DAY DESIGN PTY LTD
CONSULTING ACOUSTICAL ENGINEERS

SUITE 17, 808 FOREST ROAD, PEAKHURST 2210 ABN 73 107 291 494
P. 02 9046 3800 ACOUSTICS@DAYDESIGN.COM.AU WWW.DAYDESIGN.COM.AU

Manildra Group
C/- Shoalhaven Starches Pty Ltd
PO Box 123
Nowra NSW 2541

12 February 2024
Refer: 7425-10.1L

Attention: Mr James McSweeney
Telephone: 02 4423 8212 Email: james.mcsweeney@manildra.com.au

Dear Sir,

SHOALHAVEN STARCHES – MOD 23 – COGENERATION POWER PLANT DESIGN NOISE VERIFICATION

Day Design Pty Ltd has been engaged to prepare a Design Noise Verification Report for modification approval MP 06_0228 issued by the Minister for Planning for two natural gas turbines that will each generate an anticipated 30MW of power (Modification 23). The two turbines are to be constructed within a dedicated building located on the western extent of the existing Shoalhaven Starches site in Bomaderry.

1.0 NOISE CRITERIA

1.1 Consent Conditions

The Consolidated Development Consent contains Condition 12 which is relevant to the noise emission from the operation of the cogeneration (Cogen) power plant. Condition 12 has been extracted and reproduced below.

12. The Applicant shall ensure that noise from the development does not exceed the noise limits in Table 2.

Table 2: Development Noise Limits

Location	*Day/Evening/Night* $L_{Aeq(15\ minute)}$ *dB(A)*	*Night* $L_{A1(1minute)}$ *dB(A)*
1 - Terara on the south side of the Shoalhaven River	*38*	*48*
2,3 & 4 - Nowra on the south side of the Shoalhaven River	*38*	*48*
5 - Meroo Street, Bomaderry	*42*	*52*
6 - Other residential locations in Bomaderry	*40*	*50*

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

1.2 Shoalhaven Starches Noise Management Plan

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

The Shoalhaven Starches Noise Management Plan (SSNMP) originally prepared 31 October 2009 and revised 7 September 2010 addresses, among other things, acoustic criteria relating to the Shoalhaven Starches complex and any new developments. Section 3 of the plan lists noise limits from the Environmental Protection Licence as shown in Section 4.2 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."*

1.3 Project Specific Noise Criteria - Cogeneration Power Plant

In order to ensure compliance with the noise limits specified above, which will also ensure compliance with the noise limits specified in Section L5.1 of the Environmental Protection License 883, $L_{eq,\ 15\ min}$ design noise goals for this development at set to a 15 dB below the noise limits specified in Condition 12 and 5 dB below the SSNMP. The project specific $L_{eq,\ 15\ min}$ design noise goals for the Cogeneration power plant are calculated to be as shown in Table 1.

Table 1 Cogeneration Power Plant - Noise Criteria

Location	Day/Evening/Night $L_{Aeq(15\ minute)}$ dB(A)
Terara on the south side of the Shoalhaven River	23
Nowra on the south side of the Shoalhaven River	23
Meroo Street, Bomaderry	27
Other residential locations in Bomaderry	25

2.0 DOCUMENTS REVIEWED

The reports relevant to Modification 23 that form part of our review are listed below:

- *Environmental Noise Assessment, Proposed Modification to Shoalhaven Starches Expansion Project 06_0228 – Proposed Modification to Approved Cogeneration Plant – Modification 23* (report № 2103012E-R Rev B) prepared by Harwood Acoustics dated 16 March 2022;
- HRSG Stack Flue Gas Silencer – Shoalhaven Project Noise Study, report №21SCA017.ST01, prepared by Stopnoise Engineering SRL, supplied by John Cockerill Pty Ltd, dated 27 April 2022;
- Main Stack Calculation Report, report № 33F01 Rev B, prepared by Modalyse Engineering, dated 21 October 2021.

The relevant drawings for Mod 23 that form part of our review are listed below:

- Building Design Plans; Manildra Cogeneration Plant (Construction Issue) prepared by Edmiston Jones, dated 18 November 2022;
- Cogen Mod 23 Over All Site Plan, prepared by Manildra Group, dated 27 September 2021;
- Cogen Mod 23 Site Elevations, prepared by Manildra Group, dated 7 September 2021;
- Construction Certificate mechanical services and ventilation plant drawings prepared by VOS Group Consulting Engineers, dated 18 November 2022;
- HRSG General Arrangement, drawing № 69024_99002, supplied by Jon Cockerill Pty Ltd, dated 19 January 2022.

