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Environmental Noise Impact Assessment Shoalhaven Starches

***Proposed Modification to Shoalhaven Starches Expansion Project
06_0228 – Packing Plant Alterations and Other Works –
Modification 21.***

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: 2103003E-R

Prepared by: -

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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 their facility at 160 Bolong Road, Bomaderry, NSW.

This modification (Mod 21) relates to alterations to the approved northern packing plant and container storage area located opposite the Site on Bolong Road as well as the installation of a nitrogen generator; indirect cooking plant; associated pipe gantries; two new fermentation tanks and relocation of an approved car park near the former Dairy Farmers site.

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.

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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. Under the SSEP approval was granted for the establishment of a packing plant, container storage yard and rail spur on the northern side of Bolong Road, opposite the main facility.

In 2019 the then Independent Planning Commission approved Mod 16 which included the construction of a Specialty Product Facility and additional Gluten Dryer. The Specialty Products Building would enable the production of an increased range of specialised products as an extension to Shoalhaven Starches existing product line. The specialty products will comprise a range of modified gluten products for the food industry and modified starches for both paper manufacturing as well as food production.

As a result of the increase in range of different specialised products that will now be able to be produced as a result of Mod 16; Shoalhaven Starches has identified that amendments will be required to the approved Packing Plant on the northern side of Bolong Road to accommodate this increased range of specialised products.

This modification application (Mod 21) therefore seeks approval for alterations to the approved packing plant. These include an extension of the packing plant building to incorporate additional silos, an increase in the number of external silos, alterations and additions to the blow lines spanning Bolong Road which will provide product from the existing mills and specialty products building and an additional rail spur siding.

In addition to the proposed alterations to the packing plant this modification seeks approval for the construction of a nitrogen generator, an indirect cooking plant, two new fermentation tanks and the relocation of an approved car park at the northern end of the facility.

It is a requirement of the NSW Environment Protection Authority and Department of Planning, Industry 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.

This also considers upcoming modifications and items of plant and equipment not yet constructed at the site.

The noised design goals range between 23 dBA and 27 dBA ($L_{eq, 15 \text{ minute}}$) 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.

Noise sources associated with the proposed alterations and additions to the packing plant include the motors and fans associated with the new silos and baghouses and the two new blowers associated with the product blow lines from the specialty product building. Noise sources associated with the other aspects of this modification include the transfer pumps servicing the two new fermenters, the compressors associated with the nitrogen generator and the pumps associated with the indirect cooking plant.

The nitrogen generator will be located on the northern side of the main facility to the north east of the ethanol distillery and the indirect cooking plant will be located centrally within the facility adjacent to the glucose plant. A Site plan showing each aspect of this proposed modification is provided in Figure 2.

Noise modelling has been undertaken based on measured noise levels of similar plant and equipment within the existing facility to that which is proposed as part of this modification.

Recommendations are made in Section 6 of this Report to reduce the level of noise emission from the new items of plant and equipment to within the noise design goals at each receptor. Recommendations include advice on the construction of the additional portion of the packing plant and external silo penthouse as well as localised acoustical treatment of the blowers and the fermenter transfer pumps.

A final design will be undertaken at the time of the Design Noise Verification or during construction or commissioning of the plant.

The construction works will consist of piling for the base of the fermenters, pouring of concrete slabs for the construction of the nitrogen generator and the installation of the plant and equipment.

The predicted level of noise emission from the construction works is within the NSW EPA's *Interim Construction Noise Guideline* 2009 construction noise limits at all receptors.

None the less, construction noise mitigation measures are included in the Construction Safety & Environmental 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 1745 metres to the south east
- Location 2 – Riverview Road, Nowra approximately 1260 metres to the south west,
- Location 3 – Merroo Street, Bomaderry approximately 310 metres to the west,
- Location 4 – Coomea Street, Bomaderry approximately 400 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 packing plant building 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 ©)

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. Under the SSEP approval was granted for the establishment of a packing plant, container storage yard and rail spur on the northern side of Bolong Road, opposite the main facility.

