Noise Impact Assessment

Spring Park Data Centre – Full Site

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1 Introduction

Sweco have been instructed by Ark Estates Spring Park Limited to undertake a noise assessment, in order to determine the impact of noise associated with full Data Centre site operations at Spring Park, Corsham, to support an Environmental Permit application for the extension of the current consented site.

The exercise is based on previous baseline sound survey and noise source measurements undertaken on site for previous assessments, at SQ17, P1, P2, P3 and the HV Gen Farm, as reported in MLM document reference 102789-MLM-ZZ-XX-RP-YA-0001 dated 1 August 2019, and a detailed set of source noise measurements undertaken by Sweco at P3 for Modules 2 and 3 on Wednesday 10 February 2021. Data provided by the plant design engineers and plant manufacturers have also been used for the assessment of the extension of SQ17, SQ19, P5 North and the new building P5 South.

Document reference 102767-MLM-ZZ-XX-RP-U-0001 dated 01 April 2019 assessed the cumulative noise impact of the full site (including existing SQ17, P1, P2, P3 and P4), and the Environmental Permit was approved for the whole site, including P3 and P4 buildings (reference EPR/DP3731YL/A001).

Further report 102789-MLM-ZZ-XX-RP-YA-0001 dated 1 August 2019, evaluated and compared the results for 102767-MLM-ZZ-XX-RP-U-0001 based on the results of updated noise surveys at the receptors locations, and sound measurements undertaken on site for the operation of the different noise sources. The necessary reductions/mitigations were set out in order to meet the levels within the planning condition for the site, for the ‘Normal Operation’ Scenario.

The current assessment considers the necessary mitigations to be applied to SQ17, P1, P2 set out in the aforementioned report.

Further source measurements were undertaken by Sweco at P3 for Modules 2 and 3 on Wednesday 10 February 2021.

The current assessment considers noise from the external fixed plant associated with the development and noise breakout from equipment running within the buildings, based on source noise measurements carried out at the existing Data Centres SQ17, P1, P2 and P3, during the sites visits undertaken on site in May and June 2019, and February 2021, along with the historical data measured at P1 in 2014, and complemented by data provided by the design team for P5 North, P5 South, SQ19 and the extension of SQ17. The Assessment methodology contained in British Standard 4142[1] and British Standard 8233[2] has been considered in the Assessment.

1 British Standard 4142:2014: Method for Rating and Assessing Industrial and Commercial Sound

2 British Standard 8233:2014: Guidance on sound insulation and noise reduction for buildings

The current assessment is intended to evaluate the operation of the full site including the addition of P5 North and P5 South, SQ19 and the extension of SQ17 in support of an Environmental Permit application.

The following Report presents the results of the sound monitoring exercise carried out at three positions to determine the existing ambient sound climate at the nearest noise-sensitive receptors (NSRs) to the development. The Environmental Sound Survey was conducted by MLM Consulting Engineers between Friday 17 May and Thursday 23 May 2019. This sample is considered sufficient to provide details of representative and typical prevailing sound levels during the potential hours of operation.

The sound levels from the external and internal plant associated with the development has been predicted using the noise-modelling suite Cadna/A, which implements the ISO 9613[3] prediction methodology, and compared to relevant UK guidance criteria.

This Report contains references of a technical nature, a glossary of acoustic terminology has therefore been provided in Appendix A to assist in any interpretation.

Full tabulated and charted measurement results for the relevant periods are presented in Appendix B.

Noise maps in Appendix C graphically articulate the propagation of noise from the site to the surrounding area.

3 ISO9613-1:1993 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 1: Calculation of the Absorption of Sound by the Atmosphere; and ISO9613-2:1996 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation

2 Assessment Methodology and Criteria

The assessment has been undertaken in accordance with the following references and standard, the relevance of which is explained in the assessment text:

- ISO9613-1:1993 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 1: Calculation of the Absorption of Sound by the Atmosphere;
- ISO9613-2:1996 Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation;
- BS4142:2014+A1:2019 Method for Rating and Assessing Industrial and Commercial Sound;
- BS8233:2014 Guidance on sound insulation and noise reduction for buildings.

2.1 British Standard 4142:2014 +A1:2019 Method for Rating and Assessing Industrial and Commercial Sound

BS4142 describes the method for assessing whether noise sources of an industrial, commercial or fixed nature are likely to cause adverse impact for people residing in the area.

New developments can often incorporate plant and processes that have the potential to generate noise, especially if operated at night-time when background noise levels are at their lowest.

BS 4142 sets out a method to assess whether noise from factories, industrial premises or fixed installations and sources of an industrial nature in commercial premises are likely to cause adverse impact at noise-sensitive receptors in the vicinity.

The procedure contained in BS 4142 for assessing the impact is to compare the measured or predicted noise level from the source in question, the $L_{Aeq,T}$ 'specific noise level', immediately outside the dwelling with the $L_{A90,T}$ background noise level.

Where the noise contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific noise level to obtain the $L_{Ar,Tr}$ 'rating noise level'. A correction to include the consideration of a level of uncertainty in noise measurements, data and calculations can also be applied when necessary.

BS 4142 states: *"The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs". An estimation of the impact of the specific noise can be obtained by the difference of the rating noise level and the background noise level and considering the following:*

Typically, the greater this difference, the greater the magnitude of the impact.

A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.

A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."

For the daytime, the Assessment is carried out over a reference time period of one hour, but at night-time it is carried out over a 15-minute period. The periods associated with day or night, for the purposes of the Standard, are considered to be 07.00 to 23.00 and 23.00 to 07.00, respectively.

Based on the operational nature of the proposed development, both night-time and daytime periods have been considered.

2.2 British Standard 8233:2014

BS 8233:2014 draws on the results of research and experience to provide information on achieving internal acoustic environments appropriate to their functions. The guideline values provided are in terms of an average (L_{Aeq}) level.

The standard advises that, for steady external noise sources, it is desirable for internal ambient noise levels to not exceed the existing guidelines issued by the WHO, as detailed in Table 1 below.

Table 1: BS8233:2014 Indoor Ambient Noise Levels

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living Room	35 dB $L_{Aeq,16hours}$	-
Dining	Dining Room	40 dB $L_{Aeq,16hours}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,16hours}$	30 dB $L_{Aeq,8hours}$

BS 8233:2014 goes on to suggest 'where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal conditions still achieved".

In respect of external noise levels, the guidance in BS 8233:2014 suggests that "it is desirable that the external noise level does not exceed 50dB $L_{Aeq,T}$, with an upper guideline value of 55dB $L_{Aeq,T}$ which would be acceptable in noisier environments". The standard also suggests that "if partially open windows were relied upon for background ventilation, the insulation would be reduced to approximately 15 dB'

The guidance contained within BS 8233 is almost identical to that presented in the WHO guidelines. With respect to internal noise levels with windows open, the WHO guidelines state "…that the noise reduction from outside to inside with the window partly open is 15dB".

2.3 Local Authority Requirements

The Planning Permission 17/08760/FUL for the site includes a Noise Condition for the operation of P3 and P4.

10. During normal operational conditions, all plant (including generation plant, air conditioning units, extraction systems or other air handling plant etc.) shall be so sited and designed in order to achieve a Rating Level (BS4142:2014) of at least 5dB below the background noise level (LA90T) determined at the nearest noise sensitive receptor, when the plant is intended to operate.

At the request of the Local Planning Authority (LPA), the plant operator shall, at their own expense, employ a suitably competent and qualified person to measure and assess, whether noise from the plant meets the specified level. The assessment shall be commenced within 21 days of the notification, or such longer time as approved by the LPA. The consultant should use BS4142:2014 methodology to carry out the assessment and provide further details on the generators expected frequency of use and duration.

The standby generators shall be used only if mains power is not available and will be designed to achieve good internal standards set out in BS8233:2014 and WHO at the nearest sensitive receptors.

REASON: To ensure the creation/retention of an environment free from intrusive levels of noise and activity in the interests of the amenity of the area.

The Planning Permission 19/11352/FUL for the proposed Data Centre P5 North includes a Noise Condition Noise Condition for the operation of P5:

10. During normal operational conditions, all plant (including generation plant, air conditioning units, extraction systems or other air handling plant etc.) shall be so sited and designed in order to achieve a Rating Level (BS4142:2014) of at least 5dB below the background noise level (LA90T) determined at the nearest noise sensitive receptor, when the plant is intended to operate.

At the request of the Local Planning Authority (LPA), the plant operator shall, at their own expense, employ a suitably competent and qualified person to measure and assess, whether noise from the plant meets the specified level. The assessment shall be commenced within 21 days of the notification, or such longer time as approved by the LPA. The consultant should use BS4142:2014 methodology to carry out the assessment and provide further details on the generators expected frequency of use and duration.

Good internal standards set out in BS8233:2014 and WHO will need to be achieved at the nearest sensitive receptors.

REASON: To ensure the creation/retention of an environment free from intrusive levels of noise and activity in the interests of the amenity of the area.

Based on the above, the planning conditions set out the limit of Rating Level (BS4142:2014) of at least 5dB below the background noise level (L_{A90T}) determined at the nearest noise sensitive receptor, during normal operation, for P3-P4 and P5 North respectively.

Based on this, it is considered that a limit of a Rating Level (BS4142:2014) not exceeding the background noise level (L_{A90T}) would be appropriate for the cumulative normal operation of the full site (SQ17, SQ19, P1, P2, P3, P4, P5 North and P5 South).

3 Site and Development Description

The development is located at Spring Park in Hawthorn, Corsham, Wiltshire, SN13 9GB. The site is bound by Ministry of Defence (MOD) facilities to the north, and Westwells Road to the east. To the south, the full site is bound by woodland, with Wadswick Green residential development further south. To the west, the site is bound by woodland areas and open land, with some residential properties further west along Bradford Road.

3.1 Spring Park Data Centre Facilities

There are currently five Data Centres, known as SQ17, P1, P2, P3 and P4 at the site. Additional P5 North building, SQ19, and extension of SQ17 (modules 4 and 5) are also included in the masterplan of the full site presented below, along with the location for P5 South.

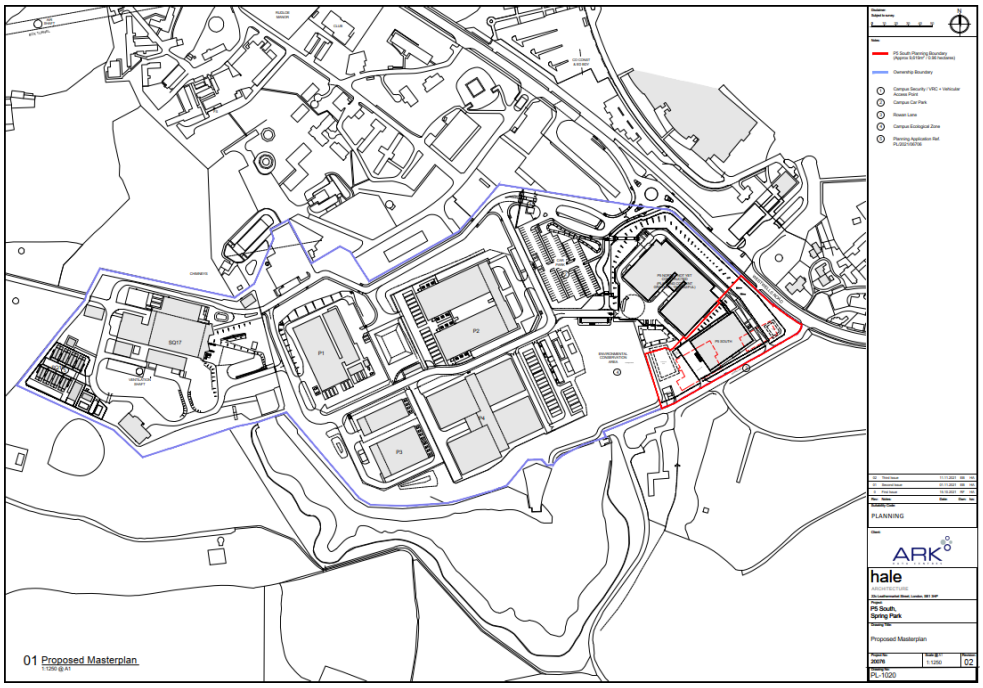


Figure 1: Full Site Masterplan Including P5 South Location (red line) and SQ19

In addition, the facility plans for each Data Centre building are presented below. The proposed plans for SQ19, P5 North and South, and tSQ17 extension are also presented. It is understood that only 'directly associated' standby generators need to be assessed at this point (shown in yellow in figures below), along with the three standby generators associated with SQ17 Modules 4 and 5, the whole HV Farm, and SQ19.