3.0 SUMMARY OF ACOUSTIC RECOMMENDATIONS

The noise calculations and subsequent noise controls recommended by Harwood Acoustics in relation to Modification 23 were based on preliminary designs of the Cogen power plant building. Changes to the design of the Cogen building were implemented following the issue of the Harwood NIA report. As such, some of the recommended noise controls specified in the report may be irrelevant to the final design.

The recommended noise controls specified in Section 7 of the Harwood report are as follows;

- All external walls of the Cogen building to be constructed from minimum 170 mm thick tilt up concrete panels or in-situ concrete.
- The roof of the Cogen building should achieve a minimum Rw rating of 42, with minimum R ratings of:
    - 31 dB at 63 Hz; and
    - 35 dB at 125 Hz.
- The roof ridgeline air intake must face east only and shall not exceed a total of 31m^2 and be fitted with acoustic louvres with minimum transmission losses as shown in Table 2.

Table 2 Roof Ridgeline Acoustic Louvre – Insertion Loss

Description	Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Acoustic Louvre – Based on NAP Silentflo 600H Line	3	8	16	21	27	27	24	21

- 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 once the construction material for the walls and roof are finalised;
- Breakout noise from the exhaust stack walls must be a minimum of 10dB less than at the outlet;
- Access doors on the eastern façade not to exceed a total 144m^2 and should achieve a minimum Rw rating of 34 with minimum R ratings of:
    - 11 dB at 31.5 Hz;
    - 18 dB at 63 Hz;
    - 19 dB at 125 Hz.
- All pedestrian doors are to be of minimum 40 mm thick solid core construction or an approved equivalent material with similar acoustic rating.

4.0 VERIFICATIONS

This assessment addresses the requirements of Condition 12 based on the drawings, reports and other documentation relevant to the design of the Cogen building and associated plant, as specified in Section 2.

There are no specific requirements within the Consolidated Consent to implement the noise control recommendations into the design of the Cogen power plant. However, a review of the various reports and drawings has been undertaken to ensure that the noise emissions from the Cogen plant will meet the established design noise goals.

The noise controls recommended in the Harwood report have been verified in the current design of the Cogen plant as follows;

- *All external walls of the con-gen building to be constructed from 170 mm thick tilt up concrete panels or in-situ concrete.*

The external walls of the Cogen building will be constructed from 170 mm thick pre-cast concrete panels. Walls of this construction typically achieve a weighted sound reduction index of R_w55 and is in general accordance with the recommended external wall construction.

- *The roof of the Cogen building should achieve a minimum Rw rating of 42, with minimum R ratings of:*
    - *31 dB at 63 Hz; and*
    - *35 dB at 125 Hz.*

The roof of the Cogen building is constructed from multiple layers, as follows:

- 1 x internal layer of Askin 200 mm thick 'Volcore Metric' insulated panel;
- 1 x layer of 9 mm thick Fibre Cement sheet laid above;
- 1 x external layer of Klip-Lok roof sheeting

This roof construction is estimated to achieve a weighted sound reduction index of R_w42 with R ratings of 20 dB at 125 Hz and 21 dB at 63 Hz. This roof construction is in general accordance with the recommended roof construction however the noise insulation performance at low frequencies is significantly lower than is recommended in the Harwood report.

Noise modelling has been conducted for the Cogen building with this roof construction, inclusive of the R ratings stated above. It is found that the operation of the Cogen plant will not increase the overall levels of noise from the operation of the existing Shoalhaven Starches facility and will meet the SSNMP design noise goals at each receptor location. No additional noise controls for the roof are required.

- *The roof ridgeline air intake must face east only and shall not exceed a total of 31m² and be fitted with acoustic louvres with minimum transmission losses as shown in Table A.*

Table A Roof Ridgeline Acoustic Louvre – Insertion Loss

Description	***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*

- *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 once the construction material for the walls and roof are finalised.*

The roof ridgeline is noted to span across the Cogen building from east to west with various ventilation fans housed within. No acoustic louvres are fitted to the ridgeline riser, however, the various ventilation fans within the riser have attenuators fitted and negate the requirement for acoustic louvres.

