

Memorandum

To	Christopher Croucamp, Urbis	From	Juan Lewis, Aurecon
Copy	Mishelle Yam, NEXTDC	Reference	P521243 NEXTDC S4
Date	2026-06-11	Pages (including this page)	4
Subject	Confirmation of Servicing Strategy LOT 305 NEXTDC S4 Data Centre– Infrastructure, Hydraulic Services and Hazardous Goods		

1 Purpose of this Memo

This memorandum has been prepared to confirm that the approved SSDA servicing strategy and environmental performance outcomes for the NEXTDC S4 Data Centre development remain valid following minor design development changes.

This memo addresses the following areas:

- Infrastructure Requirements Report
- Backup Power Report
- Preliminary Hazards Analysis
- Noise and Vibration Impact Assessment

The purpose of this memorandum is to confirm that the design development changes do not result in new or materially different impacts to those assessed under the approved State Significant Development Application (SSDA).

2 Updates to memo

This memorandum has been updated to address comments from the EPA and DPHI

Comment	Response
Environmental Protection Authority	
The EPA recommends that DPHI carefully consider the potentially unresolved risk of noise emissions with annoying characteristics from the modification and consider requesting additional information including: ■ Assumptions used for transformers including noise spectra and measurements of similar equipment (where available).	From Appendix B - measured 1/3 octave sound pressure level spectrum for a substation transformer has been adopted for noise modelling, with each individual 1/3 octave band sound pressure level corrected to provide an overall sound power level of 95 dB(A). Further information including the assumed sound power level spectrum used for noise modelling is provided under Section 6 and Table 6-1
■ Predicted noise levels at relevant receivers.	From Appendix B - Noise modelling results indicate that, with the recommended mitigation modifications (refer to Figure 6-1 and Section 7), the most stringent night-time noise criteria at all nearest sensitive receivers are fully complied with. Predicted noise levels at all nearest sensitive receivers for night-time site operations are provided in Table 7-1.

■ Demonstration that the assessment of annoying characteristics according to NPfl Fact Sheet C has been carried out, including spectral noise calculations where relevant.	From Appendix B - Assessment of annoying characteristics have been undertaken in accordance with the NPfl Fact Sheet C. Assessment results indicated that corrections for annoying characteristics are not applicable at any of the nearest sensitive receivers during night-time site operations. Refer to Appendix A for more information on tonality and low frequency noise assessment.
■ Confirmation and justification that either no further mitigation is possible, or additional assessment of mitigation considering the hierarchy of controls in the NPfl.	From Appendix B - Assessment results indicate full site noise compliance, and no additional noise mitigation is required for any of the nearest sensitive receivers.
The EPA recommends that DPHI consider requiring receiver R1 and any other potentially impacted receiver to be included in the assessment in addition to noise contour maps.	From Appendix B - Noise modelling results indicate that, with the recommended mitigation modifications (refer to Figure 6-1 and Section 7), the most stringent night-time noise criteria at all receivers including R1 are fully complied with. Predicted noise levels at all nearest sensitive receivers for night-time site operations are provided in Table 7-1. A noise contour map is provided in Appendix B showing all the nearest receivers including R1.
The EPA recommends that DPHI consider requiring overall noise levels from the premises to be presented in the report for the potentially impacted receivers.	From Appendix B - The current noise assessment has considered all noise sources onsite, including substation transformers, equipment associated with the data centre buildings, and equipment associated with the ancillary buildings. The predicted noise levels presented in this report represent the overall noise levels from the site during night-time period. Predicted noise levels at all sensitive receivers for night-time site operations are provided in Table 7-1. Refer to the Acoustic Assessment report for the project for detailed information.
DPHI	
The Department notes from the Modification Report that the increase in height of water tanks is proposed in response to increased water demand identified through detailed design. However, the Technical Memorandum provided in Appendix C of the Modification Report states that refinements to tank heights does not change the water demands of the development beyond previously assessed.	Discrepancy addressed and answered in Section 7 of this memo
The Department requests confirmation on any changes to the water consumption demands of the development and further details on water consumptions and the sites water usage effectiveness (WUE) in the even water demands of the development have increased.	Total water demand has increased to 20.69ML/d but industrial water will be predominantly serviced by Recycled Water from coNEXA in day final arrangement. WUE of 1.76 L/kWh, please refer to Section 7

3 Background

The NEXTDC S4 Data Centre was approved under State Significant Development Application SSD-63741210, supported by technical assessments prepared by Aurecon, including the **Infrastructure Requirements Report, Preliminary Hazards Analysis and the Noise and Vibration Impact Assessment.**

Since SSDA approval, minor design development has occurred as part of detailed design coordination. These changes are a result of the refinement of plant layouts and selections and do not alter the approved development intent, servicing strategy, or environmental performance assumptions.

4 Summary of Design Development Changes

The design development changes include:

- Increase the width of the pump house building by 5.5m,
- Increase in the height of the industrial water tanks by an additional 1.5m,
- Increase in the height of the fire water storage tanks by 0.5m
- Amendments to the dimensions of the fire pump building, including:
 - Building height raised by 0.94m,
 - Width increased by 1m, and
 - Length increased by 0.4m.
- Increase to the bulk fuel tank capacity from 4472kL to 4600kL.
- Administrative update to reflect 372MW backup power capacity.
- Amendments to the existing acoustic walls, including:
 - Increase in the transformer wall height from 10m to 13m,
 - Increase in the HVSB wall height from 6.85m to 10m and extended linearly by 3.5m to the south
- Administrative updates to amend the development description to remove reference to the café.

These changes are internal in nature and represent design refinement rather than a change to the approved development intent.

5 Infrastructure Requirements

The approved infrastructure servicing strategy, as reported in the Infrastructure Requirements Report, remains unchanged.

Specifically:

- The overall servicing philosophy and infrastructure strategy are unchanged
- Utility demand drivers and staging assumptions remain consistent with the approved SSDA
- No changes are proposed to external utility connections, connection locations, or authority agreements
- No additional off-site infrastructure is required

The design development changes do not alter the conclusions or assumptions of the approved Infrastructure Requirements assessment.