Figure 2: Existing SQ17 Facility Plan

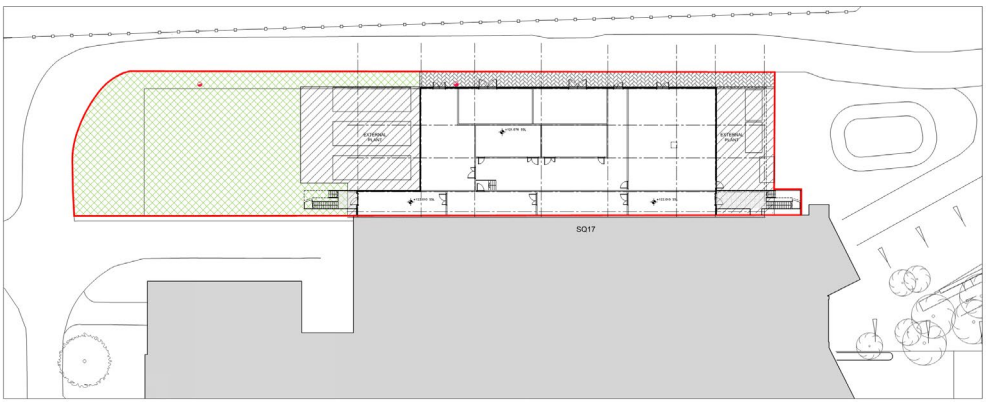


Figure 3: Proposed SQ17 Extension Plan – Modules 4 and 5

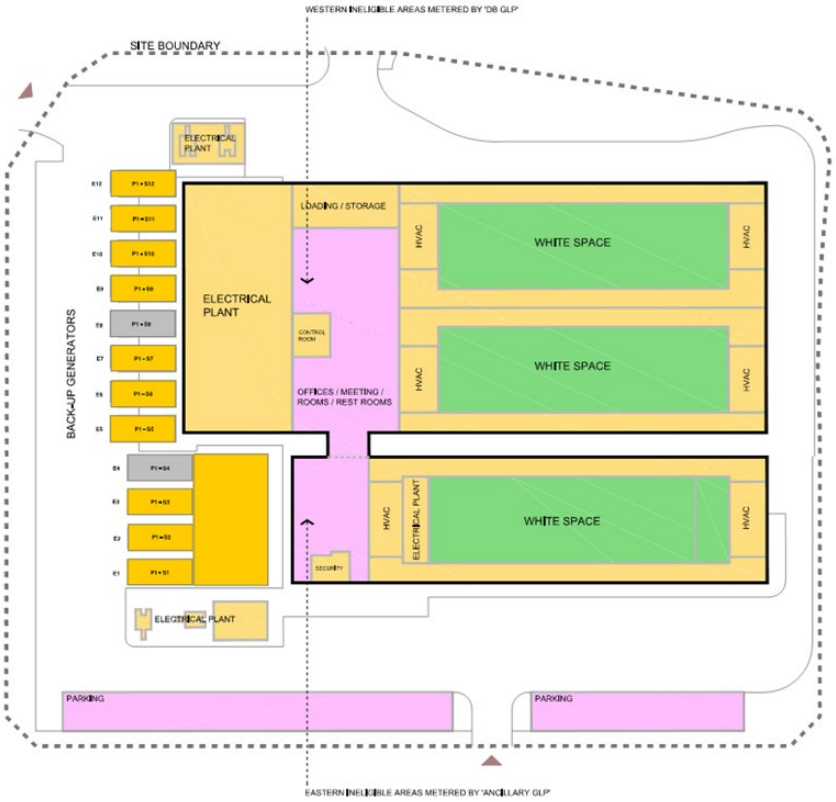


Figure 4: P1 Facility Plan

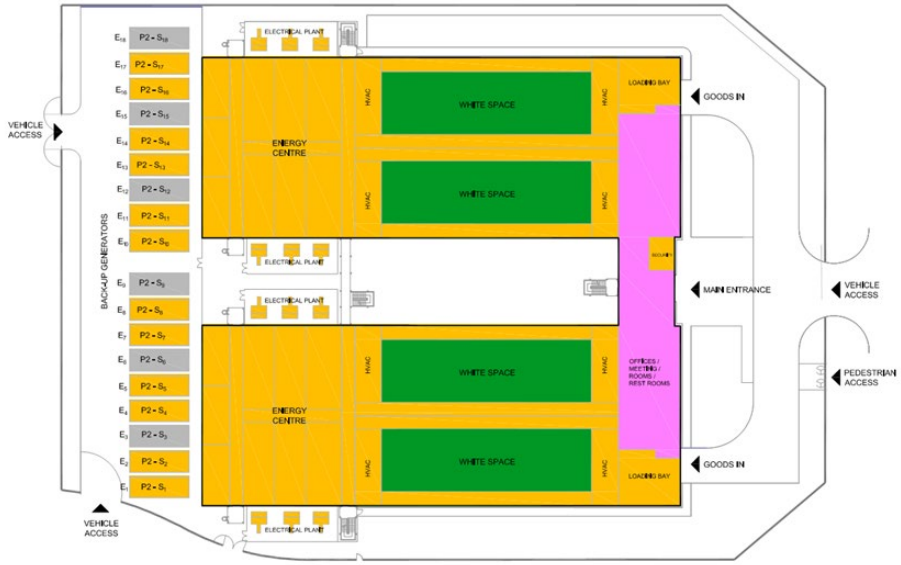


Figure 5: P2 Facility Plan

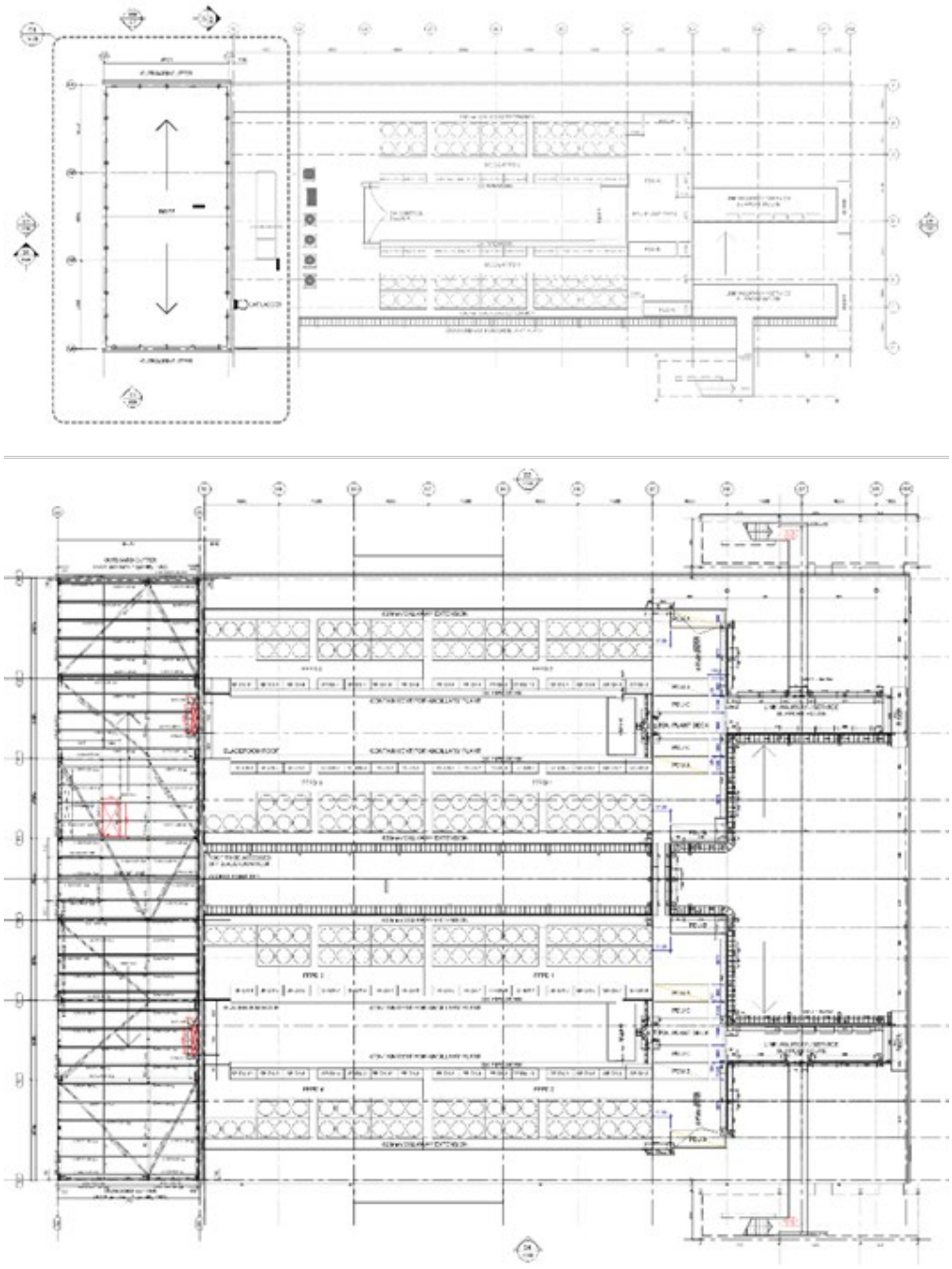


Figure 6: P3 Modules 1, 2 and 3 Roof Plans

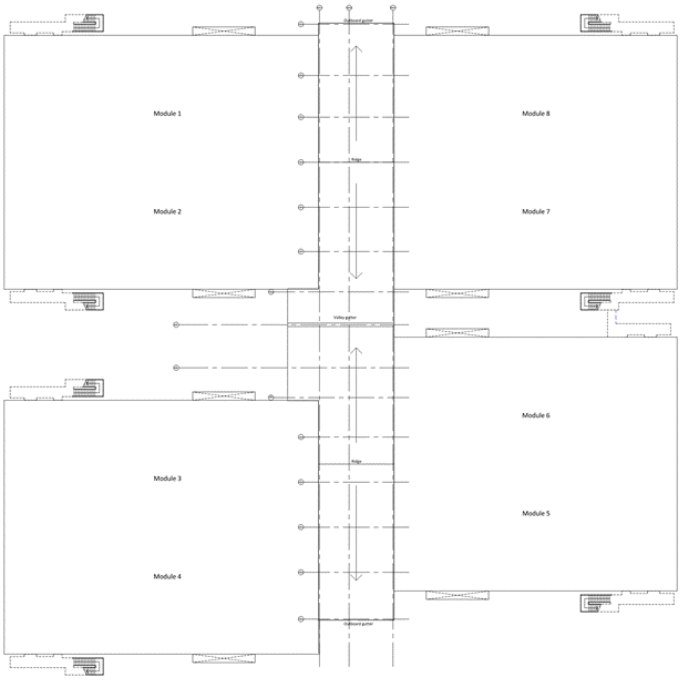


Figure 7: P4 Roof Plan

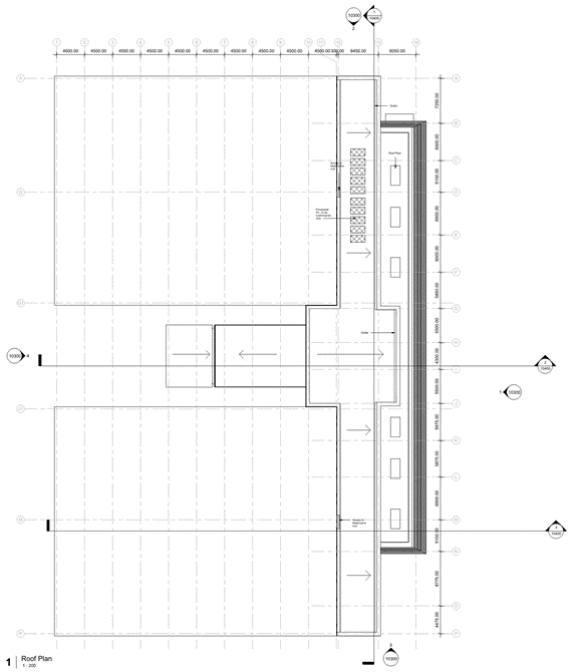


Figure 8: P5 North Roof Plan

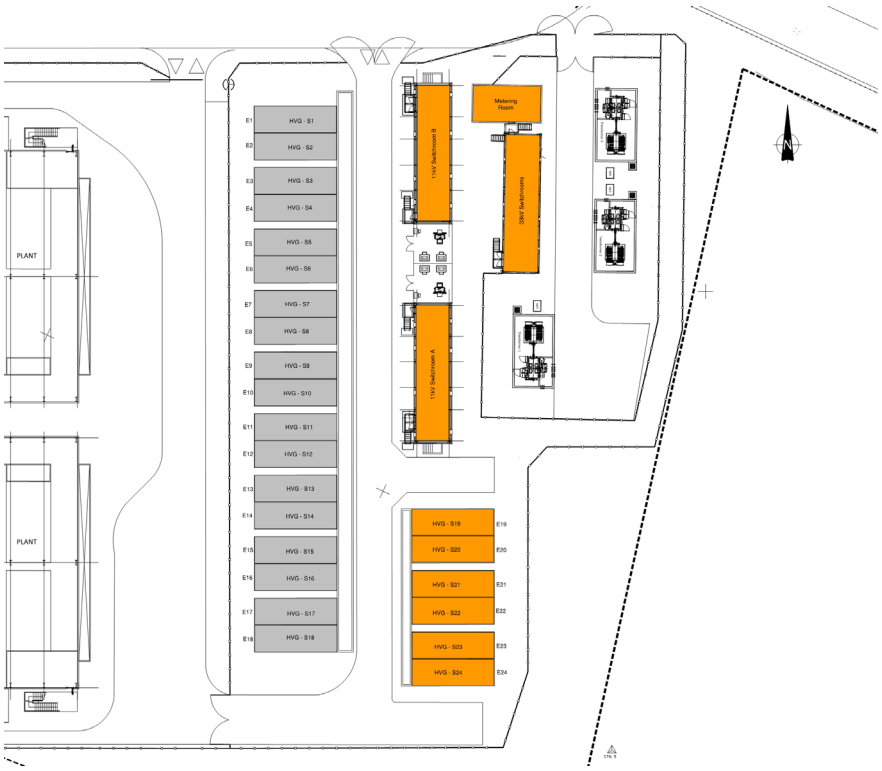


Figure 9: HV Generators Farm Facility Plan (in yellow and grey)

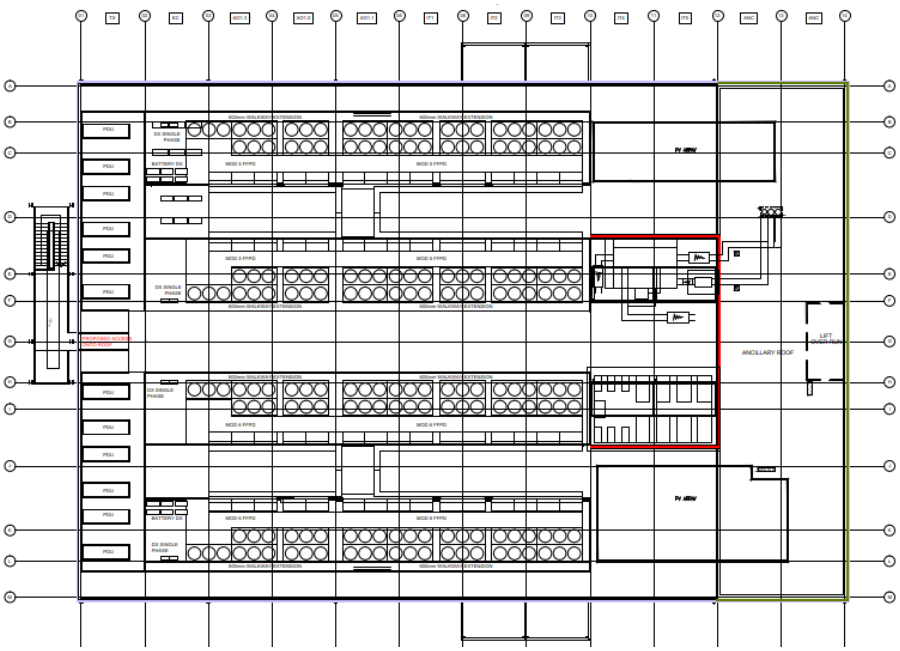


Figure 10: P5 South Roof Plan

Figure 11: SQ19 Layout

3.2 Site Operation

Under 'Normal Operation' conditions, the data suites located within the buildings are serviced by internal plant rooms, with associated ventilation inlet and outlet louvers at the sides of the buildings.

For SQ17 building, a series of external plant and ventilation louvres operate on a 24/7 basis, associated with the ventilation system of SQ17 modules. There are three sets of three chillers each serving the three modules in the building. Additionally, a KST room and its ventilation inlets and outlets were found to be a relevant noise source to be included in the normal operation of the site. The extension modules include the operation of external chillers, dry coolers and condensers.