- *Breakout noise from the exhaust stack walls must be a minimum of 10 dB less than at the outlet.*

The *HRSG Stack Flue Gas Silencer – Shoalhaven Project Noise Study*, prepared by Stopnoise Engineering, indicates that the sound power level at the HRSG stack outlet is calculated to be 95dBA. The sound power level from the outer stack surface is calculated to be 82 dBA. As such, the breakout noise level from the stack walls is in accordance with the recommendations of the Harwood report.

- *Access doors on the eastern façade not to exceed a total 144m² and should achieve a minimum Rw rating of 34 with minimum R ratings of:*
    - *11 dB at 31.5 Hz;*
    - *18 dB at 63 Hz;*
    - *19 dB at 125 Hz.*

Four operable access doors (steel roller shutters), are located on the eastern façade of the Cogen building. These doors are 6m x 6m each, for a total of 144m². Three access doors of similar construction are also located on the west façade, each 4m x 6m for a total of 72m².

Based on this construction, the estimated weighted sound reduction index for these doors is R_w29 with R ratings of 18 dB at 125 Hz, 15 dB at 63 Hz and 10 dB at 31Hz.

The overall Rw rating for these doors is lower than recommended in the Harwood report, however, the low frequency noise reduction performance is similar to the recommended R rating.

- *All pedestrian doors are to be of minimum 40 mm thick solid core construction or an approved equivalent material with similar acoustic rating.*

All pedestrian access doors to the Cogen building are fire rated, solid core construction and are in general accordance with the recommendations in the Harwood report.

We have reviewed the Construction Certificate mechanical services and ventilation plant drawings prepared by VOS Group Consulting Engineers which provides schedules of acoustic louvres, ventilation fans, fan and ductwork attenuators and indicates the location of each item on/within the Cogen building.

The various items of plant and equipment and their corresponding noise levels or attenuation values are shown in Tables 4-6 and have been included in noise modelling calculations.

Acoustic louvres will be installed within the eastern, southern and northern facades of the Cogen building. Models of louvres are yet to be specified however attenuation values assumed for façade intake acoustic louvres are shown in Table 3.

Table 3 Intake Acoustic Louvres – Insertion Loss

Location & Depth	Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
	63	125	250	500	1k	2k	4k	8k
Eastern Façade - 600 mm[1]	11	16	22	27	33	33	30	27
Southern Façade - 600 mm[1]	11	16	22	27	33	33	30	27
Northern Façade								
- 900 mm[2]	11	16	22	32	49	56	56	56
- 200 mm[3]	9	12	15	20	32	38	36	33

[1] *Based on Element Control Systems model SS600 acoustic louvre*
[2] *Based on NCS Acoustics QFS900 model acoustic louvre*
[3] *Based on Flexshield model SL4-20 model acoustic louvre*

Noise levels for various ventilation fans are shown in Table 4.

Table 4 L_{eq} Sound Power Levels – Ventilation Fans

Fantech Cat № & Locations	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)								
	dBA	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
AP0804CP9/33 - Roof Ridgeline	**96**	94	92	90	89	87	83	80	75
AP1406CA12/28 - West Building	**102**	95	95	97	95	95	92	88	85
AP0804BA7/23 - HA North - HA South	**93**	89	86	86	85	83	81	79	70
AP1004CA6/16 - HA North - HA South	**101**	89	93	90	82	80	80	89	84

Attenuation values for fan and ductwork attenuators are shown in Table 5.

Table 5 Fan & Ductwork Attenuators – Insertion Loss

Fantech Cat № & Locations	Insertion Loss (dB) at Octave Band Centre Frequencies (Hz)							
	63	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**
C2-080 - Roof Ridgeline	5	8	12	22	23	16	15	10
C2-140 - West Building	7	9	15	21	18	11	11	10
NSA22E-212-125 - GT-1 & GT-2 Ducts	6	13	25	40	36	29	21	17
C1-080 - HA North - HA South	3	4	8	14	13	9	7	6
C2-100 - HA North - HA South	6	8	13	22	19	13	12	10

5.0 CALCULATED NOISE LEVELS

Noise emission from the operation of the Cogen plant and the existing Shoalhaven Starches facility has been modelled. Tables 6 and 7 show the calculated noise levels for the Cogen plant at each receptor location in comparison with the project specific design noise goals, as defined in Section 1.3.

