommends the proponent revise the AQIA to include additional analysis of the predicted exceedances and identification of additional mitigation measures.