During the site visit at P1 and P2, certain noise sources were found relevant and included in the normal operation regime for the site. In reference to P1, ventilation louvres for the Switch Room associated with the Energy Centre, were found in operation and deemed to be part of the normal operation of the site. Along with this, four ventilation fans associated with the Energy Centre were found to be a dominant noise source and therefore have been included in the noise assessment. In reference to P2, the AHU located on the roof to the east of the building above the ancillary areas, was found to be a dominant noise source which is understood to operate 24/7. This has been included in the noise model and assessment of the normal operation of the site.

For P5 North and South, external plant associated with the ancillary bulling has been included under normal operation.

Most external plant items associated with the Data Centres are for the provision of 'Emergency Backup' power generation and emergency data suite cooling, to allow the Data Centre to continue operating and prevent the loss of any data in the event of mains power failure or primary (internal) cooling system failure, or during hot external ambient temperatures.

The air-cooled condensing units (ACCU) associated with emergency cooling system are installed at roof level on buildings P1, P2, P3, P4 and P5 North and P5 South. The large backup electricity generators associated with main power failure for all buildings are installed at ground level, within individual high performance acoustically attenuated enclosures and with silenced exhausts.

Based on the information provided by the applicant it is not possible to anticipate the duration and frequency of use of the emergency backup external plant, as this is dependent on main power failure for generator operations or extreme environmental conditions/emergency operations for the ACCUs.

Different emergency situations with different durations are being assessed as required by the applicant, including:

- a mains power failure affecting all the buildings simultaneously;
- a fire in the data centre (which normally would not impact all buildings, or modules in a building simultaneously);
- external ambient conditions with temperatures above 27˚ C, which may impact all buildings simultaneously, but will not occur at night between 23:00hrs and 07:00 hrs;
- a mains power failure affecting all the buildings simultaneously during external ambient conditions with temperatures above 27˚ C, which will not occur at night between 23:00hrs and 07:00 hrs.

Nevertheless, emergency events are unlikely and when they do occur, they tend to be rectified quickly, due to the enormous impact on the activity within the area affected.

Maintenance tests are undertaken every month, every three months and once a year for each power generator and all energy centres. The duration of the tests is of 15 minutes and testing is generally carried out generator by generator.

3.3 Nearest Noise-Sensitive Receptors (NNSRs)

The nearest and most affected noise-sensitive receptors are properties off Westwells Rd to the east at approximately 57 metres. There is one isolated property approximately 200 metres to the south in the woodland area, and Wadswick Green retirement development also to the south at approximately 270m. Other residential dwellings along Bradford Road to the south-west are at approximately 300m from the site. The NNSRs to the site are identified below.

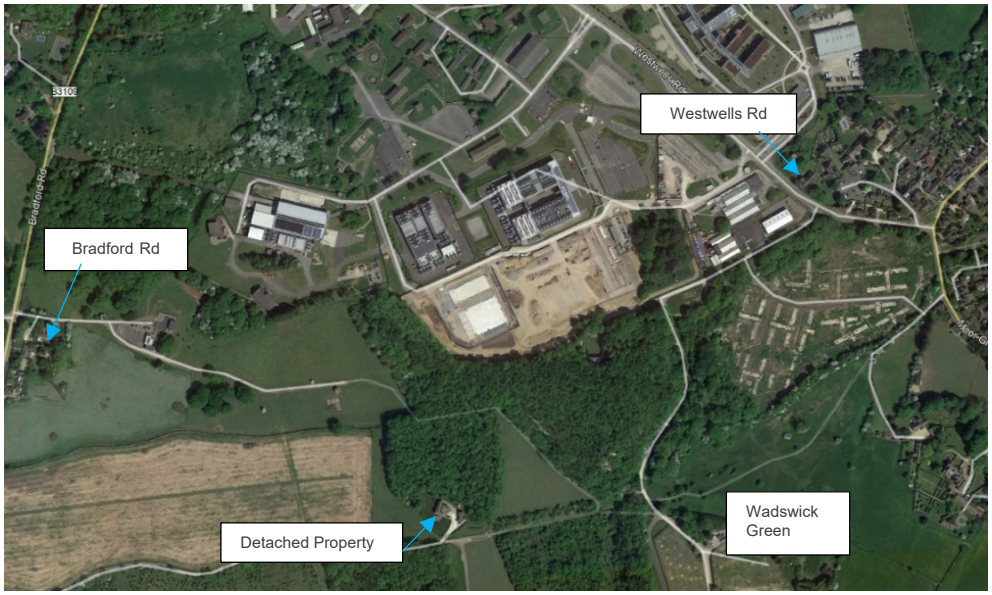


Figure 12: Nearest Noise-Sensitive Receptors (NNSRs)

4 Baseline Sound Conditions

The prevailing sound conditions at the location of the development site were determined by a detailed environmental noise survey, undertaken between Friday 17 and Thursday 23 May 2019 at three monitoring positions. The exercise was undertaken in support of a previous assessment for the full site (MLM report reference 102789-MLM-ZZ-XX-RP-YA-0001 dated 1 August 2019), and is considered valid for the current assessment.

A new residential development is under construction, off Westwells Road, to the north east of the site. Attended measurements were undertaken at a fourth location, representative of the future residential dwellings, to evaluate and inform of differences with the environmental climate at MP2, in case these future receptors need to be considered.

All sound measurements were undertaken by a suitable qualified acoustician, certified as competent in environmental sound monitoring, and in accordance with the principles of BS 7445[4] .

All acoustic measurement equipment used during the sound survey conformed to Type 1 specification of BS 61672[5]. A full inventory of this equipment is shown in Table 2 below.

Table 2: Inventory of Sound Measurement Equipment

Item	Make & Model	Serial Number	Calibration Certificate Number	Date of Expiration of Calibration
Sound Level Meter	RION NL-52	00620901	TCRT18/1581	4 July 2020
Preamplifier	RION NH-25	76417		
Microphone	RION UC-59	13342		
Sound Level Meter	RION NL-52	00620957	TCRT19/1015	7 January 2021
Preamplifier	RION NH-25	20998		
Microphone	RION UC-59	03875		
Sound Level Meter	RION NL-52	00620900	UCRT19/1471	14 April 2021

[4] British Standard 7445: 2003: Description and measurement of environmental noise. BSI

[5] British Standard 61672: 2013: Electroacoustics. Sound level meters. Part 1 Specifications. BSI.

Table 2: Inventory of Sound Measurement Equipment				
Item	**Make & Model**	**Serial Number**	**Calibration Certificate Number**	**Date of Expiration of Calibration**
Preamplifier	RION NH-25	31972		
Microphone	RION UC-59	03797		
Sound Level Meter	B&K 2250	3006737		
Preamplifier	B&K ZC 0032	16513		
Microphone	B&K 4189	2556374	TCRT/19/1016	7 January 2021
Calibrator	B&K 4231	2615249	TCRT19/1008	03 January 2020

The sound measurement equipment used during the survey was calibrated at the start and end of the measurement period. The calibrator used had itself been calibrated by an accredited calibration laboratory within the twelve months preceding the measurements. No significant drift in calibration was found to have occurred on the sound level meter. Calibration certificates of the above equipment are available upon request.

The sample period was selected following close monitoring of local weather conditions. Weather conditions were generally suitable for the noise measurement exercise, it being dry with only light winds. The periods excluded from the Assessment due to unsuitable weather are 16:00 to 23:00 on Friday 17 May.

It must be noted that construction works on site (for P4 and P3) were found to be noticeable at the receptors' locations, and therefore periods from 07:00 to 18:00 Monday to Friday and 07:00 to 14:00 on Saturday have been discarded for the assessment.

All microphones were fitted with a protective windshield and the appropriate correction applied on the Sound Level Meter.

$L_{Aeq,T}$, $L_{A90,T}$ and $L_{AF,max}$ acoustic parameters were register over sequential 15-minute periods. Measurements were carried at the following monitoring positions, as described below and shown in Figure 13.

Since the survey was largely unattended it is not possible to comment on the specific nature of the sound climate for the entire duration of the survey, however sound sources were noted during time on site.

- MP1 – Largely unattended measurement of the sound climate representative of the nearest noise-sensitive receptor to the south of the site. The microphone was located under free-field conditions, at a height of 1.5 metres above local

ground. During equipment setup the sound climate at this position was dominated by construction noise. Birdsong and very faint road traffic were audible. During equipment retrieval at night, the sound climate was dominated by plant noise and distant road traffic noise. Based on observations on site, the plant noise was steady and identified as ventilation noise, and therefore it is attributed to the existing Data Centre.

- MP2 – Largely unattended measurement of the sound climate representative of the nearest noise-sensitive receptor to the east of the site. The microphone was located under free-field conditions, at a height of 1.4 metres above local ground. The sound climate at this location was dominated by local traffic noise from Westwells Road, and birdsongs; and to a lesser extent construction noise and occasional aircrafts. During equipment retrieval at night, the sound climate at this position was dominated by steady plant noise. Nearby road traffic was intermittent and occasionally dominant when vehicles where in proximity. Additionally, residential activity (ie people talking) was audible but not itself a source of dominant noise.

- MP3 – Largely unattended measurement of the sound climate representative of the nearest noise-sensitive receptor to the west of the site. The microphone was located under free-field conditions, at a height of 1.5 metres above local ground. The sound climate at this location was dominated by local road traffic from Bradford Road. To a lesser extent, vehicle movements to the south-east and a tonal low-frequency hum possibly from the adjacent MOD site were noticeable. Although construction noise was not identified, the periods with potential construction activity has been discarded to avoid extraneous sound sources, not representative of the noise climate at this location. During equipment retrieval at night, the sound climate at this position was dominated by the aforementioned tonal low-frequency hum and to a lesser extent plant noise which may be attributed to the Data Centre.
- MP4 – Attended short-term measurement position, situated in a small woodland adjacent to Westwells Road and MOD, Corsham. The microphone was installed under free-filed conditions at a height of 1.30m above ground level. This location is considered representative of the future nearest noise-sensitive receptors to the north of site. The sound climate at this location at night was dominated by steady plant noise. Road traffic was audible and occasionally dominant depending on the proximity. Additionally, air traffic was audible and dominant when directly overhead. This location is deemed to be comparable in terms of noise climate to MP2.

The monitoring positions in relation to the site and the closest NSRs are shown in Figure 13 below.

Figure 13: Monitoring positions and approximate site boundary for Spring Park Ark Data Centre

The Wadwicks Green receptors to the south of the site (which is already developed) are in proximity to monitoring position MP1. From our observations on site, it could be concluded that MP1 is representative of typical sound conditions at Wadswick Green development.

It has been observed that MP2 is representative of typical sound conditions at the receptors to the north, off Westwells Road Green. At the moment it is not deemed necessary to consider these receptors, as compliance with closest receptors will ensure compliance at receptors further to the north, given that the sound conditions at both locations are comparable.

4.1 Sound Survey Results

The results of the sound monitoring, in terms of the typical $L_{A90,one\ hour}$ daytime (07:00-23:00) and $L_{A90,15\ minutes}$ night-time (23:00-07:00) are summarised in Table 3 below. In addition to the typical background sound levels, average ambient sound levels and typical maximum sound levels are presented to add context. Values have been rounded to the nearest whole number.

Periods from 07:00 to 18:00 Monday to Friday and 07:00 to 14:00 on Saturday have been discarded for the assessment due to construction activity on site.

In addition, the results of the 25 minute attended measurement undertaken at MP4 have been presented in Table 4, in terms of $L_{A90,5minute}$ along with corresponding average ambient sound levels and typical maximum sound levels.

Full-tabulated and charted results of the sound measurements are presented in Appendix B of this Report. The statistical analysis for obtaining the typical background sound levels used in this Assessment can also be found in Appendix B.

Table 3: Measured Broadband Sound Levels (dB)				
Measurement Position	**Period**	**$L_{A90,T}$ (dB)**	**$L_{Aeq,T}$ (dB)**	**L_{AFmax} (dB)**
MP1	Daytime (18:00-23:00)	33-35	52	76
	Night-time (23:00-07:00)	28-29	47	73
MP2	Daytime (18:00-23:00)	34	47	70
	Night-time (23:00-07:00)	24	47	71
MP3	Daytime (18:00-23:00)	43	56	74
	Night-time (23:00-07:00)	28-29	52	71

Table 4: Measured Broadband Sound Levels (dB) - STMP				
Measurement Position	**Period**	**$L_{A90,T}$ (dB)**	**$L_{Aeq,T}$ (dB)**	**L_{AFmax} (dB)**
MP4	23/05/19 23:25	29	37	48
	23/05/19 23:30	31	36	53
	23/05/19 23:35	29	35	51
	23/05/19 23:40	29	32	39
	23/05/19 23:45	29	32	49

5 Sound Predictions and Assessment

In order to assess the impact of sound from the full site, it has been necessary to predict the likely specific sound level from the sources of sound associated with the development at the nearest noise-sensitive receptors. Predictions have been carried out in the noise-modelling suite Cadna/A, in accordance with the ISO 9613 prediction methodology.

In addition to the input data described below, the model considers the effects of topography, ground absorption, atmospheric absorption and acoustic reflections, as well as applying a light downwind correction to consider a typical worst-case downwind situation. In terms of ground absorption, the intervening ground between the sources and receivers has been modelled as acoustically hard, except where ground is covered by grass, trees or other vegetation, as advised on ISO 9613-2.

5.1 Operational Scenario

As advised by the applicant different operational scenarios have been assessed for the operation of the full site, as presented below:

- Normal Operation: P1, P2, P3, P4, P5 North and P5 South data suites located within the buildings are serviced by internal plant rooms, with associated ventilation inlet and outlet louvers at the sides of the buildings. SQ17 building normal operation includes a series of external plant and ventilation louvres associated with the ventilation system of SQ17 modules along with the KST room and its ventilation. In addition to the above, P1 normal operation will include Energy Centre and Switch Room ventilation. P2 will include ancillary AHU. P5 North and P5 South ancillary external plant is included in the normal operation scenario.
- Generator Emergency Operation: In the extremely unlikely event of a total mains supply failure, all the generators running at 80% load along with the plant normally operating. This emergency running will be for a 48-hour period.
- Cooling System Emergency Operation: In the extremely unlikely event of a fire affecting all facilities at once. This emergency running will be for a 48-hour period.
- Summer Cooling System Operation: In hot external ambient conditions, the DX units will operate along with the normal operation plant for short periods of time during the daytime hours. This operation will typically last for 6 hours, between 14:00 and 20:00.
- Generator Emergency Operation during hot weather: In the extremely unlikely event of a total mains supply failure when hot external ambient condition, all the generators running at 80% load along with all the DX units and normal operation plant. This scenario is extremely unlikely and will be limited to 6 hours only during the daytime periods between 14:00 and 20:00, as outside these hours the temperature will be lower. As explained above, this generators emergency running will be for a maximum 48-hour period.
- Generator Maintenance Operation: Different maintenance tests are undertaken every month, every three months and once a year for each generator and all energy centres. The duration of the tests is of 15 minutes and testing is generally carried out generator by generator. As a worst case, the

simultaneous operation of all the generators for a 15-minute period has been considered for each building, HV farm and SQ19.