The calculated cumulative noise levels from the operation of the Cogen plant and the existing facility, as derived from the Site Wide Noise Model report 7425-3 Rev D, approved by the EPA (Letter DOC23/1088045-1, dated 20 December 2023), are also shown in addition to the contribution of the Cogen plant to the overall noise levels at each receptor location.

All noise calculations have been conducted within the modelling environment of the approved Site Wide Noise Model.

An analysis for low frequency and tonal components has been conducted. No dominant low frequency noise or tonal components are found at any of the receptor locations. As such, no corrections are applicable.

Table 6 Calculated $L_{eq,\ 15\ min}$ Noise Levels – Terara & Nowra

Receptor Location	Period	Calculated Noise Level $L_{eq,\ 15\ min}$	Noise Criteria $L_{eq,\ 15\ min}$	Compliance (Yes/No)
6 W. Berry St – Terara (DD17)		Cogen Plant 17 dBA	Design Noise Goal - 23 dBA	Yes
		Existing Site 43 dBA	EPL 883 Noise Limit – 38 dBA	No + 5 dB
		Total Noise Emission 43 dBA		
		Proposal Noise Contribution 0 dB		
58 Riverview Rd – Nowra (DD20)		Cogen Plant 23 dBA	23 dBA	Yes[4]
		Existing Site 43 dBA	EPL 883 Noise Limit – 38 dBA	No + 6 dB
		Total Noise Emission 43 dBA		
		Proposal Noise Contribution 0 dB		

[4] *Exceedances of 2 dB or less are considered to be negligible. Refer Table 4.1 and 4.2 of the NSW Noise Policy for Industry.*

Table 7 Calculated $L_{eq,\ 15\ min}$ Noise Levels – Bomaderry

Receptor Location	Period	Calculated Noise Level $L_{eq,\ 15\ min}$	Design Noise Goal $L_{eq,\ 15\ min}$	Compliance (Yes/No)
53 Meroo St – Bomaderry (L5)		Cogen Plant 29 dBA	27 dBA	Yes[5]
		Existing Site 45 dBA	EPL 883 Noise Limit – 42 dBA	No + 3 dB
		Total Noise Emission 45 dBA		
		Proposal Noise Contribution 0 dB		
Cnr Bunberra & Dalwah St – Bomaderry (L7)		Cogen Plant 24 dBA	25 dBA	Yes[5]
		Existing Site 44 dBA	EPL 883 Noise Limit – 40 dBA	No + 4 dB
		Total Noise Emission 44 dBA		
		Proposal Noise Contribution 0 dB		

It can be seen from Tables 6 and 7 that the noise levels emitted from the operation of the Cogen plant meet the design noise goals at each location, however it is noted that the design noise goals at Nowra and Meroo Street, Bomaderry are exceeded by 2dB and 1 dB respectively.

The significance of residual noise impacts is addressed in Section 4 of the NSW Noise Policy for Industry. It is stated that exceedances of 2 dB or less are considered to be negligible and not discernible to the average listener.

Notwithstanding this minor exceedance, the calculated noise levels at these locations are 3-4 dB below the SSNMP design noise goals. As such, the SSNMP design noise goals are met at all locations.

The contribution of the Cogen plant to the overall noise level emission from the existing Shoalhaven Starches facility is negligible at all receptor locations. No additional noise controls are necessary.

Noise level contours for the Cogen plant, existing site and cumulative noise levels are shown in Appendices A-C.

[5] *Exceedances of 2 dB or less are considered to be negligible. Refer Table 4.1 and 4.2 of the NSW Noise Policy for Industry.*

6.0 CONCLUSION

A review of previous Environmental Noise Impact Assessment reports has been conducted in conjunction with various construction drawings relating to the Cogen plant to demonstrate that the noise emission from the general operation of the power plant will meet the established SSNMP design noise goals and to determine any additional impacts to acoustic amenity for nearby residential receptor locations.

The construction drawings indicate that the design of the Cogen power plant building has generally implemented the various noise control recommendations into the construction of the buildings provided in previous Environmental Noise Impact Assessment report specified by Harwood Acoustics.

Noise modelling of the Cogen power plant and the existing Shoalhaven Starches facility indicates that no low frequency or tonal components are found at any receptor location, therefore no adjustments are required.