Accordingly, an update to the Infrastructure Requirements report is not considered necessary.

6 Backup Power Report

The conditions of consent for the SSDA erroneously references a total installed back-up generator capacity of 360 MW.

As per the Backup Power Report [Rev E] dated 2025-04-24, Section 5.2 Generator Design. The generators provide a total backup power capacity of 372 MW.

There is reference made to 120 off 3MW generators in the Air Quality Impact Assessment [Rev4V2], Section 2.3.2.1 Emissions from Generators, the reference to a generator capacity of 3 megawatts is a clerical error and the engine selected for the facility has been modelled in the AQIA modelling. This has been clarified in Appendix A – NEXTDC S4 Air Quality Technical Clarification

7 Hydraulic Services

The hydraulic servicing strategy remains consistent with that assessed and approved under the SSDA.

The internal layout refinements (including pump room sizing and tank height adjustments) do not:

- Alter connection points to Sydney Water or other authorities
- Introduce new hydraulic servicing risks or constraints

The industrial water servicing design for S4 has been developed since the original proposal with an increase to the onsite storage tank capacity from 18.9 ML per day to 20.69 ML/day. This capacity will in the ultimate state be made up through 4.6 ML/day from Sydney Water as approved through the Section 73 Compliance Certificate and the remaining of 16.09 ML per day will be supplied through the coNEXA Aquanet Network (Recycled Water).

The S4 facility has been designed for a Water Usage Efficiency of 1.76 L/kWh, which is below the industry standard of 1.8 L/kWh for similar facilities, though actual WUE will depend on final system configuration and operational conditions and will be confirmed through monitoring during operations.

The approved hydraulic servicing approach therefore continues to apply without modification.

8 Preliminary Hazards Assessment (Bulk Diesel Storage)

The approved SSDA includes bulk diesel storage associated with back-up power generation infrastructure. As part of detailed design refinement, a minor increase in bulk diesel storage has been proposed:

- Approved bulk diesel storage: 4,472 kL
- Proposed bulk diesel storage: 4,600 kL
- Net increase: 128 kL

This increase:

- Does not alter the hazardous goods classification previously assessed
- Does not introduce new hazardous goods storage types

Importantly, the total bulk diesel storage volume **continues to remain below the relevant thresholds under the Protection of the Environment Operations (POEO) Act**, including the 5,000 kL threshold applicable to scheduled activities. Accordingly:

- The hazardous goods classification of the development remains unchanged
- No new licensing or regulatory triggers are introduced
- The conclusions of the approved Preliminary Hazards Analysis remain valid

Based on the above, the minor diesel increase does not alter the hazard classification, and the existing SSDA assessment remains valid.

9 Acoustics

The detail design development with updated substation equipment selections and layouts has been reviewed and addressed through design development of the acoustic performance analysis. As a result, amendments to the noise wall configuration are required to ensure continued compliance with the **approved SSDA noise criteria**.

The proposed increases to existing acoustic wall heights and extents, are specifically intended to mitigate noise from the updated equipment configuration.

On this basis:

- Predicted operational noise levels at sensitive receivers are not expected to be higher compared to the previous noise assessment results
- Noise impacts at the nearest receivers will be within the stipulated noise criteria.
- There is no substantial change to the operational noise impacts previously assessed under the approved Noise and Vibration Impact Assessment

Accordingly, the approved acoustic assessment outcomes remain applicable, and the design development changes do not result in any significant change to overall operational noise impacts.

For further information please refer to Appendix B - NEXTDC S4 Substation Transformer noise study R3 discussing the relevant changes

10 Conclusion

Based on the above:

- The approved infrastructure, hydraulic servicing, hazardous goods, and acoustic strategies assessed under the SSDA continue to apply
- The design development changes represent internal refinements and do not result in new or materially different impacts
- Compliance with approved noise criteria and POEO Act thresholds will be maintained
- No additional mitigation measures beyond those already incorporated into the approved design are required
- A short design confirmation memorandum is sufficient, and full updates to the supporting technical reports are not required

This memorandum is provided to support SSDA change documentation and authority consultation.

Regards,

A handwritten signature in black ink, appearing to read 'Juan', with a stylized flourish at the end.

Juan Lewis

Technical Director, Aurecon

APPENDIX A – NEXTDC S4 Air Quality Technical Clarification

APPENDIX B – NEXTDC S4 Substation Transformer noise study R3

APPENDIX A

Letter

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Date: Thursday, 2 April 2026

Aurecon Group,
Level 11/73 Miller St, North Sydney NSW 2060

FAO: Juan Lewis

Project Name:	NEXTDC S4 Data Centre – Air Quality Technical Clarification
Reference:	24.1064.DR6V1
Status	Final

The following letter has been prepared by Northstar Air Quality Pty Ltd to provide technical clarification in response to comments received from Aurecon Group on 1 April 2026 regarding backup generator capacity and the Air Quality Impact Assessment (24.1064.FR4V2, dated 28 April 2025) produced for the NEXTDC S4 Data Centre development.

Should you require any further information or clarification, please do not hesitate to contact the undersigned.

For and on behalf of

Northstar Air Quality Pty Ltd

Declan Alder

Principal Air Quality Consultant

Reviewed by: Gary Graham

This report has been prepared with the due care and attention of a suitably qualified consultant. Information is obtained from sources believed to be reliable but is in no way guaranteed. No guarantee of any kind is implied or possible where predictions of future conditions are attempted. This report (including any enclosures and attachments) has been prepared for the exclusive use and benefit of the addressee(s) and solely for the purpose for which it is provided. Unless we provide express prior written consent, no part of this report should be reproduced, distributed or communicated to any third party. We do not accept any liability if this report is used for an alternative purpose from which it is intended, nor to any third party in respect of this report.

1. CLARIFICATION

This letter provides clarification regarding the installed backup generator capacity and associated references within the approved technical documentation for the NEXTDC S4 Data Centre development under State Significant Development (SSD) 63741210.