5.1.1 Operational Scenario for P5 South Ancillary Building External Plant

As advised by the operator and the plan designer the operational time of these plant will be as follows:

- The ancillary building and external plant will operate continuously except for the following elements:
  - AHU Condenser will only operate during daytime periods (07:00 to 23:00)
  - VRV Condenser will only operate during daytime periods (07:00 to 23:00)
  - Toilet extract fan will only normally operate during the daytime periods
  - Electrical Plant Room Condensers, only one of each pair (3no of 6no) will run at one time.
  - MMR Condensers are understood to operate at 50% load. At this stage there is no detailed information of the reduction in noise levels that will occur at lower loads, and a conservative assumption of a reduction of 2 dB has been included.
  - TX/UPS Room, only one of each pair (2no of 4no) will run at one time.

5.2 Sound Data Assumptions

Ventilation louvres are associated with 'normal operation' of the data centre, while Backup Power Generators and ACCU units are associated with 'backup operations' in the event of mains power or an emergency cooling event (fire or high external ambient temperature conditions).

A series of new detailed source noise measurements were undertaken by MLM at P1, P2 and SQ17 Data Centre buildings during daytime on 21 and 30 May 2019, and 4 and 5 June 2019. Source measurements were undertaken on site during normal operation of the existing buildings, and also during back-up power generators regular maintenance tests. Detailed source noise measurements were undertaken at Generators at HV Farm on the 30 May 2019. Additionally, measurements were undertaken during the IST test undertaken for Module 3 in P3 on the 20 May 2019.

Additionally, a detailed set of source noise measurements were undertaken by Sweco at P3 for Modules 2 and 3 on Wednesday 10 February 2021, in order to characterise noise emissions from normal operation of the data halls inlet and outlet ventilation louvres.

A summary of the derived sound emission levels of the acoustic sources based on the measurements and noise model validations for SQ17, P1, P2, P3, P4, P5 North, P5 south and SQ19 is presented below.

Data provided by the plant design engineers and plant manufacturers have also been used for the assessment of the extension of SQ17, SQ19 and the new buildings P5 North and P5 South.

Due to the close location of P5 North and P5 South to the residential receptors on Westwells Road, the external plant associated with the ancillary building have also been included as part of the normal operation of the development.

5.2.1 P1, P2, P3, P4, existing SQ17, and HV Farm

The sound power data for the ventilation inlets and outlets for P1, P2, and P3 are based on model validation following the measurements at the different buildings during the sites visits. Levels for P4 have been assumed based on the levels for P3, following the advice of the design engineers.

Table 5: Normal Operation Plant - Sound Power Levels, dB

Freq. (Hz)	Octave Band Data (dB) at Centre Frequency (Hz) - PWL								Global dB(A)
	63	125	250	500	1000	2000	4000	8000	
Inlet Ventilation Louvres P1	69	71	64	68	70	61	48	38	72
Outlet Ventilation Louvres P1	76	78	72	69	67	62	58	51	72
Inlet Ventilation Louvres P2	64	66	59	63	65	56	43	33	67
Outlet Ventilation Louvres P2	72	74	69	65	63	58	54	47	68
Inlet Ventilation Louvres P3 South	60	62	55	59	61	52	39	29	63
Outlet Ventilation Louvres P3 South	72	74	69	65	63	58	54	47	68

In relation to the other normal operation noise sources considered in P1 and P2, the sound power levels have been derived based on sound pressure levels measured on site and a model validation.

In reference to P1, four ventilation louvres for the Switch Room associated with the Energy Centre have been considered in the noise model as part as the normal operation, based on observations on site and information from the plant engineers. Four ventilation fans associated with the Energy Centre were found to be a dominant noise source and therefore have been included in the noise assessment, with a total sound power level as per the table below.

In reference to P2, the sound power levels for the AHU located on the roof to the east of the building above the ancillary areas have been derived based on sound pressure levels measured on site and a model validation.

The sound power levels for the Chillers at SQ17 have been derived based on sound pressure levels measurements of the plant undertaken during the site visit. There are three sets of three chillers each serving the three modules in the SQ17 building.

The sound power levels for the KST room breakout and its ventilation inlets and outlets at SQ17 have been derived based on sound pressure levels measurements undertaken within the room during the site visit and model validation following the measurements.

Table 6: Additional Normal Operation Plant SQ17, P1 and P2 - Sound Power Levels, dB									
Freq. (Hz)	**Octave Band Data (dB) at Centre Frequency (Hz) - PWL**								**Global dB(A)**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Ventilation Louvres P1 Energy Centre Switch Room	81	79	76	70	69	66	63	56	75
Energy Centre Ventilation Fans P1	75	93	85	84	84	81	71	59	88
AHU Ancillary Building Roof P2	74	74	81	81	83	92	77	78	94
Module 1 Chillers SQ17	87	87	89	86	84	79	77	70	89
Module 2&3 Chillers SQ17	97	92	86	86	86	80	75	70	89
KST Outlet Ventilation Louvre SQ17	75	85	84	80	69	71	72	61	81
KST Inlet Ventilation Louvre SQ17	84	94	94	92	84	82	75	70	92
KST Room Internal Noise Levels Breakout	71	86	86	80	81	76	52	40	85

The sound power data for the power generators at P1, P2, SQ17 and HV Farm have been derived based on sound pressure level measurements of the plant undertaken during the maintenance test carried out at the different dates above. The sound power data are based on model validation following the measurements at the different buildings.

For the generators at SQ17, which are within buildings rather than individual enclosures, the model has assumed inlet ventilation levels to be 2 dB below the outlet ventilation levels measured, due to the lack of specific data and based on the original data for P1 generators.

The sound power data for the cooling units at P1 and P2 is based on model validation following the measurements at P1. The original sound power data for the cooling units at P3 were calculated based on the air optimiser datasheet provided based on 66 dBA at 3 metres and considering the dimensions of the unit. The current sound power data for the cooling units at P3 are based on the original data and a model validation following the measurements undertaken during the IST test for Module 3. The sound power data for the cooling units at P4 have been modelled based on the results for the P3 test.

Table 7: Emergency Backup Operation Plant - Sound Power Levels, dB									
Freq. (Hz)	Octave Band Data (dB) at Centre Frequency (Hz) - PWL								Global dB(A)
	63	125	250	500	1000	2000	4000	8000	
Cooling Units at P1 & P2	85	84	83	79	75	73	70	62	82
Cooling Units at P3 & P4	90	80	77	76	76	69	68	63	79
Backup Generator Exhaust – P1	93	91	90	85	85	77	69	64	88
Backup Generator Outlet - P1	90	89	90	75	73	67	65	63	83
Backup Generator Inlet – P1	83	82	78	76	77	69	63	56	79
Backup Generator Breakout - P1	79	76	74	76	79	71	62	62	81
Backup Generator Exhaust – P2	93	91	90	85	85	77	69	64	88
Backup Generator Outlet - P2	92	91	92	77	75	70	67	65	85
Backup Generator Inlet - P2	84	82	79	77	78	70	64	57	80
Backup Generator Breakout - P2	81	78	76	78	81	73	64	64	83
Backup Generator Exhaust – SQ17 Type 1	92	90	89	84	84	76	68	63	87
Backup Generator Outlet - SQ17 Type 1	95	94	95	80	78	72	70	68	88
Backup Generator Inlet - SQ17 Type 1	93	92	93	78	76	70	68	66	86
Backup Generator Exhaust – SQ17 Type 2	97	95	94	89	89	81	73	68	92
Backup Generator Outlet - SQ17 Type 2	101	100	101	86	84	78	76	74	94
Backup Generator Inlet - SQ17 Type 2	99	98	99	84	82	76	74	72	92
Backup Generator Exhaust - HV Gen Farm	100	98	97	92	92	84	76	71	95

Table 7: Emergency Backup Operation Plant - Sound Power Levels, dB									
Freq. (Hz)	**Octave Band Data (dB) at Centre Frequency (Hz) - PWL**								**Global dB(A)**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Backup Generator Outlet - HV Gen Farm	95	94	95	80	78	73	70	68	88
Backup Generator Inlet - HV Gen Farm	82	80	77	75	76	68	62	55	78
Backup Generator Breakout - HV Gen Farm	87	84	82	84	87	79	70	71	89

The levels above present differences from the levels assumed in the previous environmental permit application noise assessment and the following mitigations/reduction in levels have been assumed in order to reduce the impact of the normal operations at the closest residential receptors to the site:

- Reduction of 12 dB to the noise emission levels for the AHU at P2 Roof associated with the Ancillary Building;
- Attenuation of 3 dB for the ventilation louvres at P1 Energy Centre Switch Room;
- Attenuation of 15 dB for Module 1 Chillers at SQ17 building;
- Attenuation of 18 dB for Module 2&3 Chillers at SQ17 building;
- Attenuation of 14 dB for each KST Room Outlet Louvres at SQ17 building;
- Attenuation of 20 dB for each KST Room Inlet Louvres at SQ17 building;
- Attenuation of 15 dB for the KST Room Breakout at SQ17 building.

The total number of cooling units considered in the model are 36 on the roof of P1, 72 on the roof of P2, 80 on the roof of P3 and 240 on the roof of P4.

The total number of generators considered in the model are five at SQ17, nine at P1, 12 at P2 and 24 at HV Generators Farm serving P3, P4 and P5 North.

5.2.2 P5 North

The sound power data for the ventilation inlets and outlets for P5 North have been assumed based on the levels for measured for P3 in February 2021, presented in Table 5, following the advice of the design engineers.

The sound power data for the cooling units at P5 North is calculated based on the manufacturer datasheet provided based on 66 dBA at 3 metres.

Table 8: Emergency Operation Plant - Sound Power Levels, dB									
Freq. (Hz)	**Octave Band Data (dB) at Centre Frequency (Hz) - PWL**								**Global dB(A)**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Cooling Units at P5 North	72	72	76	81	84	78	77	70	87

The total number of cooling units considered in the model are 120 on the roof of P5 North.

The plant designers have provided noise data for the external plant to be installed on the roof of the ancillary block which are presented below.

The external plant will comprise the following:

- 3 No AHUs (AHU01, AHU02 and AHU03)
- 3 No AHUs CONDENSER UNITS
- 16 No MMR CONDENSER UNITS
- 4 No CRAC CONDENSER UNITS
- 2 No VRV Condenser Units
- 1 No Landlord VRV Condenser Unit

Table 9: Normal Operation Plant – P5 North Ancillary Block External Plant Noise Emission Data from Manufacturer

Description		Octave Band Data (dB) at Centre Frequency (Hz) – PWL								Global dB(A)
		63	125	250	500	1000	2000	4000	8000	
AHU01 (Barkell)	Supply Inlet	72	67	78	75	67	60	54	46	74
	Return Outlet	76	71	86	79	76	76	74	69	83
	Breakout	64	62	59	41	38	39	34	34	52
AHU02 (Barkell)	Supply Inlet	71	66	77	74	66	59	50	45	73
	Return Outlet	75	70	85	78	75	75	73	68	82
	Breakout	63	61	58	40	37	38	33	33	51
AHU03 (Barkell)	Supply Inlet	62	63	69	66	60	53	45	38	66
	Breakout	59	58	45	34	35	37	31	29	45
AHU Condenser (Airedale BluCube)		80	84	80	85	85	75	69	62	87
MMR Condensers (Stulz)		94	87	85	77	74	68	59	50	81
CRAC Condensers (Stulz)		94	84	78	74	72	66	56	44	77
VRV Units (Daikin REYQ30U)		81	79	75	73	68	66	67	59	75
VRV Landlord Unit (Daikin REYQ14U)		73	74	71	71	64	60	60	58	71

The sound power data for the AHUs breakout and the VRV units have been derived based on the sound pressure level at certain distances provided by the manufacturers.

The following mitigations/reduction in levels have been assumed in order to reduce the impact of the normal operations at the closest residential receptors to the site. The mitigations are driven by compliance with night-time operation limit and Planning Condition 10 for P5 North.

- Reduction of Data Halls Inlet Ventilation noise levels in 10 dB for the louvres facing south
- Reduction of Data Halls Outlet Ventilation noise levels in 10 dB for the louvres facing south
- Reduction of 17dBA for AHU01 and AHU02.
- Reduction of 20dBA for each AHUs Condenser Unit.
- Reduction of 17dBA for each MMR Condenser Unit located to the south and reduction of 15dBA for each MMR Condenser Unit located to the north.
- Reduction of 15dBA for each CRAC Condenser Unit.
- Reduction of 8dBA for each VRV Condenser Unit.
- Reduction of 5dBA for the Landlord VRV Condenser Unit.
- 4.5 metres high solid barrier at the roof boundary.

The barriers assumed should be solid, continuous, sealed at all interfaces and have a surface density of at least 10 kg/m^2, or provide a minimum sound attenuation of 20 dB.

5.2.3 SQ17 Extension: Module 4&5

Noise emissions are based on data provided by the design engineers of the development.

The plant designers have provided noise data for the external plant which are presented below.

The external plant will comprise the following:

- 4 No Battery Room Condenser Units
- 4 No AHUs Condenser Units – Only 2 units running at a time
- 3 No Chillers – Only 2 units running at a time
- 2 No Dry Coolers

Table 10: SQ17 Modules 4 and 5 External Plant Noise Emission Data from Manufacturer

Freq. (Hz)	Octave Band Data (dB) at Centre Frequency (Hz) - PWL								Global dB(A)
	63	125	250	500	1000	2000	4000	8000	
Battery Room Condensers (Daikin RZASG100MV1)	76	73	72	69	61	56	53	48	70
AHU Condensers (Mitsubishi PUHZ-ZRP71VHA)	73	71	72	63	62	58	53	46	68
Chillers (Daikin EWAT540B-XLA2+VFDFAN)	89	94	93	90	90	87	85	79	95

Table 10: SQ17 Modules 4 and 5 External Plant Noise Emission Data from Manufacturer									
Freq. (Hz)	**Octave Band Data (dB) at Centre Frequency (Hz) - PWL**								**Global dB(A)**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Dry Coolers (Gunter GFD 080.3C/2x3-ND1D/4P.E)	96	82	80	82	83	79	74	70	87

The total number of generators associated with SQ17 modules 4 and 5 are three.

The sound power data for the generators have been derived based on sound pressure level of 75 dBA at 1 metre distance and the dimensions provided by the manufacturers. Based on spectrum data available for other generator units, the total following sound power data have been used for each generator.

Table 11: SQ17 Modules 4 and 5 Generators - Sound Power Levels, dB									
Freq. (Hz)	**Octave Band Data (dB) at Centre Frequency (Hz) - PWL**								**Global dB(A)**
	63	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	
Backup Generator	105	104	105	90	88	82.5	90	78	98

5.2.4 SQ19

The proposals include 16 power generators along with transformers.