In 2019 the then Independent Planning Commission approved Mod 16 which included the construction of a Specialty Product Facility and additional Gluten Dryer. The Specialty Products Building would enable the production of an increased range of specialised products as an extension to Shoalhaven Starches existing product line. The specialty products will comprise a range of modified gluten products for the food industry and modified starches for both paper manufacturing as well as food production.

As a result of the increase in range of different specialised products that will now be able to be produced as a result of Mod 16; Shoalhaven Starches has identified that amendments will be required to the approved Packing Plant on the northern side of Bolong Road to accommodate this increased range of specialised products.

This modification application (Mod 21) therefore seeks approval for alterations to the approved packing plant. These include an extension of the packing plant building to incorporate additional silos, an increase in the number of external silos, alterations and additions to the blow lines spanning Bolong Road which will provide product from the existing mills and specialty products building and an additional rail spur siding.

In addition to the proposed alterations to the packing plant this modification seeks approval for the construction of a nitrogen generator, an indirect cooking plant, two new fermentation tanks and the relocation of an approved car park at the northern end of the facility.

Noise sources associated with the proposed alterations and additions to the packing plant include the motors and fans associated with the new silos and baghouses and the two new blowers associated with the product blow lines from the specialty product building. Noise sources associated with the other aspects of this modification include the transfer pumps servicing the two new fermenters, the compressors associated with the nitrogen generator and the pumps associated with the indirect cooking plant.

The nitrogen generator will be located on the northern side of the main facility to the north east of the ethanol distillery and the indirect cooking plant will be located centrally within the facility adjacent to the glucose plant. A Site plan shown in each aspect of this proposed modification is provided in Figure 2.