Noise levels from the general operation of the Cogen power plant are below the SSNMP design noise goals at each receptor location in Terara, Nowra and Bomaderry and will not result in any significant increase to the overall noise emission from the existing site. No additional noise controls are required.

Alexander Mendoza, MDesSc(Audio & Acoustics), MAAS
Acoustical Consultant
for and on behalf of Day Design Pty Ltd

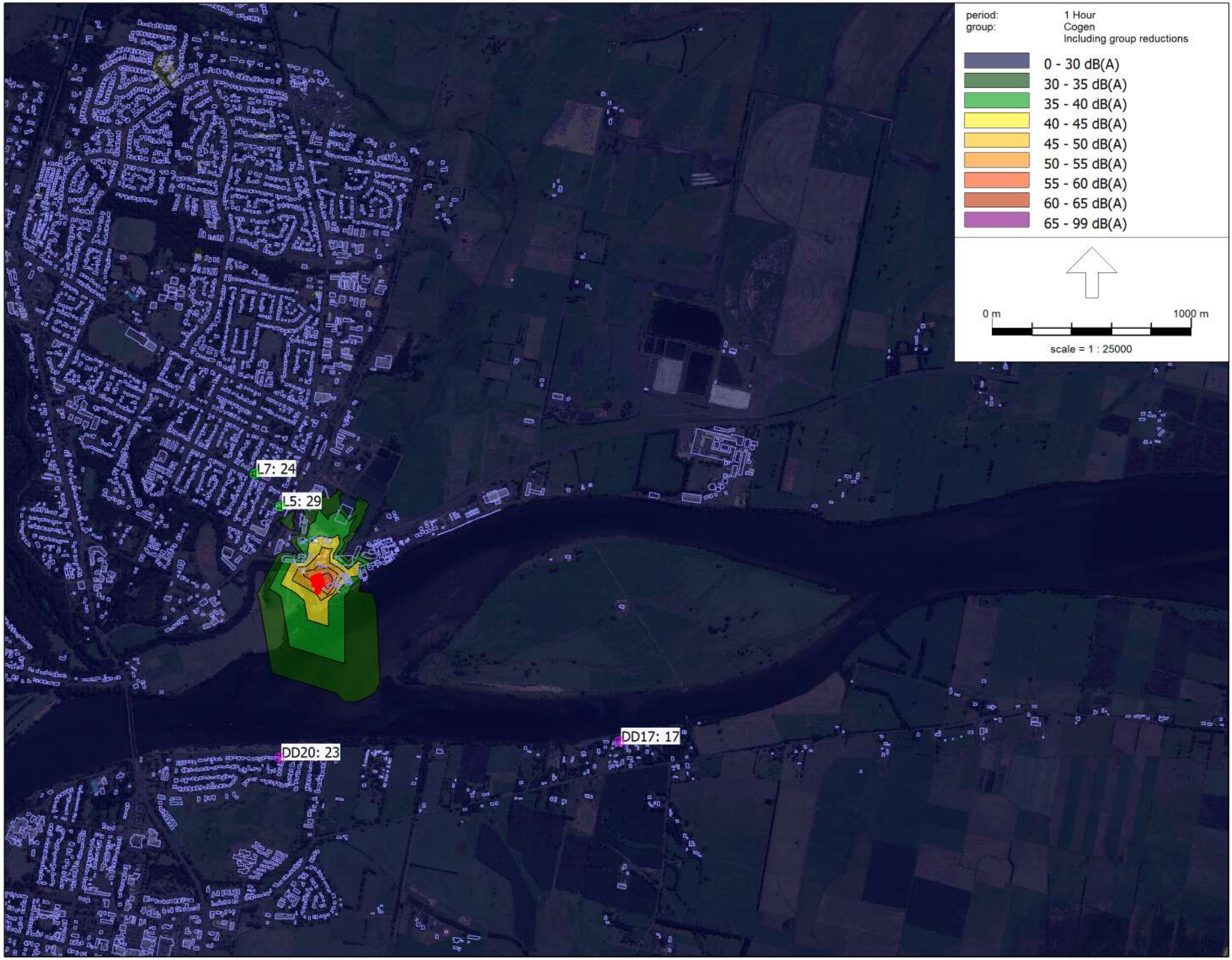
AAAC MEMBERSHIP

Day Design Pty Ltd is a member company of the Association of Australasian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

The undersigned hereby certifies that this Report has been checked and approved in accordance with our Quality Management System.