Test data for comparable power generation plant has been provided by the plant designers. Following a model validation in relation to the test results provided, the proposed plant is comparable to the power generators within the HV Farm, and therefore the noise data presented in Table 7 have been used for the generators proposed at SQ19.

Data from the Sweco library have been used for the two transformers. The transformers included present a sound power level of 79 dBA and are based on site measurements at comparable power plant sites.

5.2.5 P5 South

The sound power data for the ventilation inlets and outlets for P5 South have been assumed based on the levels for measured for P3 in February 2021, presented in Table 5, following the advice of the design engineers.

Certain differences were found during the measurements undertaken at the two P3 modules and therefore the highest levels have been used in this assessment to allow for a robust worst-case scenario.

The sound power data for the cooling units at P5 South is calculated based on the manufacturer datasheet provided based on 66 dBA at 3 metres. The levels are the same as for P5 North, presented in Table 8.

The total number of cooling units considered in the model are 60 on the roof of P5 South.

The plant designers have provided noise data for the external plant to be installed on the roof which are presented below.

- The external plant will comprise the following:
- 1 No AHU
- 1 No AHU Condenser Unit
- 1 No Toilets Extract Fan
- 8 No MMR Room Condenser Unit
- No Electrical Plant Room Condenser Unit
- 1 No VRV Condenser Unit
- 12 No Battery Room Condenser Units
- 4 TX/UPS Room Condenser Units

Table 12: Ancillary Block External Plant Noise Emission Data From Manufacturer

Description		Octave Band Data (dB) at Centre Frequency (Hz) – PWL								Global dB(A)
		63	125	250	500	1000	2000	4000	8000	
AHU	Supply Inlet	71	66	77	74	66	59	50	45	73
	Extract Outlet*	75	70	85	78	75	75	73	68	82
AHU Condenser		89	80	79	77	76	70	64	59	80
WC Extract Fan		75	71	63	63	63	59	53	51	67
MMR Condensers		97	86	77	73	70	65	55	43	78*
Elec. Plant Room Condensers		76	75	73	72	66	65	60	56	73
VRV Condenser		75	78	74	72	65	64	63	52	74
BR Condensers		71	80	58	59	56	51	46	47	66
BR Condensers - NIGHT		67	76	54	55	52	47	42	43	62
TX/UPS Room Condensers		69	67	64	67	58	52	49	45	66
TX/UPS Room Condensers - NIGHT		65	63	60	59	53	52	47	43	62
*A 2 dB reduction has been included in the calculations to allow for a 50% load operation, with a global level of 76 dBA										

The sound power data for the AHU condenser has been derived based on sound pressure levels at certain distances provided by the manufacturers. For the VRV Condenser units, the spectrum for a comparable unit has been used.

Based on the information provided, attenuators will be included for the AHU and the WC extract fan. The following insertion loss data have been provided by the M&E design team.

Table 13: Attenuators Insertion Loss Data from Manufacturer								
Description		Octave Band Data (dB) at Centre Frequency (Hz)						
		63	125	250	500	1000	2000	4000	8000
ANC-ATT-03	AHU Supply Inlet	8	16	25	40	54	48	45	31
ANC-ATT-04	AHU Extract Outlet	8	16	25	40	54	48	45	31
ANC-ATT-045	WC Extract Outlet	5	9	16	22	29	23	19	11

The following mitigations/reduction in levels and have been agreed with the design team in order to reduce the impact of the normal operations at the closest residential receptors to the site. The mitigations are mainly driven by compliance with planning night-time operation limit.

- Reduction of Data Halls Inlet Ventilation noise levels; a 10 dB reduction will be included by means of internal attenuators.
- Reduction of Data Halls Outlet Ventilation noise levels; the attenuation measures include the enclosure/encasement of the outlet chimneys using insulated panels (including the bottom and the extension of the chimneys up to 2 meters above roof level).
- Each Electrical Plant Room Condenser Unit will be attenuated 7 dB by means of acoustic enclosures.
- Reduction of 12dB for each MMR Condenser Unit (with an operational maximum sound power level of 66 dBA.
- 3.5 metre high solid barrier at the roof, surrounding the ancillary plant deck.

The barrier assumed should be solid, continuous, sealed at all interfaces and have a surface density of at least 10 kg/m^2, or provide a minimum sound attenuation of 20 dB.

5.3 Assessment of the Normal Operation

The potential impact of sound from the normal operation of the full Data Centre site has been assessed in accordance with BS 4142:2014. This is based on a comparison between the predicted $L_{Ar,Tr}$ rating sound levels from the ventilation inlet and outlet and the rest of the sources included in the normal operation regime for P1, P2, P5 North and South and SQ17, with the typical measured $L_{A90,T}$ background sound levels at the nearest noise-sensitive receptors in the vicinity. Sound predictions have been carried out in the noise-modelling suite Cadna/A, in accordance with the ISO 9613 prediction methodology.

For the purpose of this assessment, it is assumed that all the internal plant for the ventilation of the data suites will operate simultaneously and continuously, except for the pressure relief dampers that are assumed to only operate when the gas suppression system is activated, which is in case of fire, and therefore not considered as part of the site operation.

In relation to the ancillary block services plant, it is assumed that all the external plant will operate simultaneously and continuously except for certain elements as advised by the designers and presented in section 5.1 above.

BS4142:2014 advises that when the noise contains a tonality, impulsivity, intermittency and other sound characteristics, then a correction depending on the grade of the aforementioned characteristics of the sound is added to the specific noise level to obtain the $L_{Ar,Tr}$ 'rating noise level'. A correction to include the consideration of a level of uncertainty in sound measurements, data and calculations can also be applied when necessary. It also advises that the assessment of the significance of sound needs to consider the context in which the sound will occur. Based on the character of the proposed ventilation plant no penalties are considered necessary for intermittency, tonality or impulsivity of the sound arising from the development.

The prevailing background sound levels used within the assessment were measured over a 5-day period and in accordance with the principles of BS7445:2003. All acoustic measurement equipment used during the sound survey conformed to Type 1 Specification of British Standard 61672. This reduces the significance of the uncertainty in the measurements. The sound predictions were carried out using the noise-modelling suite Cadna/A, in accordance with the ISO 9613 prediction methodology. They are based on manufacturer data and supported by source emission levels measured at the existing plant, and a conservative approach has been followed.

The above approach effectively removes the significance of uncertainty, which has consequently, resulted in no uncertainty budgets being included within the assessment. Considering the context; the sound from the plant is not expected to alter the character of the prevailing acoustic environment.

Table 14 below presents the predicted sound rating levels at the most exposed NSRs and compares them against the prevailing background sound levels during the daytime and night-time respectively. Receptors have been modelled at 4 metres high to represent the worst-case upper floor. Values have been rounded to the nearest whole number.

Table 14: Assessment of the Impacts on Residential Dwellings during Normal Operation

Location	Period	Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)	Typical Background Sound Level $L_{A90,T}$ (dB)	Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)	Significance of Sound (Depending on the context)
Detached Property (south)	Day	27	33-35	-6/-8	Low Adverse Impact
	Night	27	28-29	-1/-2	Low Adverse Impact
	Day	28	33-35	-5/-7	Low Adverse Impact

Table 14: Assessment of the Impacts on Residential Dwellings during Normal Operation					
Location	**Period**	**Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)**	**Typical Background Sound Level $L_{A90,T}$ (dB)**	**Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)**	**Significance of Sound (Depending on the context)**
Wadwicks Green (south)	Night	27	28-29	-1/-2	Low Adverse Impact
Westwells Road (east)	Day	27	34	-7	No Adverse Impact
	Night	26	24	+2	Low Adverse Impact
Bradford Road (west)	Day	26	43	-17	No Adverse Impact
	Night	26	28-29	-2/-3	Low Adverse Impact

During the daytime periods, when background sound is higher, the sound from the 'normal operation' of the proposed full Data Centre will be between 5 dB below and 17 dB below the typical background at the nearest and most potentially exposed NSRs, which is an indication of Low to No Adverse Impact.

During the night-time periods, when background sound drops to very low levels, the sound from the 'normal operation' of the proposed full Data Centre will be between 2 dB above and 3 dB below the typical background at the nearest and most potentially exposed NSRs, which is an indication of Low Adverse Impact, considering the context.

Although this is above the requirements in Planning Conditions of a rating level 5 dB below background for the operation of P3 and P4, and P5, it must be noted that the planning conditions refer to partial operation of the site, and not for the full site operation.

It must be noted that the only exceedance of the background levels at Westwells Road receptor is due mainly to chillers and dry coolers within SQ17 extension. It can be expected that the operation of the chillers and dry coolers will be at lower rates during the night when temperatures are lower, and therefore based on experience in similar projects a 3 dB reduction in noise emission levels could be assumed for the night-time operation as a robust assumption. This would reduce the impact at the most exposed receptor on Westwells Road by more than 1 dB, and therefore the rating sound level would be predicted to marginally exceed typical background levels.

It must be noted that BS4142:2014 states that 'when making assessments and arriving at decision it is essential to place the sound in context', following on to say that 'where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night'. Both background sound levels (28 and 24 dBA) and rating levels (27 and 26 dBA) are definitely low at these assessment locations, with absolute levels low enough to ensure good internal noise conditions within the dwelling during the night-time period ('ie Indoor Ambient Noise Levels within the dwelling in the order of 12, and 11 dBA when considering a partially open window for ventilation, following the 15 dB reduction from outside to inside as stated in BS8233 and WHO Guidelines).

Based on the above, this BS4142:2014 Assessment concludes that the 'normal operation' of the plant, assuming the mitigation measures in section above, will not produce an adverse noise effect onto the nearest NSRs.

Sound maps showing the sound breakout contours at 1.5 metres above ground are presented in Appendix C, which graphically articulate the propagation of sound from the plant into the surrounding area.

5.4 Assessment of Not Normal Operational Scenarios

The potential impact of sound during the Emergency and Maintenance operational scenarios as presented in Section 5.1 has been assessed in accordance with BS4142:2014. It must be noted that certain scenarios include extremely unlikely events, such as a mains power failure and fire in the data halls. To put this into context, according to the applicant, in the last ten years of operation at Spring Park there has only been one mains power failure which impacted one building (not all) during a thunderstorm.

In addition, due to the emergency character of the plant included in this not normal operation scenarios which is expected to operate very occasionally, an assessment based on BS8233:2014/World Health Organization guidelines has been carried out to add context.

5.4.1 Generator Emergency Operation – Scenario b

In the extremely unlikely event of a total mains supply failure, all the generators will be running at 80% load along with the plant normally operating. This emergency running it's understood to be for a 48-hour period.

5.4.1.1 BS4142 Assessment

For the purpose of this assessment and as a worst-case scenario, it is assumed that all plant (normal operation plant and emergency power generators) on all buildings will operate simultaneously and continuously for 48 hours, which in reality is an extremely unlikely scenario.

Based on our experience the good acoustic design of these plant and associated sound mitigation elements are capable of reducing intermittency, tonality or impulsivity of the plant, which are not expected to be noticeable at receptors locations. Accordingly, no additional penalties have been added to the predicted specific sound level to obtain the rating sound level.

Table 15 below presents the predicted sound rating levels at the most exposed Noise-Sensitive Receptors (NSRs) during generators emergency backup operations and compares them against the prevailing background sound levels during the daytime and night-time respectively. Receptors have been modelled at 4 metres high to represent a worst-case upper floor. Values have been rounded to the nearest whole number.

Table 15: Assessment of the Impacts on Residential Dwellings during Generators Emergency Backup Operations – Scenario b

Location	Period	Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)	Typical Background Sound Level $L_{A90,T}$ (dB)	Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)	Significance of Sound (Depending on the context)
Detached Property (south)	Day	41	33-35	+8/+6	Significant Adverse Impact
	Night	41	28-29	+13/+12	Significant Adverse Impact
Wadwicks Green (south)	Day	42	33-35	+9/+7	Significant Adverse Impact
	Night	42	28-29	+14/+13	Significant Adverse Impact
Westwells Road (east)	Day	36	34	+2	Low Adverse Impact
	Night	36	24	+12	Significant Adverse Impact
Bradford Road (west)	Day	43	43	+0	Low Adverse Impact
	Night	43	28-29	+15/+14	Significant Adverse Impact

During the daytime periods, the sound from all the emergency generators of the development will be between 0 and 9 dB above the typical background at the nearest and most potentially exposed residential receptors, which is an indication of Low Impact to Significant Adverse Impact, depending on the context.

During the night-time periods, when background sound drops to very low levels, the sound from all the emergency generators of the proposed development will be between 12 and 15 dB above the typical background at the nearest and most potentially exposed residential receptors, which is an indication of Significant Adverse Impact, depending the context.

A sound map, showing the sound breakout contours at 1.5 metres above ground is presented in Appendix C, which graphically articulates the propagation of sound from the generators' emergency plant into the surrounding area.

As advised by the applicant, the emergency generators are for the provision of power generation, to allow the Data Centre to continue operating and prevent the loss of any data in the event of mains power failure. These events are extremely unlikely to occur and if they did, would be for period of 48 hours given the operational nature of the data centres.

Considering the extremely infrequent and short duration of this scenario, it is considered appropriate to also assess its impact in accordance with BS8233:2014/World Health Organization guidelines.

5.4.1.2 BS8233:2014/World Health Organisation Assessment

Based on the guideline values presented in this guidance, the noise emissions from the proposed emergency plant should be controlled to ensure that the $L_{Aeq,T}$ value does not exceed 50 dB externally during the day, or 30 dB internally during the night, at the nearest noise-sensitive receptors.

For the calculation of the indoor noise levels, as a worst-case scenario the assessment considers that background ventilation on existing NSRs is provided via partially open windows, which will provide a noise reduction from outside to inside of approximately 15 dB, according to BS8233:2014 and WHO Guidelines.

The predicted noise levels and subsequent assessment at each receptor is presented in Table 16 and Table 17 below. It must be noted that daytime levels at external amenity areas have been predicted at 1.5m above ground at the curtilage of the properties, while external night-time levels have been predicted as incident façade levels at first floor. Values have been rounded to the nearest whole number.

Table 16: Assessment of External Amenity Areas during daytime – Generators Emergency Backup Operations – Scenario b

Location	Predicted External Noise Level $L_{Aeq,T}$ (dB)	External Target $L_{Aeq,T}$ (dB)	Excess of External Noise Target
Detached Property (south)	39	50	-11
Wadwicks Green (south)	38		-12
Westwells Road (east)	34		-16
Bradford Road (west)	43		-7

Table 17: Assessment of Indoor Ambient Noise Levels at Residential Dwellings – Generators Emergency Backup Operations – Scenario b				
Location	**Predicted Façade Incident Noise Level $L_{Aeq,T}$ (dB)**	**Predicted Indoor Ambient Noise Level $L_{Aeq,T}$ (dB)**	**Indoor Ambient Noise Target $L_{Aeq,T}$ (dB)**	**Excess of Indoor Ambient Noise Target**
Detached Property (south)	41	26	30	-4
Wadwicks Green (south)	42	27		-3
Westwells Road (east)	36	21		-9
Bradford Road (west)	43	28		-2

It can be observed in Table 16 above that external noise target to protect outdoor amenity spaces is comfortably achieved at all NSRs.