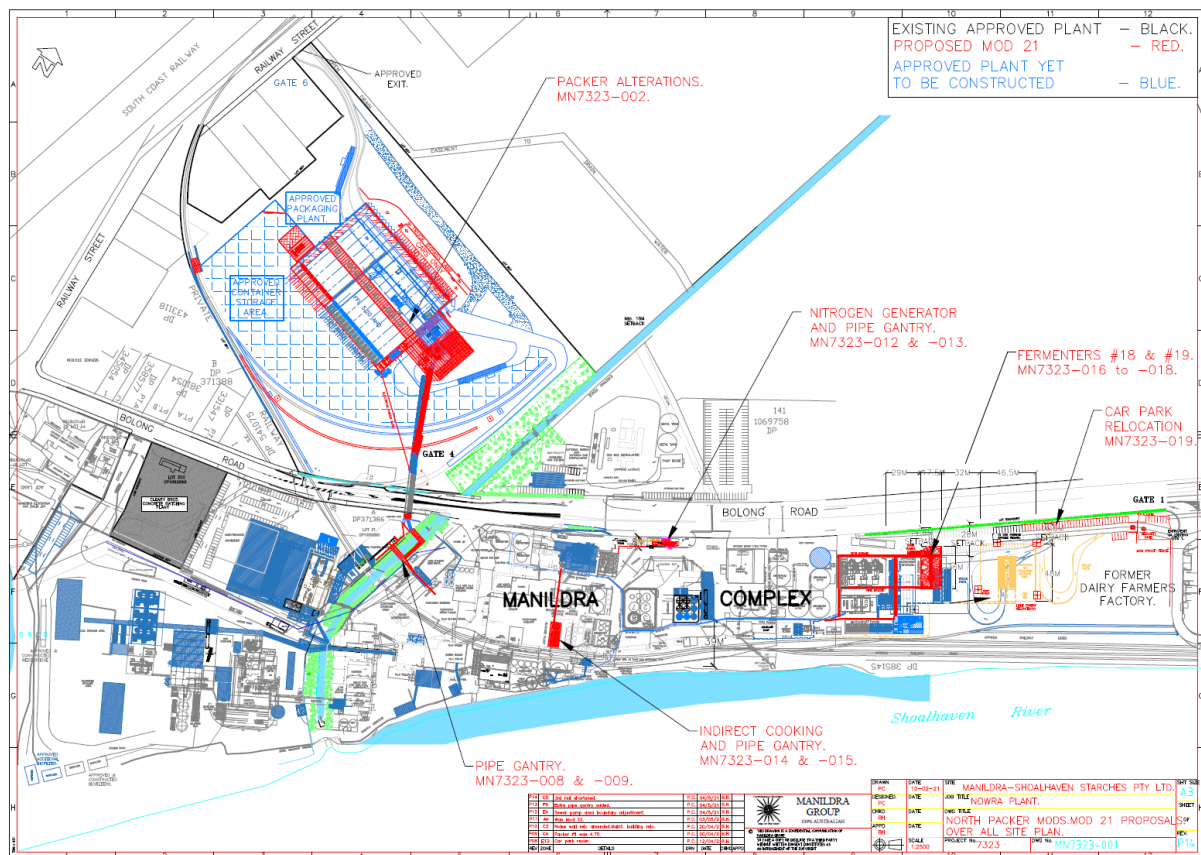


Figure 2. Proposed Modification 21 Alterations and Additions

(source: Manildra Group's building design plans MN7323-001 for Project No. 7323, Rev P14 issued 04/05/2021)

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, Industry 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 generally 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).

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 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 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 ₉₀)
135 Terara Road, Terara March 2012	Day (7 am to 6 pm)	33 dBA
55 Terara Road, Nowra 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 have been 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)	43 dBA (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"> 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. 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.
Location 2 (Nowra)	50 dBA (40 + 10)	
Locations 3 & 4 (Bomaderry)	48 dBA (38 + 10)	
	Highly noise affected 75 dB(A)	<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"> 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"> 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) 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. VARIOUS PLANT NOISE EMISSION

4.1 Plant and Equipment Source Noise Levels

Noise sources associated with this modification will include the follow:-

- motors and fans at the top of the silos and baghouses within the proposed expansion of the packing plant
- sifters within the packing plant building,
- motors located at the base of the secondary silos below the sifter level,
- motors and fans at the top of the silos and baghouses within the proposed penthouse at the top of the external silos which will be located on the south eastern side of the packing plant,
- compressors associated with the nitrogen generator,
- transfer pumps associated with the two fermentations tanks, and
- pumps associated with the indirect cooking plant.

The author has carried out a number of noise surveys within and around the Shoalhaven Starches Site which have included most recently surveys of the existing packing sheds and the associated silos, baghouses and sifters. Previous assessments have included noise measurements of the transfer pumps servicing the fermenters as well as general pumps, motors and compressors.

Table 3 below therefore provides a schedule of octave band and overall 'A' frequency weighted sound power levels, in decibels re: 1 pW, derived from previous site measurements.

Table 3 **L_{eq} Sound Power Levels – Plant and Equipment**

Description	L _{eq} , 15 minute Sound Power Level (dBA)
Silo motor and fan	87
Silo motor with baghouse pulse	84
Sifter	84
Transfer pump (fermenter)	93
Nitrogen generator compressor	76
Indirect cooking pumps	90 – 93
Blowers (product blowers)	110

Packing plant noise sources discussion

Previous noise impact assessments relating the approved packing plant, container storage yard and rail spur have been carried out as follows:-

- Noise Impact Assessment titled 'Acoustical Assessment, Proposed Ethanol Upgrade, Shoalhaven Starches' prepared by The Acoustic Group, ref 38.3849.R52:ZJM, dated June 2008,
- Environmental Noise Impact Assessment, prepared by Day Design Pty Ltd, reference 5843-1.1R dated 15 March 2016, and

- Notice of Modification Packing Plant and Container Storage Yard, prepared by Harwood Acoustics Pty Ltd, reference 1609006E-R dated September 2016.