Condition A6 of SSD-63741210, dated 24 December 2025 states:

A6. The Applicant must ensure the back-up generators installed and operated under this consent do not exceed a total installed generating capacity of 360 megawatts.

As documented in Section 5.2 (Generator Design) of the Backup Power Report (Rev E, dated 24 April 2025), the installed generators provide a total backup power capacity of 372 MW, reflecting 120×3.1 MW generators. The Backup Power Report provides the definitive design basis for backup generation capacity at the NEXTDC S4 data centre.

Within Section 2.3.2.1 (Emissions from Generators) of the AQIA (24.1064.FR4V2, dated 28 April 2025), reference is made to 120×3 MW generators. This is acknowledged as a clerical carry-over from earlier project discussions and represents a nominal ('approximate') descriptor only.

For clarity, the AQIA assessment scenarios conservatively assume that standby generators operate at 100 % (full) load with corresponding emissions data provided in Appendix E. The dispersion modelling has been carried out using manufacturer-derived performance and emissions data for two candidate generator engines, namely the Caterpillar C175-20 and MTU 20V4000G94LF generator sets. Based on manufacturer technical specifications presented in Appendix E, the full-load electrical outputs for the assessed generators are as follows:

- Caterpillar C175-20: 3 102 kW; and,
- MTU 20V4000G94LF: 3 307 kW.

Pollutant emission data for each candidate generator (expressed as $\text{g}\cdot\text{hr}^{-1}$ and $\text{g}\cdot\text{kWh}^{-1}$) were used to derive the emission rates applied in the dispersion modelling (expressed as $\text{g}\cdot\text{s}^{-1}$). The AQIA modelling therefore reflects manufacturer specified full-load generator performance rather than the nominal description provided in Section 2.3.2.1. Accordingly, the reference to '3 MW generators' within Section 2.3.2.1 represents a clerical descriptor only and does not affect the emissions inputs used in the dispersion modelling and the AQIA modelling remains valid.

It is our understanding that the total installed backup generation capacity is 372 MW, as documented in the Backup Power Report, and is assessed as such in the AQIA.

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air quality	Northstar specialises in all aspects of air quality, dust, and odour management, covering monitoring, modelling and assessment, due diligence and process specification, licencing and regulatory advice, peer review and expert witness.
environment	Our team has extensive experience in environmental management, covering environmental policy and management plans, licencing, compliance reporting, auditing, data, and spatial analysis.
sustainability	We look beyond compliance to add value and identify opportunities. Our services range from sustainability strategies, ecologically sustainable development reporting and assessment, to bespoke greenhouse gas and energy estimation and reporting.

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APPENDIX B

Memorandum

To	James Cameron	From	Mark Cheng
Copy	Juan Lewis	Reference	P521243
Date	2026-06-11	Pages (including this page)	10
Subject	NEXTDC S4 – Substation transformer noise study		

1 Executive summary

This memorandum presents an updated noise assessment for the NEXTDC S4 Data Centre with specific consideration to the substation transformers at 16 Johnston Crescent, Horsley Park.

A review was required because Aurecon was informed that the original sound power level target for each substation transformer (confirmed in email correspondence dated 01 March 2024) specified by the manufacturer during the SSDA stage (89 dBA) cannot be achieved. The design of the project has now progressed to the Tender Design Stage and hence the noise model has been updated for all noise sources for the project. The minimum achievable sound power level for the substation power transformers is now understood to be **95 dBA**.

Using the latest tender design stage noise model, worst-case operational scenarios were assessed for the new substation transformer sound power levels, and agreed additional mitigation options were evaluated.

Key findings of the study are as follows:

- Predicted impacts: Without mitigation, noise levels at the nearest sensitive receivers are predicted to exceed the site noise limits.
- Mitigation effectiveness: Increasing noise wall heights, adding absorptive lining, and extending southern end of the High Voltage Switch Board (HVSB) noise wall reduces predicted noise levels effectively.
- Based on the assessment, Table 1-1 summarises additional noise mitigation for the substation transformers recommended to be incorporated to the project. This is based on the preferred evaluated mitigation option for Scenario S5. Refer to Section 6 for details with regard to the assessed scenarios.

Table 1-1 Comparison of noise mitigation recommended in the SSDA and this memorandum

Reference	HVSB noise wall requirements	Substation C-shaped noise wall requirements	Other mitigation
Noise mitigation recommended in the SSDA (Old Design)	6.85m height (a solid surface with minimum surface weight of 10 kg/m ² , with absorption panel with NRC 1.0 (Megasorber P100 or equivalent) on the side facing the transformers)	10m height (a solid surface with minimum surface weight of 10 kg/m ² , with absorption panel with NRC 1.0 (Megasorber P100 or equivalent) on the side facing the transformers)	-
Noise mitigation recommended in this report (Scenario S5)	10m height noise wall with 2 layers comprising: ■ A solid surface with Weighted Sound Reduction Index (Rw) > 35	13m height noise wall with 2 layers comprising: ■ A solid surface with Rw > 35	A local 3.5m length extension to the southern end of the HVSB

Reference	HVSB noise wall requirements	Substation C-shaped noise wall requirements	Other mitigation
	■ Absorption panel with NRC 1.0 (Flexshield Sonic V100 or equivalent) on the side facing the transformers	■ Absorption panel with NRC 1.0 (Flexshield Sonic V100 or equivalent) on the side facing the transformers	noise wall (10m height)