Attachments:

Appendix A - $L_{eq,\ 15\ min}$ Noise Contours: Cogeneration Power Plant
Appendix B - $L_{eq,\ 15\ min}$ Noise Contours: Existing Site
Appendix C - $L_{eq,\ 15\ min}$ Noise Contours: Total Existing Site & Cogen Plant



Leq, 15 min - Cogeneration Power Plant.

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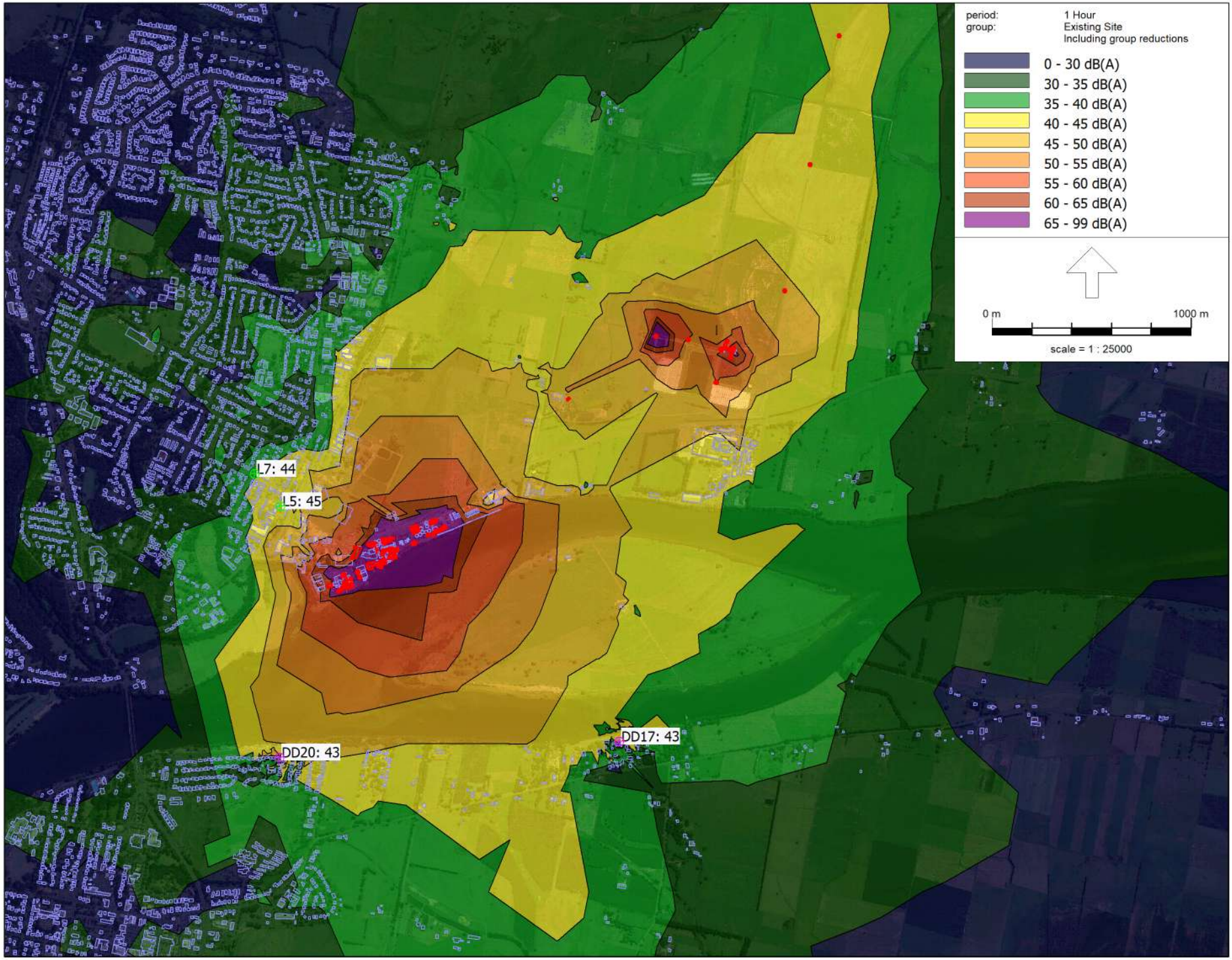
7425-10 Appendix A - Leq, 15 min: Existing Site