I was the author of the two latter reports.

The assessments covered the level of noise emission from the operation of the packing plant building (as it was proposed at the respective times) as well as forklift movements outside of the building in the container yard, the movement of containers and the loading and unloading of trains including the train movements, both locomotive and shunting of wagons.

A number of physical and administrative noise controls were recommended and many of these have formed part of the conditions of approval.

The proposed alterations to the packing plant that are associated with this modification do not include any new noise sources other than those associated with the silos and the blowers as detailed in Table 3 above, that have not been previously assessed.

For example, the additional rail spur proposed as part of this modification will not involve the operation of additional locomotives or additional forklift movements that have not formed part of previous assessments.

For this reason, the noise design goals for this modification are stringent, to ensure that any new noise sources that are not part of current operations, or previously assessed operations, do not increase overall site noise. To this end, there is no consideration given to modelling previous noise sources, that already form part of the previous assessments and contribute to the reason for the stringent noise goals.

A noise design verification will be carried out to ensure that the noise controls are appropriate and adequately implemented in the final design prior to construction and adjusted if and where necessary.

4.2 Noise Level Predictions

4.2.1 Modelling Equations

For all items of plant and equipment located within the proposed packing plant building and external silo penthouse, 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:

- 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 emission emanating from the external pumps, compressors and motors, 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
Design Noise Goal ($L_{eq, 15 \text{ minute}}$)	23	23	27	25
Silos within packing plant building	11	13	22	20
Silo motors within penthouse	7	8	13	12
Nitrogen Generator	1	3	13	13
Indirect Cooking	14	15	20	19
Fermentation Transfer Pumps	13	2	14	14
Blowers	3	3	10	9
Combined	18	18	24	24
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 packing plant building and penthouse as per recommendations made in Section 6.1,
- Sound power levels as detailed in Table 3,
- Reduction from acoustic enclosure for blowers as recommended in Section 6.2,
- Reduction from localised treatment of fermentation pumps as detailed in Section 6.3.

5. MODIFYING FACTOR ASSESSMENT

5.1 Low Frequency Noise Characteristics

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

Table 5 Predicted L_{eq} Sound Pressure Levels – Combined Plant at R3

Plant item	dBA	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
All plant combined	24	32	27	22	20	19	15	12	9

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 is **10 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. That is not the case in this instance.

5.2 Tonal Characteristics

In order to determine the potential the presence of tonal characteristics at distant receptor locations, we have undertaken one-third octave band noise measurements of various plant and equipment.

Figure 3 below shows the L_{eq} , short-term one-third octave band spectrum of a measurement taken in the floor of the existing packing plant building fronting Bolong Road.