- The following alternative mitigation strategies were also considered however were identified to be insufficient to mitigate noise impacts or not feasible and reasonable for the project:
 - installing a dog leg wall to be extended from C shaped wall towards the oil spill tank. Refer to Figure 6-1 for noise wall extent and orientation.
 - installing a minimum 8 m high angled wall to the south of the transformer yard near the batter zone (Scenario 2). Refer to Figure 6-1 for noise wall extent and orientation.
 - installing Pyrotek Reapor or equivalent absorption of Noise Reduction Coefficient (NRC) 0.95 on the eastern façade of Building D for at least 80% of the area.
- The following assumptions have currently been made in the modelling exercise:
 - A measured 1/3 octave sound pressure level spectrum for transformers¹ has been adopted for noise modelling, with each individual 1/3 octave band sound pressure level corrected to provide an overall sound power level of 95 dB(A).
 - The 1/3 octave sound power levels for some mechanical equipment have been interpolated from manufacturers’ 1/1 octave data.
- The assessment findings of this updated study are:
 - Modelling results indicate that, with the recommended mitigation modifications, the most stringent night-time operational noise limits are expected to be fully compliant at all nearest sensitive receivers. The assessment indicated that corrections for tonality and low frequency characteristics are not applicable at all assessed sensitive receivers during night-time period. No correction for intermittency and duration factors is applicable as there are no repeated sudden and periodic step changes in noise and one-off/unusual events occurring on site.

1.1 Response to agency feedback on the noise study

This updated memorandum has been prepared in response to the relevant agency feedback. Table 1-2 below summarises the relevant agency feedback and the corresponding comments and section references.

¹ Gange, M. (2011). Low-frequency and tonal characteristics of transformer noise. Proceedings of Acoustics 2011, Gold Coast, Australia

Table 1-2 Response to agency feedback

Agency	Feedback	Comment and section reference
Environmental Protection Agency (EPA)	The EPA recommends that DPHI carefully consider the potentially unresolved risk of noise emissions with annoying characteristics from the modification and consider requesting additional information including:	A measured 1/3 octave sound pressure level spectrum for a substation transformer has been adopted for noise modelling, with each individual 1/3 octave band sound pressure level corrected to provide an overall sound power level of 95 dB(A). Further information including the assumed sound power level spectrum used for noise modelling is provided under Section 6 and Table 6-1.
	Assumptions used for transformers including noise spectra and measurements of similar equipment (where available).	
	Predicted noise levels at relevant receivers.	Noise modelling results indicate that, with the recommended mitigation modifications (refer to Figure 6-1 and Section 7), the most stringent night-time noise criteria at all nearest sensitive receivers are fully complied with. Predicted noise levels at all nearest sensitive receivers for night-time site operations are provided in Table 7-1.
	Demonstration that the assessment of annoying characteristics according to NPfI Fact Sheet C has been carried out, including spectral noise calculations where relevant.	Assessment of annoying characteristics have been undertaken in accordance with the NPfI Fact Sheet C. Assessment results indicated that corrections for annoying characteristics are not applicable at any of the nearest sensitive receivers during night-time site operations. Refer to Appendix A for more information on tonality and low frequency noise assessment.
	Confirmation and justification that either no further mitigation is possible, or additional assessment of mitigation considering the hierarchy of controls in the NPfI.	Assessment results indicate full site noise compliance, and no additional noise mitigation is required for any of the nearest sensitive receivers.
	The EPA recommends that DPHI consider requiring receiver R1 and any other potentially impacted receiver to be included in the assessment in addition to noise contour maps.	Noise modelling results indicate that, with the recommended mitigation modifications (refer to Figure 6-1 and Section 7), the most stringent night-time noise criteria at all receivers including R1 are fully complied with. Predicted noise levels at all nearest sensitive receivers for night-time site operations are provided in Table 7-1. A noise contour map is provided in Appendix B showing all the nearest receivers including R1.
	The EPA recommends that DPHI consider requiring overall noise levels from the premises to be presented in the report for the potentially impacted receivers.	The current noise assessment has considered all noise sources onsite, including substation transformers, equipment associated with the data centre buildings, and equipment associated with the ancillary buildings. The predicted noise levels presented in this report represent the overall noise levels from the site during night-time period.

Agency	Feedback	Comment and section reference
		Predicted noise levels at all sensitive receivers for night-time site operations are provided in Table 7-1. Refer to the Acoustic Assessment report for the project for detailed information.

2 Introduction

Aurecon has been commissioned by NEXTDC to review and evaluate the noise impacts from the S4 Data Centre with specific consideration to the substation transformers located within the S4 site at 16 Johnston Crescent, Horseley Park.

The key reason for this updated study is due to the manufacturer of the substation transformer not being able to meet the sound power level target initially specified during the SSDA stage of the project. During the SSDA stage of the project, the potential manufacturer for the substation transformer (i.e. Wilson Transformers) indicated that a Sound Power Level of 89 dBA was achievable for the transformer.

Subsequently, Aurecon was informed that the original sound power level target specified by the manufacturer during the SSDA stage (89 dBA) cannot be achieved. Further the design of the project has now progressed to the Tender Design Stage and hence the noise model now has updated information for the noise sources. The minimum achievable sound power level for the substation power transformers is now understood to be **95 dBA**.

Hence, a revised assessment of noise impacts has been undertaken for the nearest sensitive receivers, utilising the latest noise model prepared based on tender stage design and the updated transformer sound power levels.

3 Assessment limitations and uncertainty

The following are the main limitations for the noise assessment:

- For typical operation, it has been assumed that all equipment is operating continuously and simultaneously over the assessment period, providing the most conservative noise predictions.
- It has been assumed that data such as building heights from Open Street Maps or the elevation contours from ELVIS (Elevation and Depth - Foundation Spatial Data) are accurate and current at the time of the assessment.
- Modelling and assessment have been undertaken based on the selected and preferred equipment provided to Aurecon by Multiplex and project contractors at the time of this report. A measured 1/3 octave sound pressure level spectrum for transformers has been adopted for noise modelling, with individual 1/3 octave band sound power levels corrected for an overall sound power level of 95 dB(A). Also, the 1/3 octave noise data for some mechanical equipment have been interpolated from 1/1 octave data where 1/3 octave data was not available.
- Sound absorbing treatment is assumed on the internal faces (facing the transformer) of substation noise wall and the High Voltage Switch Board (HVSB) Building noise wall. Acoustic performance requirements for these sound absorbing finishes are discussed in Section 7.