It can also be observed in Table 17 that Indoor Ambient Noise Levels (IANL) target is achieved at all NSRs.

Based on the emergency character of this plant and the very occasional and short use expected, this assessment concludes that the 'Generators Emergency Backup Operations' of the plant will not produce a significant adverse noise effect at the nearest NSRs.

5.4.2 Cooling Systems Emergency Operation - Scenario c

In the extremely unlikely event of a fire affecting all the facilities at once, the DX and ACCU external units will be running at full load along with the plant normally operating. This emergency running it's understood to be for a 48-hour period. Assuming a fire will affect all buildings and all modules in a building, simultaneously, is an extreme scenario.

5.4.2.1 BS4142 Assessment

For the purpose of this assessment and as a worst-case scenario, it is assumed that all plant (normal operation plant and emergency cooling plant) on all buildings will operate simultaneously and continuously for 48 hours, which in reality is an extremely unlikely scenario.

Based on our experience the good acoustic design of these plant and associated sound mitigation elements are capable of reducing intermittency, tonality or impulsivity of the plant, which are not expected to be noticeable at receptors locations. Accordingly, no additional penalties have been added to the predicted specific sound level to obtain the rating sound level.

Table 18 below presents the predicted sound rating levels at the most exposed Noise-Sensitive Receptors (NSRs). The assessment is done as per section 5.4.1.1

Table 18: Assessment of the Impacts on Residential Dwellings during Cooling System Emergency Operations – Scenario c

Location	Period	Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)	Typical Background Sound Level $L_{A90,T}$ (dB)	Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)	Significance of Sound (Depending on the context)
Detached Property (south)	Day	43	33-35	+10/+8	Significant Adverse Impact
	Night	43	28-29	+15/+14	Significant Adverse Impact
Wadwicks Green (south)	Day	46	33-35	+13/+11	Significant Adverse Impact
	Night	46	28-29	+18/+17	Significant Adverse Impact
Westwells Road (east)	Day	53	34	+19	Significant Adverse Impact
	Night	53	24	+29	Significant Adverse Impact
Bradford Road (west)	Day	39	43	-4	Low Adverse Impact
	Night	39	28-29	+11/+10	Significant Adverse Impact

During the daytime periods, the sound from all the emergency cooling system plant of the development will be between 4 dB below and 19 dB above the typical background at the nearest and most potentially exposed residential receptors, which is an indication of Low Impact to Significant Adverse Impact, depending on the context.

During the night-time periods, when background sound drops to very low levels, the sound from all the emergency cooling system plant of the proposed development will be between 10 and 29 dB above the typical background at the nearest and most potentially exposed residential receptors, which is an indication of Significant Adverse Impact, depending the context.

A sound map, showing the sound breakout contours at 1.5 metres above ground is presented in Appendix C, which graphically articulates the propagation of sound from the cooling system emergency plant into the surrounding area.

As advised by the applicant, this scenario would happen in the event of a fire affecting all the facilities, which is extremely unlikely to occur and if it did, would be for period of no longer than 48 hours.

Considering the extremely unlikely and short duration of this scenario, it is considered appropriate to also assess its impact in accordance with BS8233:2014/World Health Organization guidelines.

5.4.2.2 BS8233:2014/World Health Organisation Assessment

The assessment has been done as per section 5.4.1.2 above.

Table 19: Assessment of External Amenity Areas during daytime – Cooling System Emergency Operations – Scenario c

Location	Predicted External Noise Level $L_{Aeq,T}$ (dB)	External Target $L_{Aeq,T}$ (dB)	Excess of External Noise Target
Detached Property (south)	43	50	-7
Wadwicks Green (south)	44		-6
Westwells Road (east)	53		+3
Bradford Road (west)	39		-11

Table 20: Assessment of Indoor Ambient Noise Levels at Residential Dwellings – Cooling System Emergency Operations – Scenario c

Location	Predicted Façade Incident Noise Level $L_{Aeq,T}$ (dB)	Predicted Indoor Ambient Noise Level $L_{Aeq,T}$ (dB)	Indoor Ambient Noise Target $L_{Aeq,T}$ (dB)	Excess of Indoor Ambient Noise Target
Detached Property (south)	43	28	30	-2
Wadwicks Green (south)	46	31		+1
Westwells Road (east)	53	38		+8
Bradford Road (west)	39	24		-6

It can be observed in Table 19 above that external noise target to protect outdoor amenity spaces is comfortably achieved at all NSRs, except for Westwells Road receptors where it is slightly exceeded.

It can also be observed in Table 20 that Indoor Ambient Noise Levels (IANL) target is achieved at NSRs, except for Westwells Road and Wadwicks Green receptors.

It must be noted that BS8233:2014 recognises that with a relaxation of 5 dB upon the above targets, reasonable noise conditions can still be expected. Therefore, the internal ambient noise levels at night will slightly exceed reasonable conditions at Westwells Road receptors.

Based on the emergency character of this scenario operation in case of a fire at all the facilities simultaneously (extremely unlikely) and short use expected (48 hours), this assessment concludes that the 'Cooling System Emergency Operations' of the plant will not produce a significant adverse noise effect at the nearest NSRs.

5.4.3 Summer Cooling Systems Operation - Scenario d

In hot external ambient conditions with temperatures above 27˚C, the DX and ACCU units will operate along with the normal operation plant for short periods of time during the daytime hours, when these temperatures are more likely in hot summer days. This operation will typically expand for 6 hours, between 14:00 and 20:00.

5.4.3.1 BS4142 Assessment

For the purpose of this assessment and as a worst-case scenario, it is assumed that all plant (normal operation plant and emergency cooling plant) on all buildings will operate simultaneously and continuously during the daytime for 6 hours, which will only occur in very hot days during the summer.

As mentioned above, no additional penalties have been added to the predicted specific sound level to obtain the rating sound level.

Table 21 below presents the predicted sound rating levels at the most exposed Noise-Sensitive Receptors (NSRs) during hot external ambient conditions operations and compares them against the prevailing background sound levels during the daytime. Receptors have been modelled at 4 metres high to represent a worst-case upper floor. Values have been rounded to the nearest whole number.

Table 21: Assessment of the Impacts on Residential Dwellings during Summer Hot Weather Days Operations – Scenario d

Location	Period	Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)	Typical Background Sound Level $L_{A90,T}$ (dB)	Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)	Significance of Sound (Depending on the context)
Detached Property (south)	Day	39	33-35	+6/+4	Adverse Impact

Table 21: Assessment of the Impacts on Residential Dwellings during Summer Hot Weather Days Operations – Scenario d					
Location	**Period**	**Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)**	**Typical Background Sound Level $L_{A90,T}$ (dB)**	**Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)**	**Significance of Sound (Depending on the context)**
Wadwicks Green (south)	Day	42	33-35	+9/+7	Significant Adverse Impact
Westwells Road (east)	Day	48	34	+14	Significant Adverse Impact
Bradford Road (west)	Day	35	43	-8	Low Adverse Impact

During the daytime periods, the sound from all the emergency cooling system plant of the development will be between 8 dB below and 14 dB above the typical background at the nearest and most potentially exposed residential receptors, which is an indication of Low Impact to Significant Adverse Impact, depending on the context.

A sound map, showing the sound breakout contours at 1.5 metres above ground is presented in Appendix C, which graphically articulates the propagation of sound from the cooling system plant in hot weather conditions into the surrounding area.

As advised by the applicant, this scenario would happen in hot summer days when the external temperature is above 27˚C, which is unlikely to occur for several days in the year.

Considering the unlikely and short duration of this scenario, it is considered appropriate to also assess its impact in accordance with BS8233:2014/World Health Organization guidelines.

5.4.3.2 BS8233:2014/World Health Organisation Assessment

Based on the guideline values presented in this guidance, the noise emissions from the proposed emergency plant should be controlled to ensure that the $L_{Aeq,T}$ value does not exceed 50 dB externally during the day, or 35 dB internally, at the nearest noise-sensitive receptors.

The assessment is done as per section 5.4.1.2.

Table 22: Assessment of External Amenity Areas during daytime – Summer Hot Weather Days Operations – Scenario d			
Location	**Predicted External Noise Level $L_{Aeq,T}$ (dB)**	**External Target $L_{Aeq,T}$ (dB)**	**Excess of External Noise Target**
Detached Property (south)	39	50	-11
Wadwicks Green (south)	40		-10
Westwells Road (east)	48		-2
Bradford Road (west)	35		-15

Table 23: Assessment of Indoor Ambient Noise Levels at Residential Dwellings – Summer Hot Weather Days Operations – Scenario d				
Location	**Predicted Façade Incident Noise Level $L_{Aeq,T}$ (dB)**	**Predicted Indoor Ambient Noise Level $L_{Aeq,T}$ (dB)**	**Indoor Ambient Noise Target $L_{Aeq,T}$ (dB)**	**Excess of Indoor Ambient Noise Target**
Detached Property (south)	39	24	35	-11
Wadwicks Green (south)	42	27		-8
Westwells Road (east)	48	33		-2
Bradford Road (west)	35	20		-15

It can be observed in Table 22 above that external noise target to protect outdoor amenity spaces is comfortably achieved at all NSRs.

It can also be observed in Table 23 Indoor Ambient Noise Levels (IANL) target is achieved at all NSRs.

Based on the sporadic character of this scenario operation, this assessment concludes that the 'Summer Hot Weather Cooling Operations' of the plant will not produce a significant adverse noise effect at the nearest NSRs.

5.4.4 Generators Emergency during Hot Weather Operation - Scenario e

In the extremely unlikely event of a total mains supply failure when hot external ambient conditions, all the generators running at 80% load along with all the DX and ACCU units. This scenario is extremely unlikely and will be limited to 6 hours only during the daytime periods between 14:00 and 20:00, as outside these hours the temperature will be lower. This emergency running will be for a maximum 48-hour period.

5.4.4.1 BS4142 Assessment

For the purpose of this assessment and as a worst-case scenario, it is assumed that all plant (normal operation plant, emergency power generators and emergency cooling plant) on all buildings will operate simultaneously and continuously during the daytime for 6 hours, which in reality is an unlikely scenario.

The assessment is done as per section 5.4.3.1.

Table 24: Assessment of the Impacts on Residential Dwellings during Generators Emergency during Hot Weather Operation - Scenario e

Location	Period	Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)	Typical Background Sound Level $L_{A90,T}$ (dB)	Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)	Significance of Sound (Depending on the context)
Detached Property (south)	Day	43	33-35	+10/+8	Significant Adverse Impact
Wadwicks Green (south)	Day	45	33-35	+12/+10	Significant Adverse Impact
Westwells Road (east)	Day	49	34	+15	Significant Adverse Impact
Bradford Road (west)	Day	43	43	+0	Low Adverse Impact

During the daytime periods, the sound from all the emergency generators and cooling system plant of the development will be between 0 dB and 15 dB above the typical background at the nearest and most potentially exposed residential receptors, which is an indication of Low Impact to Significant Adverse Impact, depending on the context.

A sound map, showing the sound breakout contours at 1.5 metres above ground is presented in Appendix C, which graphically articulates the propagation of sound from the emergency plant into the surrounding area.

As advised by the applicant, this scenario would happen in the event of mains power failure during hot summer days when the external temperature is above 27˚C, which is unlikely to occur for several days in the year. Also, these events are extremely unlikely to occur and if they did, would be for period of 2days given the operational nature of the data centres.

Considering the extremely unlikely and short duration of this scenario, it is considered appropriate to also assess its impact in accordance with BS8233:2014/World Health Organization guidelines.

5.4.4.2 BS8233:2014/World Health Organisation Assessment

The assessment is done as per section 5.4.3.2.

Table 25: Assessment of External Amenity Areas during daytime Generators Emergency during Hot Weather Operation - Scenario e

Location	Predicted External Noise Level $L_{Aeq,T}$ (dB)	External Target $L_{Aeq,T}$ (dB)	Excess of External Noise Target
Detached Property (south)	41	50	-9
Wadwicks Green (south)	42		-8
Westwells Road (east)	48		-2
Bradford Road (west)	44		-6

Table 26: Assessment of Indoor Ambient Noise Levels at Residential Dwellings – Generators Emergency during Hot Weather Operation - Scenario e

Location	Predicted Façade Incident Noise Level $L_{Aeq,T}$ (dB)	Predicted Indoor Ambient Noise Level $L_{Aeq,T}$ (dB)	Indoor Ambient Noise Target $L_{Aeq,T}$ (dB)	Excess of Indoor Ambient Noise Target
Detached Property (south)	43	28	35	-7
Wadwicks Green (south)	45	30		-5
Westwells Road (east)	49	34		-1
Bradford Road (west)	43	28		-7

It can be observed in Table 25 above that external noise target to protect outdoor amenity spaces is comfortably achieved at all NSRs.

It can also be observed in Table 26 Indoor Ambient Noise Levels (IANL) target is achieved at all NSRs.

Based on the emergency character of this scenario in the event of mains power failure during hot summer days when the external temperature is above 27˚C and short use expected (48 hours), this assessment concludes that the 'Generators Emergency during hot weather Operations' of the plant will not produce a significant adverse noise effect at the nearest NSRs.

5.4.5 Generators Maintenance Operation - Scenario f

Different maintenance tests are undertaken every month, every three months and once a year for each generator and all energy centres. The duration of the tests is of 15 minutes and it's generally done generator by generator. As a worst case, the simultaneous operation of all the generators along with normal operation plant during 15 min has been considered for each building individually.

5.4.5.1 BS4142 Assessment

For the purpose of this assessment and as a worst-case scenario, it is assumed that all plant (normal operation plant and emergency power generators) on each building will operate simultaneously and continuously during 15 minutes during the daytime. The HV Farm maintenance tests have been assessed operating all the engines at the same time which represent a worst case, as the actual tests take place in batches.

As for the previous assessments, no additional penalties have been added to the predicted specific sound level to obtain the rating sound level.

The tables below present the predicted sound rating levels at the most exposed Noise-Sensitive Receptors (NSRs) during generators maintenances tests for each building and compares them against the prevailing background sound levels during the daytime. Receptors have been modelled at 4 metres high to represent a worst-case upper floor. Values have been rounded to the nearest whole number.