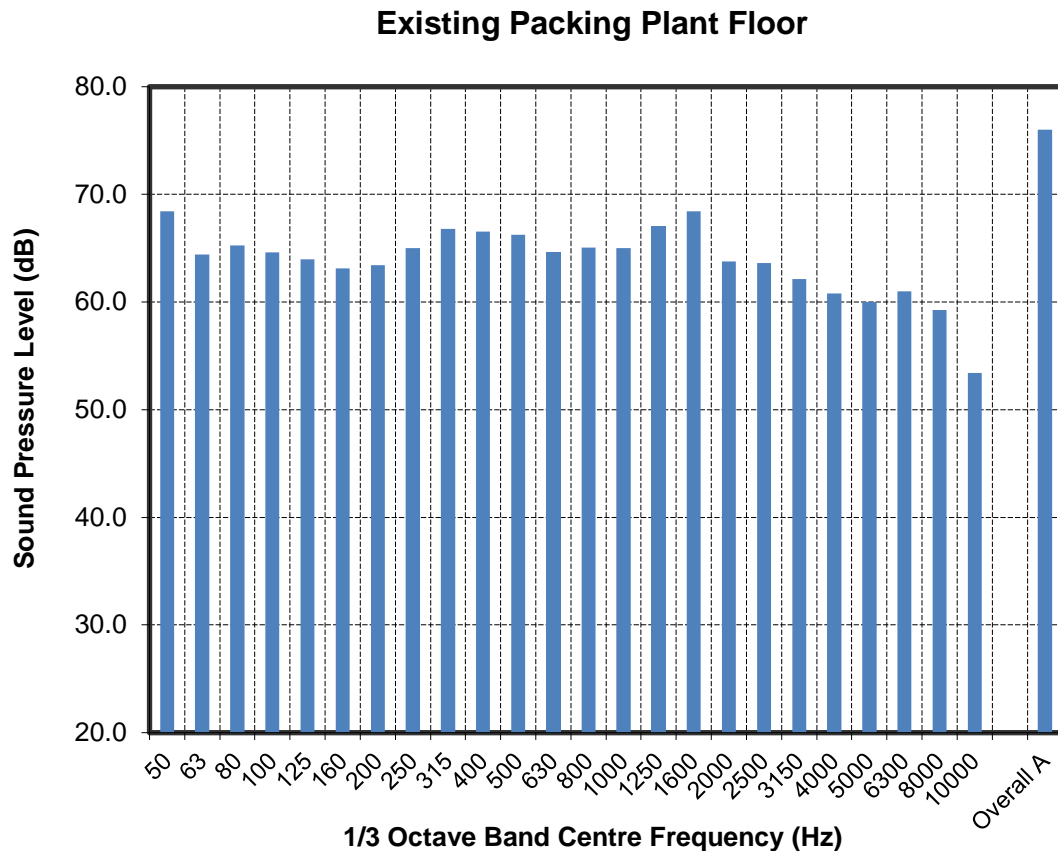


Figure 3. One-Third Octave Band Spectrum Existing Packing Plant Inside Reverberant Field

It can be seen that the general reverberant noise level on the floor of the packing plant does not display tonal characteristics. This is in the absence of warning alarms, sirens or tonal reversing alarms of any forklifts or trucks.

Figure 4 below shows the L_{eq} , short-term one-third octave band spectrum of a baghouse motor, taken at the penthouse level of the existing packing plant in close proximity to the motor at the base of the baghouse.