4 Sensitive receivers

The potentially most affected noise sensitive receivers have been shown in Figure 4-1. The predicted noise levels for all nearby sensitive receivers have been considered to assess the noise from the site including the substation transformers and other equipment associated with the data centre buildings and ancillary buildings.

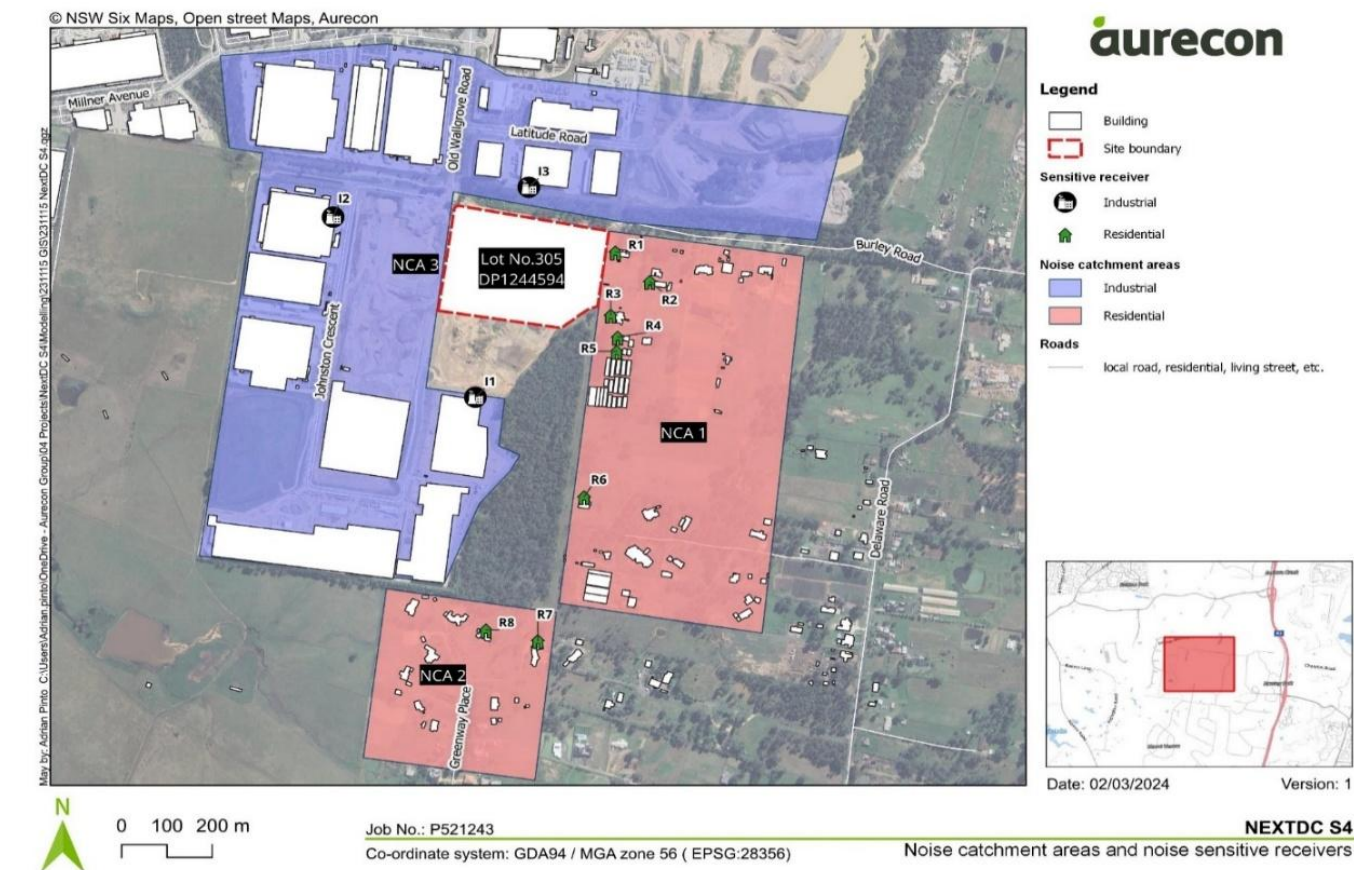


Figure 4-1 Nearest sensitive receivers

5 Transformer operational modes:

We understand that the substation transformers could be operating in one of two possible modes:

Mode 1: Normal maximum load operation: all 4x 170MVA transformers operational with transformers varying between 102 and 123 MVA load. This is approximately 75% of the full capacity.

Mode 2: Worst case Fail / N-1 operation is where the transformers would be running at their highest expected load: 3x 170MVA transformers operational at 174MVA load, with the 4th transformer de-energised (offline).

Through noise modelling for each of the above case, it was found that mode 2 generates a marginally higher noise level (1.3 dBA higher) and has been assumed in the model although it is unlikely to be a common occurrence. Predicted levels for mode 1 were predicted to be slightly lower than that of mode 2.

¹ Gange, M. (2011). Low-frequency and tonal characteristics of transformer noise. Proceedings of Acoustics 2011, Gold Coast, Australia

6 Assumptions

For the purposes of this assessment, the worst-case scenario during the night-time period of 10 pm to 7 am, when the most stringent operational noise criteria are applicable at the nearest sensitive receivers, has been assessed.

Key noise sources in these scenarios are equipment associated with data centre operation and the substation transformers. Although the mechanical plant may operate at a reduced capacity during certain periods, a conservative approach has been taken by assuming 100% operation. The equipment considered includes the following:

- Mechanical equipment on rooftop including:
 - Water-cooled chillers within plantrooms
 - Front of House OAP units
 - OA fans
 - Cooling towers
 - Rooftop condenser units
- Electrical equipment such as substation transformers
- Mechanical equipment associated with the ancillary buildings
- Onsite traffic

The noise assessment was conducted for all scenarios under noise-enhancing meteorological conditions.