Table 27: Assessment of the Impacts on Residential Dwellings during P1 Generators Maintenance Tests - Scenario f

Location	Period	Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)	Typical Background Sound Level $L_{A90,T}$ (dB)	Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)	Significance of Sound (Depending on the context)
Detached Property (south)	Day	27	33-35	-6/-8	Low Adverse Impact
Wadwicks Green (south)	Day	28	33-35	-5/-7	Low Adverse Impact

Table 27: Assessment of the Impacts on Residential Dwellings during P1 Generators Maintenance Tests - Scenario f					
Location	**Period**	**Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)**	**Typical Background Sound Level $L_{A90,T}$ (dB)**	**Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)**	**Significance of Sound (Depending on the context)**
Westwells Road (east)	Day	27	34	-7	No Adverse Impact
Bradford Road (west)	Day	26	43	-17	No Adverse Impact

Table 28: Assessment of the Impacts on Residential Dwellings during P2 Generators Maintenance Tests - Scenario f					
Location	**Period**	**Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)**	**Typical Background Sound Level $L_{A90,T}$ (dB)**	**Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)**	**Significance of Sound (Depending on the context)**
Detached Property (south)	Day	27	33-35	-6/-8	Low Adverse Impact
Wadwicks Green (south)	Day	28	33-35	-5/-7	Low Adverse Impact
Westwells Road (east)	Day	27	34	-7	No Adverse Impact
Bradford Road (west)	Day	26	43	-17	No Adverse Impact

Table 29: Assessment of the Impacts on Residential Dwellings during SQ17 Generators Maintenance Tests					
Location	**Period**	**Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)**	**Typical Background Sound Level $L_{A90,T}$ (dB)**	**Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)**	**Significance of Sound (Depending on the context)**
Detached Property (south)	Day	28	33-35	-5/-7	Low Adverse Impact
Wadwicks Green (south)	Day	28	33-35	-5/-7	Low Adverse Impact
Westwells Road (east)	Day	27	34	-7	No Adverse Impact
Bradford Road (west)	Day	27	43	-16	No Adverse Impact

Table 30: Assessment of the Impacts on Residential Dwellings during HV Farm Generators Maintenance Tests					
Location	**Period**	**Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)**	**Typical Background Sound Level $L_{A90,T}$ (dB)**	**Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)**	**Significance of Sound (Depending on the context)**
Detached Property (south)	Day	27	33-35	-6/-8	Low Adverse Impact
Wadwicks Green (south)	Day	28	33-35	-5/-7	Low Adverse Impact
Westwells Road (east)	Day	28	34	-6	No Adverse Impact
Bradford Road (west)	Day	26	43	-17	No Adverse Impact

Table 31: Assessment of the Impacts on Residential Dwellings during SQ19 Generators Maintenance Tests					
Location	**Period**	**Predicted Rating Sound Level $L_{Ar,Tr}$ (dB)**	**Typical Background Sound Level $L_{A90,T}$ (dB)**	**Excess of $L_{Ar,Tr}$ above $L_{A90,T}$ (dB)**	**Significance of Sound (Depending on the context)**
Detached Property (south)	Day	27	33-35	-6/-8	Low Adverse Impact
Wadwicks Green (south)	Day	28	33-35	-5/-7	Low Adverse Impact
Westwells Road (east)	Day	27	34	-7	No Adverse Impact
Bradford Road (west)	Day	27	43	-16	No Adverse Impact

The sound from all the emergency generators maintenance tests of the development will be between 5 dB and 17 dB below the typical background at the nearest and most potentially exposed residential receptors, which is an indication of Low to No Adverse Impact, depending on the context.

The sound from the site generators maintenance tests is well below the typical background levels at the receptor's location.

6 Conclusion

Sweco have been instructed by Ark Estates Spring Park Limited to undertake a noise assessment, in order to assess the impact of noise associated with full Data Centre site operations at Spring Park, Corsham, to support an Environmental Permit application for the extension of the current consented site.

The current assessment is intended to evaluate the operation of the full site including the addition of P5 North and P5 south, SQ17 extension and SQ19 in support of an Environmental Permit application.

This Report assesses the acoustic acceptability of the full Data Centre site, following the baseline sound survey previously carried out at the nearest noise-sensitive receptors and a comprehensive noise modelling exercise. The assumptions of the noise model are detailed in the assessment text and are based on source noise measurements carried out at existing and operating Data Centre P1, P2, P3, SQ17, data provided by the applicant, and necessary sound reductions.

Six scenarios have been assessed. The 'Normal Operation' scenario assesses acoustic impact of plant which will normally be running, such us the internal plant rooms with associated ventilation inlet and outlet louvers at the buildings' facades and the external roof plant associated with P5 North and P5 South ancillary blocks, and SQ17 extension. Additional noise sources found to be significant during the site visits at P1, P2 and SQ17 have also be incorporated for the 'Normal Operation' scenario.

Different 'Emergency Backup' and not normal scenarios assess the acoustic impact of the different situations, including the extremely unlikely event of roof-mounted air-cooled condensing units associated with emergency cooling system operation and backup electricity generators operation associated with main power failure occurring simultaneously.

The outcomes of the assessment show that incorporating the noise reductions set out in the text, the 'Normal Operations' are expected to have No Impact or a Low Adverse Noise Impact at the nearest and most exposed noise-sensitive receptors, when assessed in accordance with BS4142:2014.

The 'Emergency Generators Backup Operations' have shown to have a Low to Significant Adverse noise impact when assessed in accordance with BS4142:2014. However, considering the emergency, short duration and very occasional occurrence of this scenario, it is considered appropriate to extend the Assessment to comply with BS8233:2014/WHO Guidelines.

This Assessment has found that in the worst-case scenario of all emergency power generators from all buildings operating at the same time, the BS8233:2014/WHO Guidelines at external amenity areas and the Indoor Ambient Noise Levels targets are achieved at all nearby properties. This scenario operation will not produce a significant adverse noise effect at the nearest NSRs, considering the context.

The ‘Cooling System Emergency Operations’ have shown to have a Low to Significant Adverse noise impact when assessed in accordance with BS4142:2014. However, considering the emergency, short duration and extremely rare occurrence of this scenario, it is considered appropriate to extend the assessment to comply with BS8233:2014/WHO Guidelines.

This assessment has found that in the worst-case scenario of all emergency cooling system plant from all buildings operating at the same time, the BS8233:2014/WHO Guidelines at external amenity areas are achieved at most nearby properties and slightly exceeded at Westwells Road although reasonable conditions are met. The Indoor Ambient Noise Levels targets are achieved at most nearby properties and reasonable conditions are achieved at Wadwicks Green and slightly exceeded at Westwells Road. This scenario operation will not produce a significant adverse noise effect at the nearest NSRs considering the extremely rare occurrence.

The ‘Summer Cooling System Operations’ have shown to have a Low to Significant Adverse noise impact when assessed in accordance with BS4142:2014. However, considering the short duration of this scenario, it is considered appropriate to extend the Assessment to comply with BS8233:2014/WHO Guidelines.

This assessment has found that in the worst-case scenario of all cooling system plant from all buildings operating at the same time during the afternoon and evening, the BS8233:2014/WHO Guidelines at external amenity areas and Indoor Ambient Noise Levels are achieved at all nearby properties. This scenario operation will not produce a significant adverse noise effect at the nearest NSRs considering the context.

The ‘Emergency Generators during Hot Weather Backup Operations’ have shown to have a Low to Significant Adverse noise impact when assessed in accordance with BS4142:2014. However, considering the emergency, short duration and very rare occurrence of this scenario, it is considered appropriate to extend the assessment to comply with BS8233:2014/WHO Guidelines.

This assessment has found that in the worst-case scenario of all cooling system plant from all buildings and all emergency power generators operating at the same time during the afternoon and evening, the BS8233:2014/WHO Guidelines at external amenity areas and Indoor Ambient Noise Levels are achieved at all nearby properties. This scenario operation will not produce a significant adverse noise effect at the nearest NSRs.

The ‘Emergency Generators Maintenance Tests Operations’ have shown to have a Low to No Adverse noise impact when assessed in accordance with BS4142:2014.

Appendix A – Glossary of Acoustic Terminology

Wording	Description
Sound Pressure	Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
Sound Pressure Level (Sound Level)	The sound level is the sound pressure relative to a standard reference pressure of 20μPa (20x10-6 Pascals) on a decibel scale.
Decibel (dB)	A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds s1 and s2 is given by 20 log10 (s1 / s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20μPa.
A-weighting, dB(A)	The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
Noise Level Indices	Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out.
$L_{eq,T}$	A noise level index called the equivalent continuous noise level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded.
$L_{max,T}$	A noise level index defined as the maximum noise level during the period T. L_{max} is sometimes used for the Assessment of occasional loud noises, which may have little effect on the overall Leq noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
$L_{90,T}$	A noise level index. The noise level exceeded for 90% of the time over the period T. L_{90} can be considered to be the "average minimum" noise level and is often used to describe the background noise.
$L_{10,T}$	A noise level index. The noise level exceeded for 10% of the time over the period T. L_{10} can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise.

Wording	Description
Free-Field	Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m
Facade	At a distance of 1m in front of a large sound reflecting object such as a building façade.
Fast Time Weighting	An averaging time used in sound level meters. Defined in BS 5969.