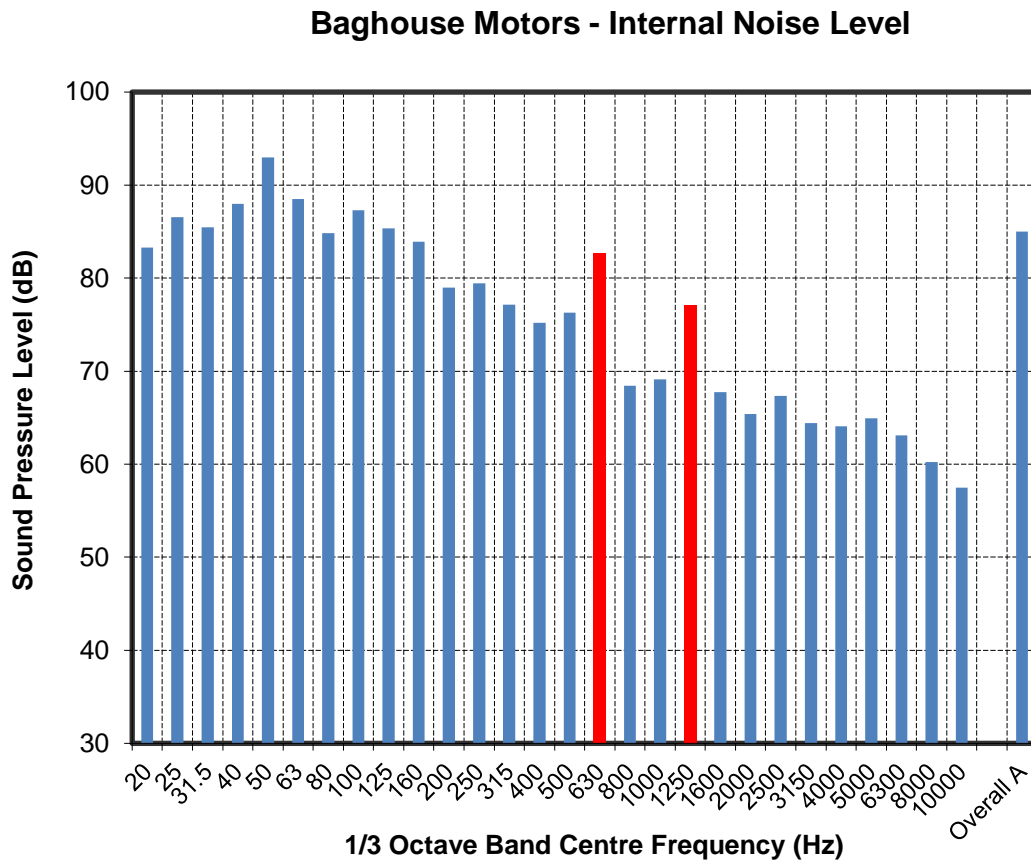


Figure 4. One-Third Octave Band Spectrum Baghouse Motor – Reverberant Field

Figure 4 show that the baghouse motor measured on the day of the noise survey shows tonal components at the one-third octave bands centred on 630 and 1250 Hz.

The internal noise level, as measured, has then been modelled to the closest receptor in Bomaderry, approximately 320 metres to the west of the proposed penthouse.

Sound insulation data for the proprietary wall panelling system proposed to be used for the penthouse has been supplied by the manufacturer, in terms of R values in one-third-octave bands between 50 Hz and 5000 Hz inclusive.

Figure 5 below shows the predicted noise level at 320 metres after attenuation achieved from transmission loss of the building material as well as distance to the receptor.