- Night period – 2 m/s winds from source to receiver under Class F temperature inversion

The noise assessment was conducted using the manufacturers' noise data available at the time of this assessment. A measured 1/3 octave sound pressure level spectrum for transformers¹ has been adopted for noise modelling, with each individual 1/3 octave band level corrected to provide an overall sound power level of 95 dB(A). The sound power spectrum of the modelled substation transformers is shown in Table 6-1. For information with regard to other assessment assumptions, refer to the noise and vibration assessment reports for the project.

6.1 Assessment scenarios

Five assessment scenarios with different additional mitigation were evaluated to determine the most suitable option for the project. Note that it was determined that additional mitigation measures associated with Scenario 5 is the preferred option for the project, and the previously assessed scenarios (S1 to S4) have been superseded and are no longer relevant to this memorandum. Further details considering additional mitigation associated with Scenario S5 are provided in this memorandum.

All scenarios that have been assessed (in both the previous revisions and this current revision), as well as the SSDA Design, are summarised in Table 6-2 and indicated in Figure 6-1.

Table 6-1 Sound power spectrum of the modelled substation transformers

Equipment	Linear weighted sound power level, dB(Z)																							Overall sound power level, dB(A)
	1/3 Octave band centre frequency, Hz																							
	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	
Substation transformer	77	81	81	101	81	77	96	83	94	95	90	86	79	79	78	71	69	67	65	62	63	65	64	95

Table 6-2 Scenarios assessed

Scenario	Transformer set up	Transformer noise source height AGL	Transformer bay perimeter C shaped noise wall height	HVSB Noise wall height	Additional walls	Absorption lining	Comments
SSDA (old design)	4x transformers at Lw 89 dBA	3m	10m	6.85m	No	Absorption for the fire walls and HVSB noise wall	This is the SSDA noise model scenario, with the sound power level (89dBA) for the substation transformers and noise mitigations.
S1 (superseded, assessed in previous revision)	3x transformers Lw 95 dBA + 1x de-energised at Lw 89 dBA	3m	12m	10m	Yes. 12 m high dog leg wall to be extended from C shaped wall towards the oil spill tank. Refer to Figure 6-1 for noise wall location, extent and orientation.	Absorption for the C-shaped noise wall, dog leg wall, HVSB noise wall, and the extension portion of the HVSB noise wall.	The noise mitigation was insufficient to mitigate noise impacts. This scenario has been superseded and is no longer relevant to this memorandum.
S2 (superseded, assessed in previous revision)	3x transformers Lw 95 dBA + 1x de-energised at Lw 89 dBA	3m	12m	10m	Yes. 8 m high wall to the south of the transformer yard near the batter zone. Refer to Figure 6-1 for noise wall location, extent and orientation.	Absorption for the C-shaped noise wall and HVSB noise wall.	The noise mitigation was considered not feasible and reasonable for the project. This scenario has been superseded and is no longer relevant to this memorandum.
S3 (superseded, assessed in previous revision)	3x transformers Lw 95 dBA + 1x de-energised at Lw 89 dBA	3m	13m	10m	No	Absorption for the C-shaped noise wall and HVSB noise wall.	The noise mitigation was insufficient to mitigate noise impacts. This scenario has been superseded and is no longer relevant to this memorandum.
S4 (superseded, assessed in previous revision)	2x transformers Lw 95 dBA	3m	13m	10m	No	Absorption for the C-shaped noise wall and HVSB noise wall.	The noise mitigation was insufficient to mitigate noise impacts. This scenario has been superseded and is no longer relevant to this memorandum.
S5 (preferred mitigation option)	3x transformers Lw 95 dBA + 1x de-energised at Lw 89 dBA	3m	13m	10m	Yes. A local 3.5m long (length) extension to the southern end of the HVSB noise wall (10m height). Refer to Figure 6-1 for noise wall location, extent and orientation.	Absorption for the C-shaped noise wall, HVSB noise wall, and the extension portion of the HVSB noise wall.	The noise mitigation is considered feasible and reasonable for the project. Noise mitigation associated with this scenario is the preferred option for the project. Further details are provided in this memorandum.

Absorption: Flexshield Sonic V100 lining or equivalent with Noise reduction coefficient (NRC) 1.0 on the side facing the transformers. Details are provided in Section 7.