Leq, 15 min - Existing Site

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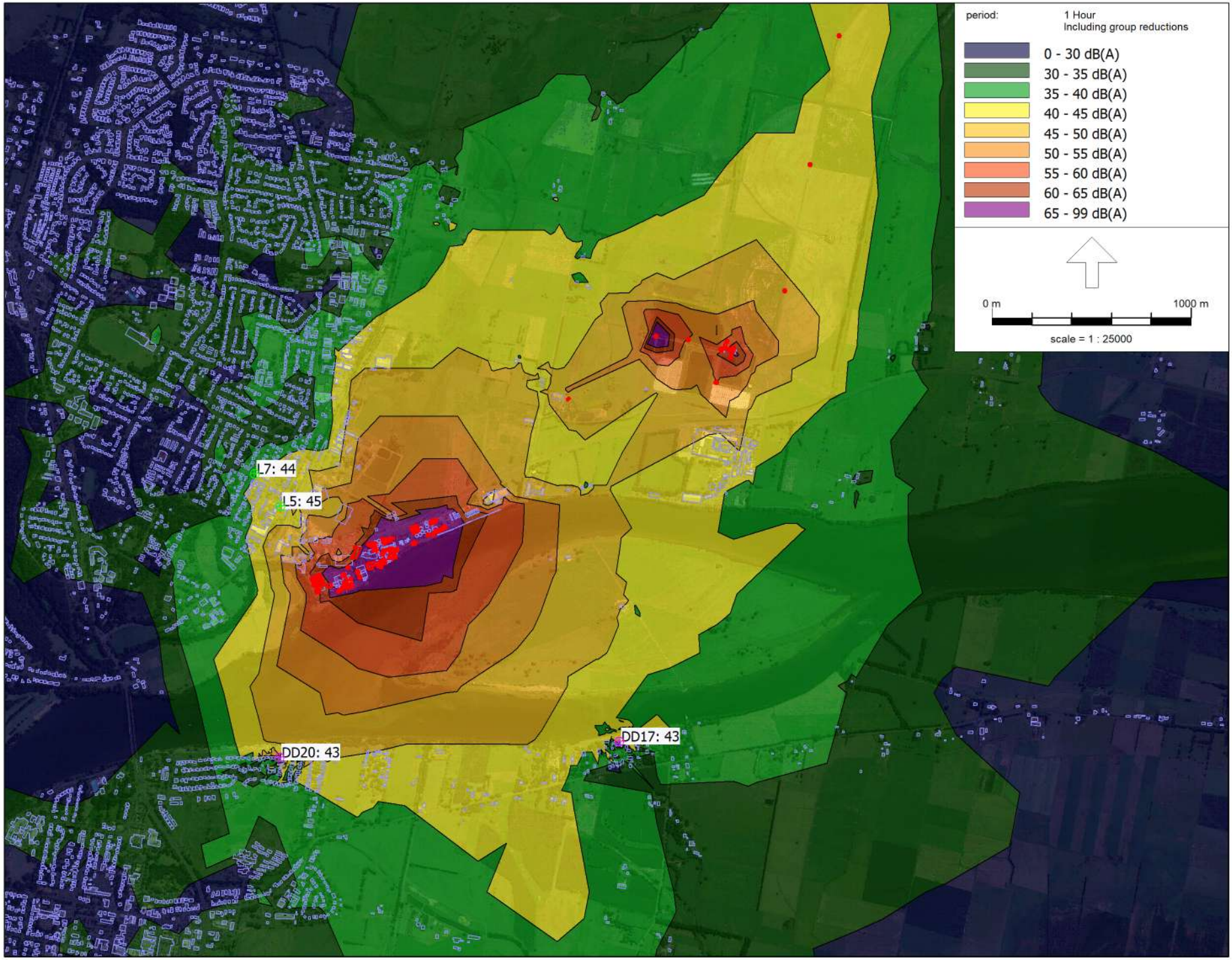
ISO 9613 (1/3-oct.), [7425-3 - 7425-10 Cogen w/pipebridge (Approved SWNM)] , iNoise V2024 Enterprise Licensed to Day Design Pty Ltd - Australia

7425-10 Appendix A - Leq, 15 min: Cumulative Cogeneration Power Plant & Existing Site



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