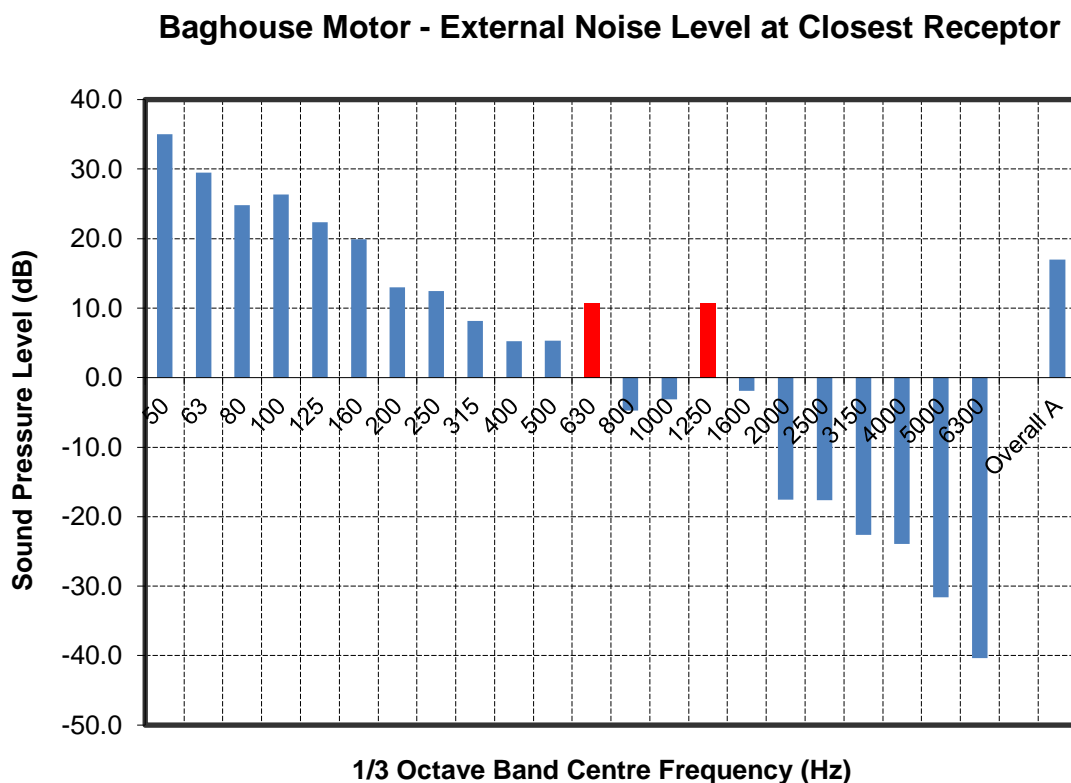


Figure 5. Predicted One-Third Octave Band Spectrum Baghouse Motor – Circa 320 metres

Figure 5 shows that the predicted noise level of the baghouse motor still displays tonal characteristics at the one-third octave bands centred on 630 and 1250 Hz. However, the level of noise emission from the baghouse motors is predicted to be well below 20 dBA and the noise level at the one-third octave bands centred on 630 and 1250 Hz is predicted to be 10 to 11 dB respectively and < 10 and 10 dBA respectively.

These levels will not be audible at the receptor location. Tonality is defined by the EPA in its Noise Policy for Industry as a Noise containing a prominent frequency and characterised by a definite pitch. Noise from this plant will not be audible above ambient and other factory noise and is therefore considered acceptable.

5.3 Intermittent Noise

The Noise Policy for Industry defines intermittent noise sources as those that can be heard at the receiver and which vary by more than 5 dB and that the intermittent nature of the noise is clearly audible.

Each of the packing lines within the packing plant includes the packer head, conveyor, associated hoppers, product transfer screws and baghouse with associated motor and fan. Whilst any given item of plant or equipment may switch on and off during night time operations, it is reported that at least one packing line and its constituent parts would be operating at any given time.

Therefore, any individual noise sources located within the penthouse that would be considered intermittent within the building, up close, would not be audible or subjectively noticeable as intermittent at the closest residential receptor locations.

6. CONSTRUCTION NOISE EMISSION

The construction of the packing plant building, container yard area, noise wall and rail spur are assessed in previous assessments that form part of the approval for the overall packing plant development.

Construction works associated with this modification will therefore consist of piling (for the fermenter tanks only), pouring of concrete slabs for the nitrogen generator 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
Concrete Truck / Pump	105
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
Noise Design Goal ($L_{eq, 15 \text{ minute}}$)	43	50	48	48
With hammer piling	42	43	47	46
With auger piling	37	38	42	41
Construction activity (no piling)	29 – 30	30 – 34	36 – 46	35 – 45
Complies	Yes	Yes	Yes	Yes

Notwithstanding the potential for compliance with the construction noise limits, Shoalhaven Starches will prepare a Construction Safety & Environmental Management Plan for this project.

7. 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.

7.1 Packing Plant and Penthouse Building Construction

Walls

- All external walls and the roofs of the packing plant extension and the penthouse above the external silos should achieve a minimum weighted sound reduction index (R_w) rating of 33:-
- for example
- 'Kingspan' *Europanel S5 Extra series* 100 mm thick (minimum) or *Rockspan Extra* 100 mm thick (minimum)
 - <https://www.kingspan.com/au/en-au/products-brands/insulated-roof-wall-panel-systems/wall-panel-systems>
 - Architectural Roof Panelling system '*K-Dek (KS 1000 KD)*' with an internal layer of 13 mm thick sound rated plasterboard, or 9 mm thick fibre cement sheet fixed directly to one side, or equivalent*
 - * to be confirmed prior to construction
- <https://www.kingspan.com/au/en-au/products-brands/insulated-roof-wall-panel-systems/wall-panel-systems>

NB Once the construction material for the walls and roof are finalised confirmation should be sought to ensure that the acoustical performance of the chosen construction satisfies the required sound reduction in each octave band centre frequency.