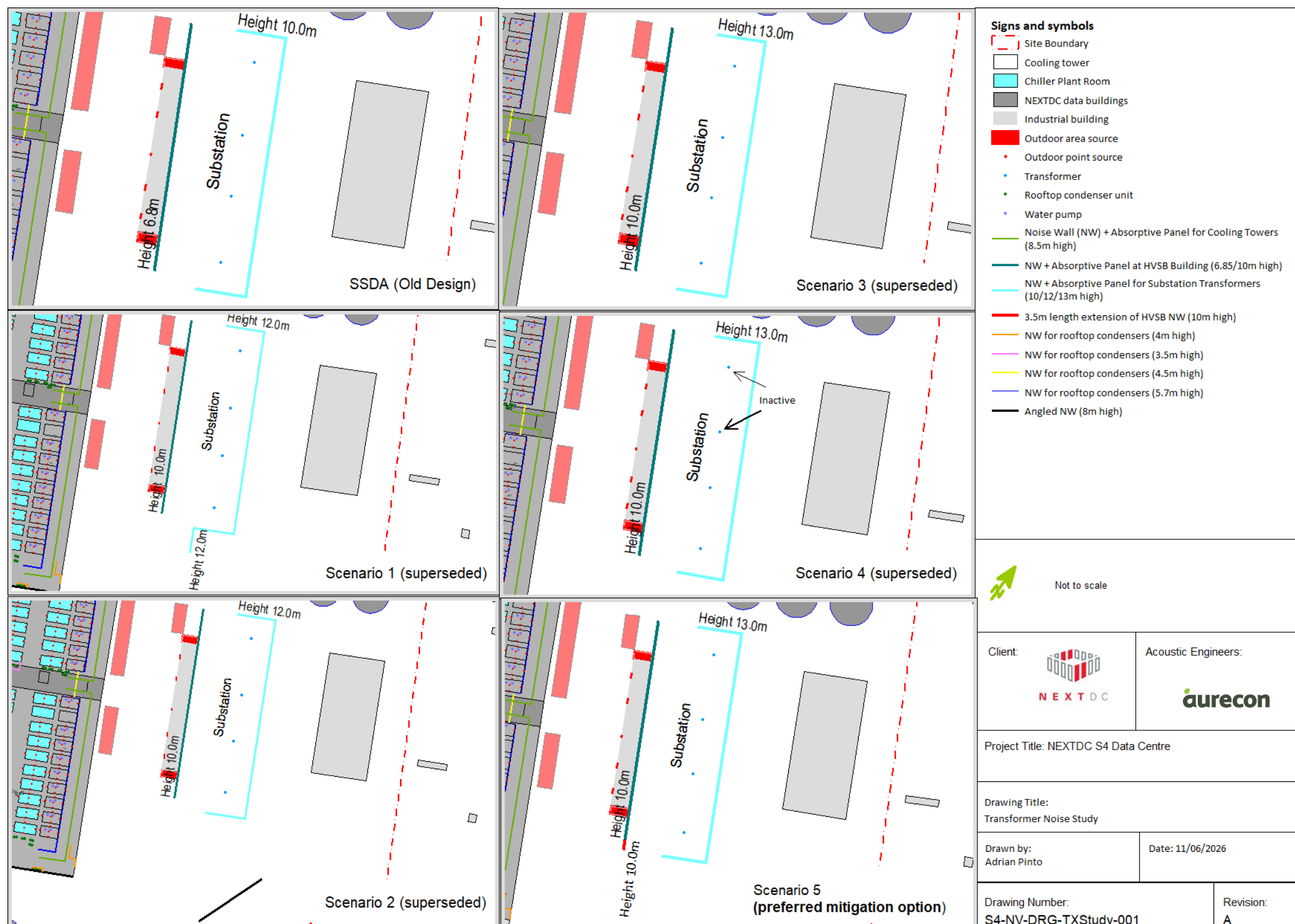


Figure 6-1 Overview of old design and assessment scenarios

7 Predicted noise levels

Noise modelling was undertaken using the latest tender design stage noise model. Note that the previously assessed scenarios (S1 to S4) have been superseded and are no longer relevant to this memorandum.

The worst predicted noise levels for the preferred scenario S5 are summarised in Table 7-1, and a noise contour map showing the nearest residences worst affected by the substation transformers is provided in Appendix B. Results of the SSDA design from the SSDA model, as documented in the SSDA Noise and Vibration Assessment Report dated 1st May 2025, are presented in Table 7-1 for comparison only.

Table 7-1 Predicted noise levels at the nearest sensitive receivers – night-time standard operation

Receiver name	Night-time criteria, dBA	Predicted noise levels, L _{Aeq,15min} dB						
		SSDA (Old design)	Scenario S1	Scenario S2	Scenario S3	Scenario S4	Scenario S5	
							SPL (with penalty)	Total Applicable Penalty ¹
I1	45	43	These scenarios have been superseded and are no longer relevant to this current memorandum.				44	0
I2	45	42					42	0
I3	45	43					44	0
R1	38	38					36	0
R2	38	37					37	0
R3	38	38					38	0
R4	38	38					36	0
R5	38	37					36	0
R6	38	35					34	0
R7	36	35					32	0
R8	36	36	36	0				

Noise prediction results indicate that:

- The following noise mitigation measures are required to achieve noise compliance:
 - **Transformer bays:**
 - Install a minimum 13 m high C-shaped noise wall
 - Apply absorptive panel with NRC 1.0 (e.g. Flexshield Sonic V100 lining) on the inner surface facing transformers, where low frequency performance (absorption coefficient > 0.2 between 50 and 100 Hz) is required
 - Note: SSDA model assumed a 10 m high noise wall

¹ Total applicable penalty represents the sum of applicable corrector factors for annoying noise characteristics including tonality and low frequency in accordance with the NPfI.

- **HVSB façade:**
 - Install a minimum 10 m high noise wall
 - Apply absorptive panel with NRC 1.0 (e.g. Flexshield Sonic V100 lining) on the inner surface facing transformers, where low frequency performance (absorption coefficient > 0.2 between 50 and 100 Hz) is required
 - Note: SSDA model assumed a 6.85 m high noise wall
- **Southern HVSB wall extension:**
 - Provide a **3.5 m (length) local extension** at the southern end (Scenario 5)
 - Apply absorptive panel with NRC 1.0 (e.g. Flexshield Sonic V100 lining) on the inner surface facing transformers, where low frequency performance (absorption coefficient > 0.2 between 50 and 100 Hz) is required
 - Note: This mitigation (Southern HVSB wall extension) was not included in SSDA model
- The modelled acoustic lining product (or equivalent), Flexshield Sonic System V100, should be adopted to minimise effects of noise reflections. The acoustic absorption spectra of Flexshield Sonic System V100 used for modelling are shown in Table 7-2.

Table 7-2 Absorption coefficients of acoustic lining used for noise modelling

Acoustic lining product	1/3 octave band centre frequency, Hz																			
	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25	1.6k	2kH	2.5k	3.15	4k
Flexshield Sonic System V100	0.2	0.4	0.4	0.8	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

- Annoying characteristics including tonality and low frequency were assessed for the nearest sensitive receivers in accordance with the NPfI. Assessment below 50 Hz could not be undertaken as equipment noise data were not available in this range at this stage of the project. Assessment results indicated that corrections for tonality and low frequency characteristics are not applicable at any of the nearest sensitive receivers during night-time period. No correction for intermittency and duration factors is applicable as there are no repeated sudden and periodic step changes in noise and one-off/unusual events occurring on site. Assessment details are provided in Appendix A.
- 7.1 Summary
- The assessment findings of this updated study are:
 - Modelling results indicate that, with the recommended mitigation modifications, the most stringent night-time operational noise limits are expected to be fully complied with at all nearest sensitive receivers. The assessment also indicates that no annoying characteristics are applicable at the nearest sensitive receivers during night-time period.