Ventilation Penetrations

There should be no acoustically untreated penetrations in the walls or roof of the packing plant extension or the penthouse.

- Any penetrations must not undermine the acoustical performance of the wall or roof system (R_w 33 minimum),
- Ventilation fans where required must be acoustically treated to ensure that the noise design goals are not exceeded at any receptor location, this may be done, if required by the installation of acoustical silencers, lined ductwork, acoustic louvres or a combination.
- The selection of and requirement for ventilation fans in the proposed packing plant building extension and the penthouse, (for silo motors) are not finalised at this stage. A detailed noise control design will be undertaken once these selections have been finalised during the noise design verification process prior to construction as required by Condition 14 M of the Project Approval.

7.2 Blower Acoustical Enclosures

The two blowers will be located within the existing main packing building located approximately in the centre of the facility.

- The acoustic enclosures are required to provide a minimum reduction of **35 dB** from each blower which may be achieved using, for example concrete, or approved acoustically equivalent construction,
- A detailed noise control design will be undertaken during the noise design verification process prior to the issue of a Construction Certificate to ensure that any ventilation requirements are satisfied.

7.3 Fermenter Transfer Pumps

Based on the noise level of a typical fermenter transfer pump (L_w 93 dBA) and the potential for four (4) pumps, an additional **10 dB** reduction in noise will be required from these items of plant at receptors R3 and R4 in Bomaderry.

- Thus may be achieved by a combination of selecting alternative, lower noise models; erecting sound barrier screening atop the concrete bund walls in close proximity to each pump or enclosing the pumps,

Again, a final certification of the design and required methods of attenuation will be undertaken during the noise design phase. Given the location of the pumps relative to the receptors, the required reduction in noise from these pumps can be readily achieved.

7.4 Future Consideration of Modifying Factors

In addition to the recommendations above, any ventilation fans, blowers, pumps or other ancillary noise sources should be designed to not exhibit tonal or low frequency noise, with an appropriate one third octave assessment undertaken in accordance with assessment methodology of the EPA's *Noise Policy for Industry* 2017.

This assessment will be undertaken prior to the commencement of construction, at the Noise Design Verification Stage (in accordance with Condition 14M of the Approval).

8. CONCLUSION

An assessment of the potential noise impact from the proposed alterations to the approved northern packing plant and other works at Shoalhaven Starches on Bolong Road, Bomaderry, NSW has been undertaken. The modification also includes the construction of a nitrogen generator, an indirect cooking plant, the installation of the two new blowers and two new fermenters and the relocation of an approved car park.

Noise producing aspects of this proposed modification include the motors and fans associated with new silos at the packing plant, as well as those associated with the nitrogen generator and indirect cooking plant, pumps associated with the fermentation tanks and the new blowers.

Recommendations are made in Section 6 of this Report to reduce the level of noise emission from the items of plant and equipment associated with this modification to within the noise design goals derived from Environment Protection Licence 883 noise limits at each receptor location.

A final assessment of required noise controls will be undertaken at the time of the Design Noise Verification process prior to construction, to ensure the noise design goals are met at all receptors.

The level of noise emission from the construction phase of the project will be within the noise management levels set by the NSW EPA's *Interim Construction Noise Guideline*.

None the less, construction noise mitigation measures are included in the Construction Safety & Environmental Management Plan prepared by Shoalhaven Starches.



Matthew Harwood, MAAS

Principal Acoustic Consultant

Attachments:-

Important Note

Appendix A – Modifying Factor Adjustments – EPA Fact Sheet C

Important Note

*All products and materials suggested by Harwood Acoustics Pty Ltd 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, ventilation 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"> • 5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz • 8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz • 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 <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"> • 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 • 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.