8 Future Considerations

- Another round of noise modelling and assessment be undertaken if reselection of equipment or design changes are required.
- Confirm acoustic performance of absorption material.

Appendix A: Tonality and Low Frequency Noise Assessment

Scenario 5 – Standard Operation (Night-time) during noise-enhancing meteorological conditions

Tonality & Low frequency assessment - Standard Operation (Night) - Substation Transformer Noise Study - Scenario S5 (Preferred Mitigation Option)

				Predicted Noise Levels, dB																											
NSR ID	Applicable Penalty	Rating/Broadband/Input			1/3 Octave Band Centre Frequency, Hz																										
		dB(C)-dB(A)	dB(C)	dB(A)	50	63	80	100	125	160	200	250	315	400	500	630	800	1k	1.25k	1.6k	2k	2.5k	3.15k	4k	5k	6.3k	8k	10k			
I1	1			12	56	44	Predicted Noise Levels	50.8	49.2	49.6	47.9	44.4	42.8	42.5	38.7	39.6	39.1	35.7	34.3	34.6	34.3	32.8	32.3	30.7	27.1	24.2	19.3	12.8	5.5	-3.4	-15.6
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	1	-1	2	0	-2	-1																		
I2	2			14	56	42	Predicted Noise Levels	51.2	49.7	50.1	44.6	43.4	41.4	38.4	36.9	36.1	34.9	34.1	32.7	32.6	32.0	30.6	29.9	28.1	25.7	24.0	19.4	14.3	6.0	-4.8	-19.9
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	1	0	2	-3	-3	-3																		
I3	3			13	57	44	Predicted Noise Levels	51.5	49.9	49.1	49.5	45.3	42.6	44.4	37.7	41.6	41.9	37.4	34.9	32.8	32.4	30.4	29.3	27.7	24.1	20.8	17.8	13.6	10.6	6.7	-0.4
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	2	0	1	2	-1	-1																		
R1				16	52	36	Predicted Noise Levels	47.9	46.0	45.6	42.1	39.8	37.3	35.1	31.3	31.4	30.4	26.9	25.0	23.5	22.6	21.1	21.1	19.7	17.2	15.1	11.8	8.2	3.3	-2.8	-10.8
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	-2	-4	-2	-6	-6	-7																		
R2				14	51	37	Predicted Noise Levels	46.8	45.0	45.5	41.6	38.5	36.5	35.2	33.1	32.7	31.6	30.2	28.4	26.5	25.0	23.2	23.1	21.1	18.4	16.9	12.8	7.1	-0.8	-10.9	-24.0
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	-3	-5	-3	-6	-8	-8																		
R3				16	54	38	Predicted Noise Levels	49.2	47.2	47.7	46.1	41.1	39.0	38.3	33.2	34.3	33.3	29.3	27.0	25.5	24.6	23.1	22.9	21.4	19.3	17.7	15.0	11.8	7.1	1.0	-7.3
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	-1	-3	0	-2	-5	-5																		
R4				16	52	36	Predicted Noise Levels	48.1	46.2	46.8	42.8	39.1	37.2	35.3	32.0	31.9	30.5	27.8	25.8	25.1	24.2	22.8	22.5	21.0	18.7	16.9	12.6	8.9	2.8	-5.4	-17.0
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	-2	-4	-1	-5	-7	-7																		
R5				16	52	36	Predicted Noise Levels	47.7	45.7	46.2	41.3	38.7	36.7	34.2	31.6	30.8	29.2	26.9	25.2	25.0	24.5	22.8	22.2	20.5	17.7	15.8	11.7	7.4	1.1	-7.6	-19.8
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	-2	-4	-2	-7	-7	-7																		
R6				14	48	34	Predicted Noise Levels	43.4	41.7	42.1	38.1	36.4	34.5	31.9	29.8	28.6	27.2	25.6	24.5	24.4	23.6	21.5	20.3	18.2	14.1	11.2	4.5	-4.7	-17.4	-34.8	-59.5
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	-7	-8	-6	-10	-10	-10																		
R7				12	45	32	Predicted Noise Levels	39.5	38.0	38.4	35.5	34.5	33.2	31.0	29.7	27.7	26.1	24.0	23.1	23.5	22.8	21.1	19.6	17.1	11.8	7.0	-2.7	-17.0	-37.3	-65.7	-106.4
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	-11	-12	-10	-13	-12	-11																		
R8				11	46	36	Predicted Noise Levels	40.3	39.0	39.5	36.6	35.7	34.6	32.4	31.4	30.0	28.7	27.3	27.0	27.6	26.7	25.2	23.8	21.3	15.8	10.9	1.0	-13.5	-33.7	-61.2	-100.2
	ISO 1996-2:2017 Annex K: Assessment of Tone Audibility	Tonality Penalty	0				Tonal penalty required?	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	-	
	NPfl low frequency Assessment	LF Penalty	0				Predicted level - low frequency threshold	-10	-11	-9	-11	-10	-9																		

Assessment criteria of annoying noise characteristics

NPfl Low Frequency Noise Threshold	Frequency, Hz	10	13	16	20	25	32	40	50	63	80	100	125	160	Penalty applies when the overall dB(C) level minus dB(A) level is 15 dB or more AND where any of the one-third octave low frequency noise threshold is exceeded	
	Noise Thresholds, dB(Z)	92	89	86	77	69	61	54	50	50	48	48	46	44		
NPfl Tonality Noise Threshold		15 dB or more if the centre frequency of the band containing the tone is in the range 25-125 Hz														
	Level of one-third octave band exceeds the level of the adjacent bands on both sides by:	8 dB or more if the centre frequency of the band containing the tone is in the range 160–400 Hz														
		5 dB or more if the centre frequency of the band containing the tone is in the range 500–10,000 Hz														

Appendix B: Noise Contour Map

Scenario 5 - Standard Operation (Night-time) during noise-enhancing meteorological conditions