Appendix B – Full Sound Measurements Results

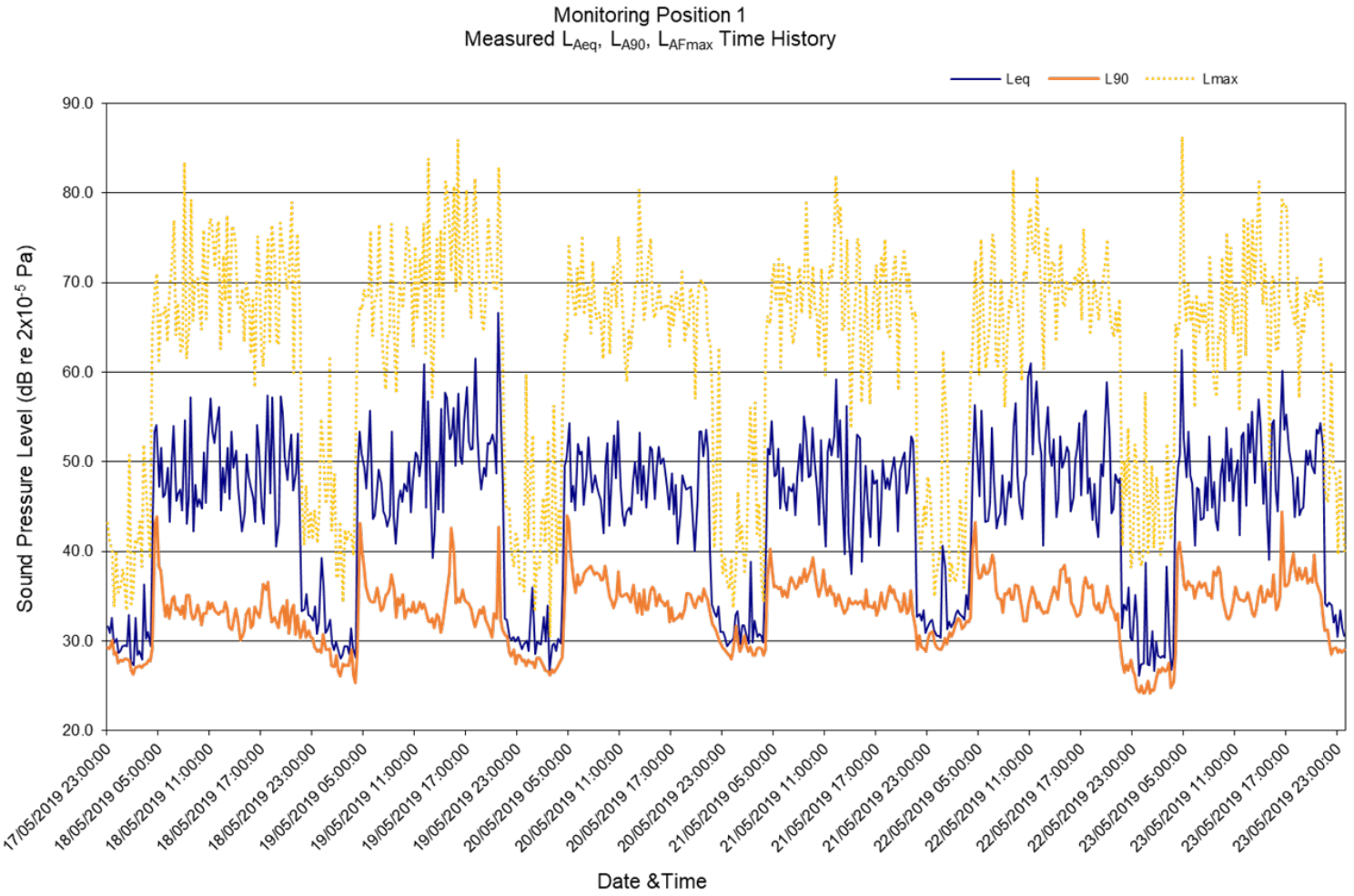


Figure B1: Monitoring Position 1 – Time History Graph

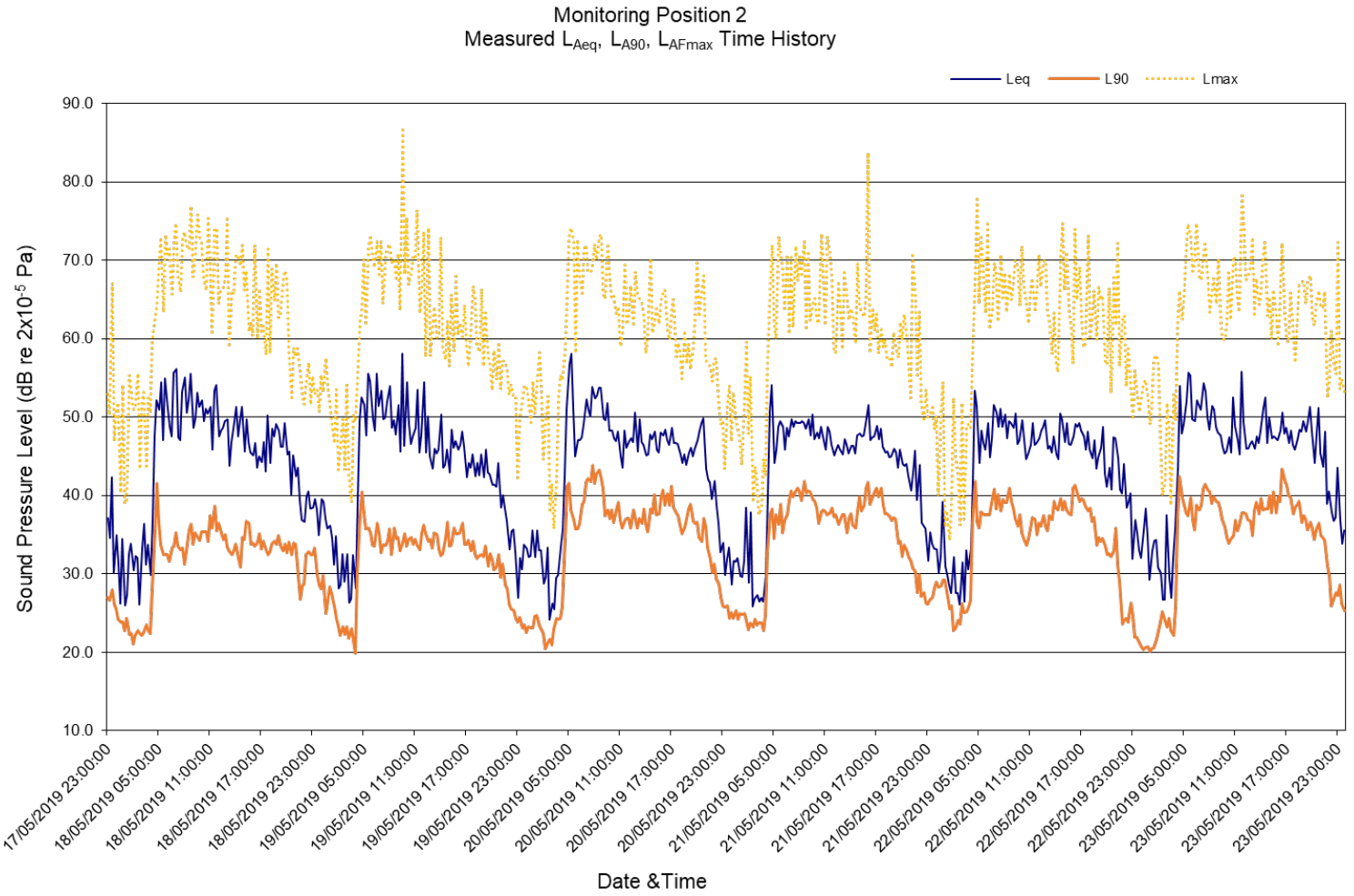


Figure B2: Monitoring Position 2 – Time History Graph

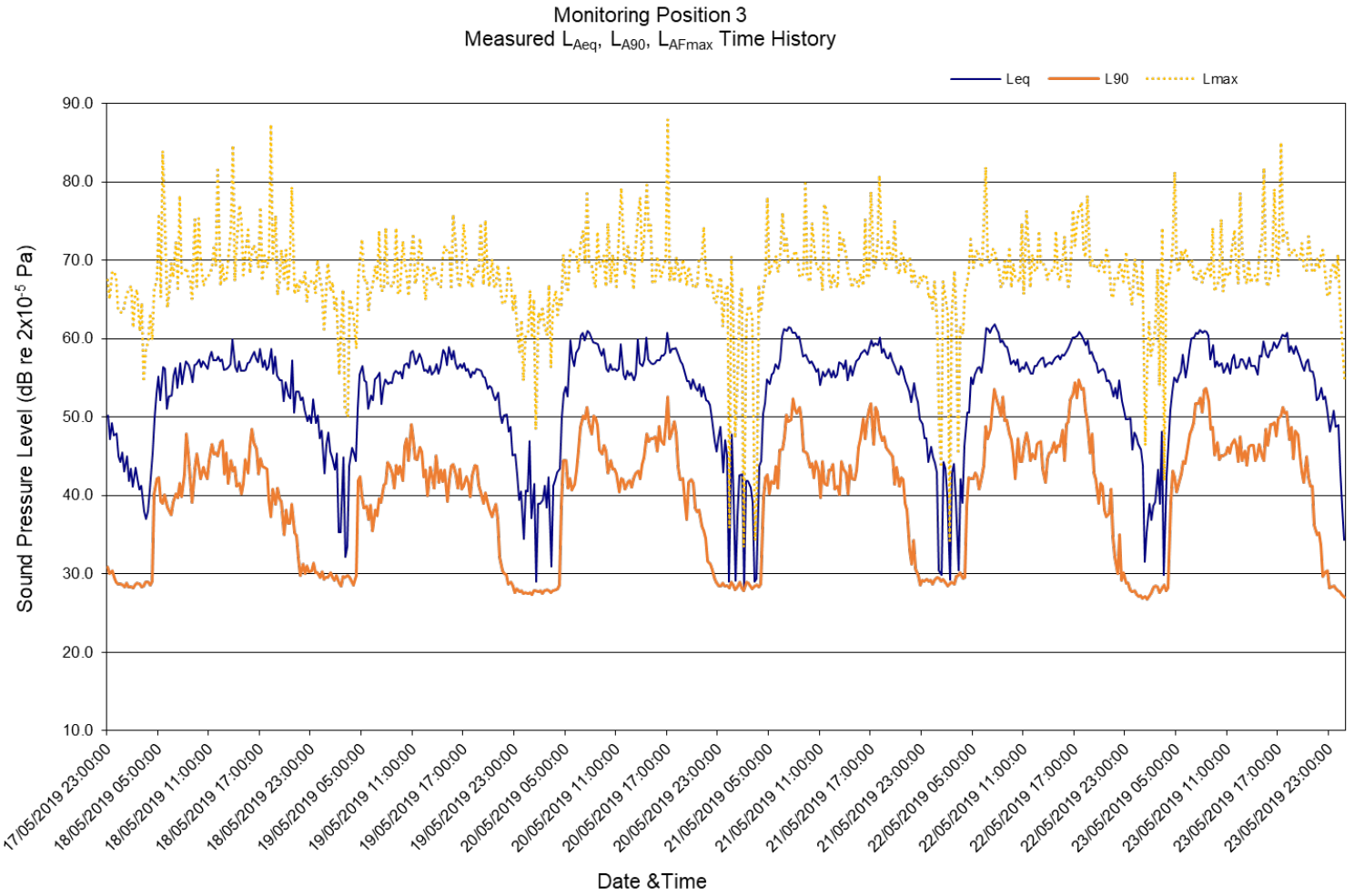


Figure B3: Monitoring Position 3 – Time History Graph

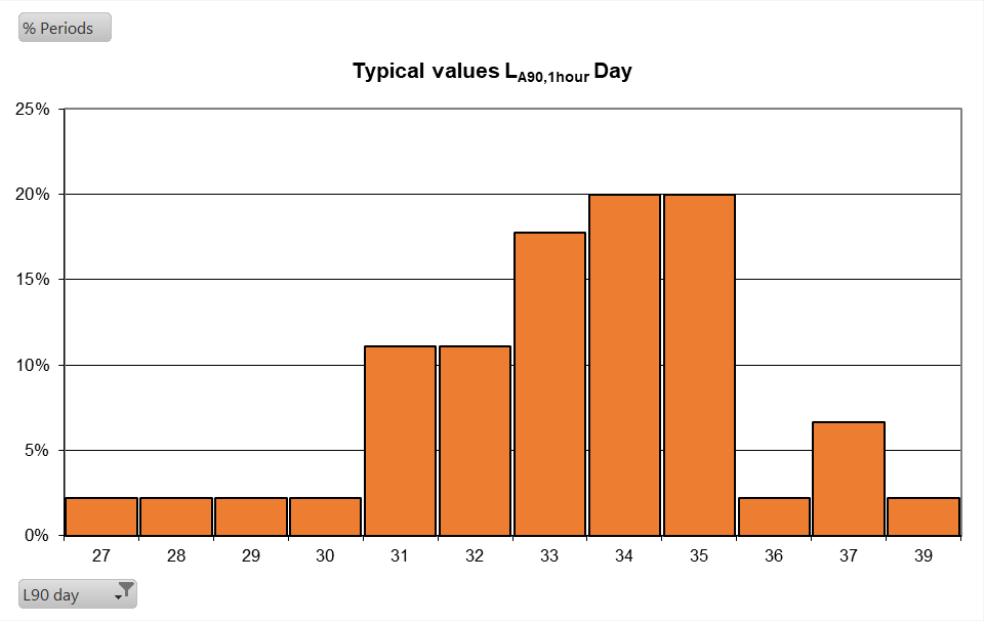


Figure B4: Daytime L_{A90} Statistical Analysis –Position 1

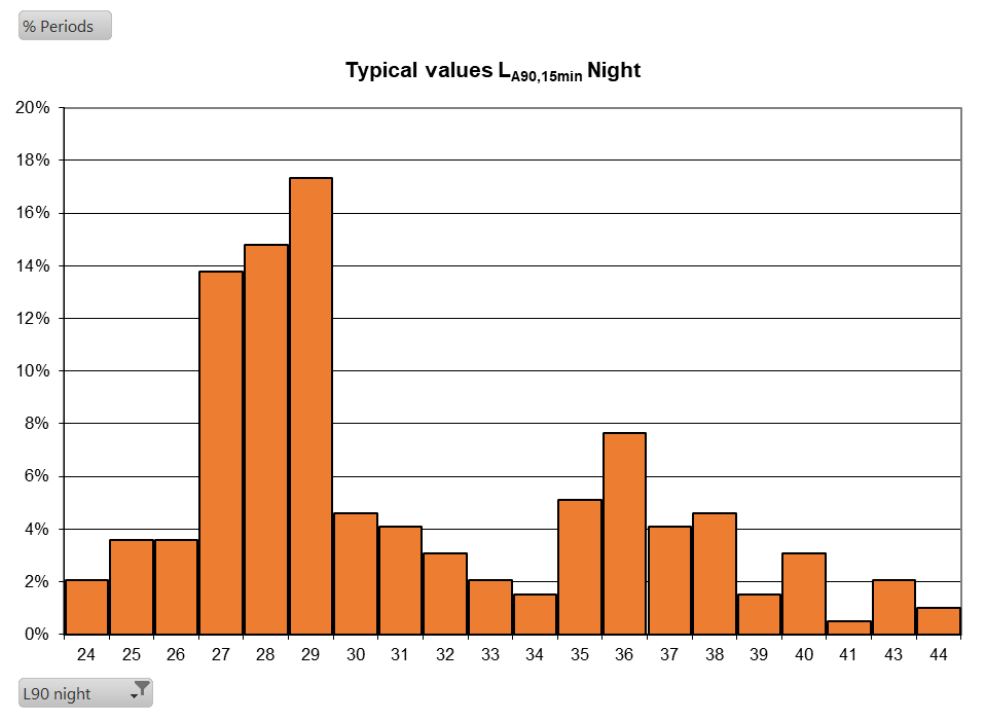


Figure B5: Night-time L_{A90} Statistical Analysis –Position 1

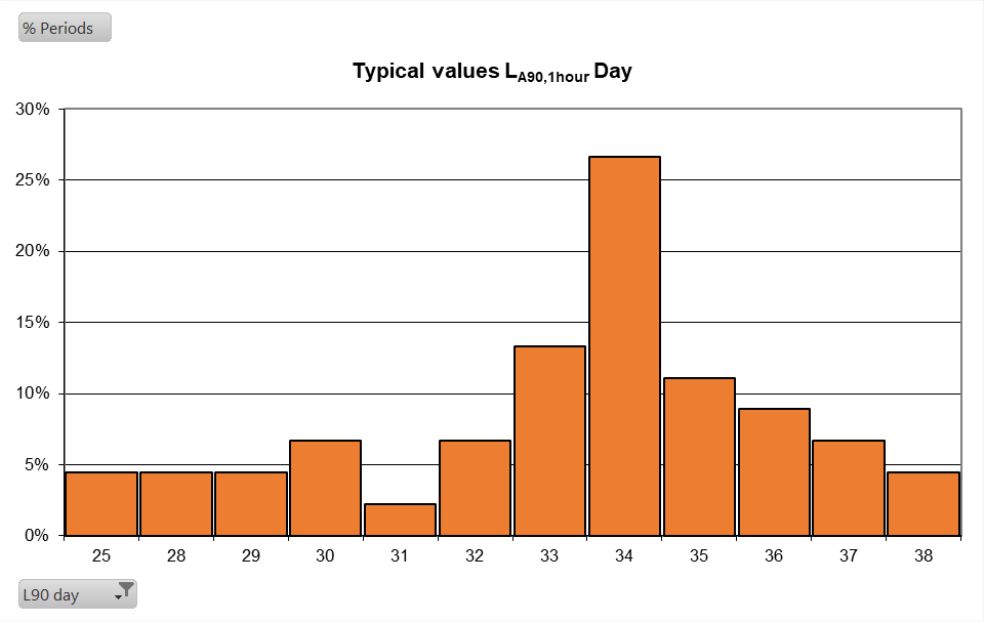


Figure B6: Daytime L_{A90} Statistical Analysis –Position 2

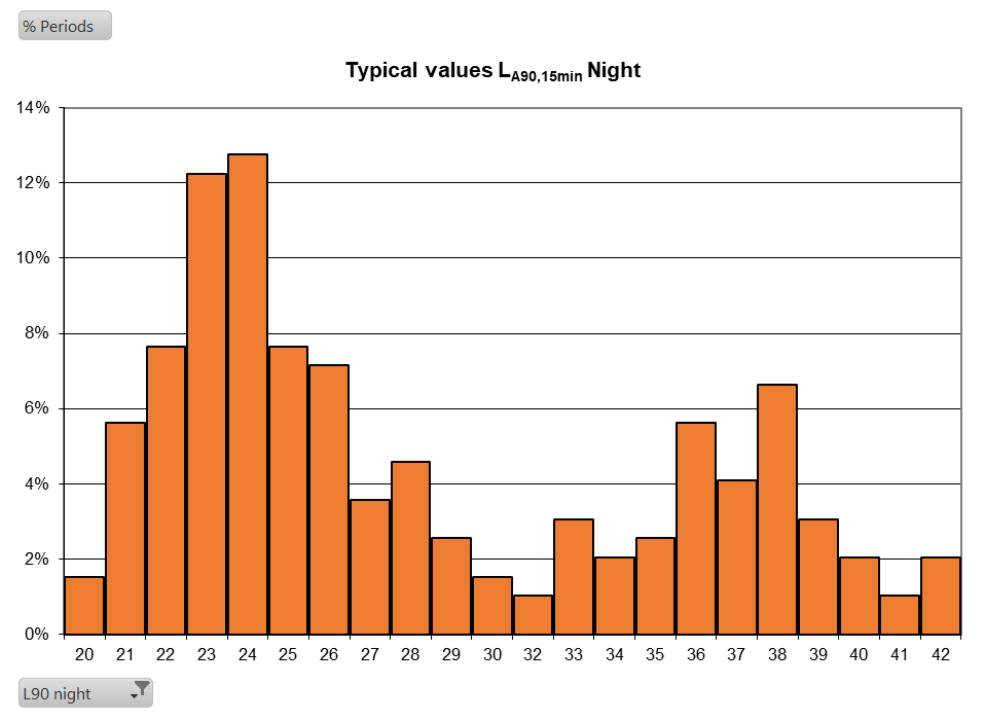


Figure B7: Night-time L_{A90} Statistical Analysis – Position 2

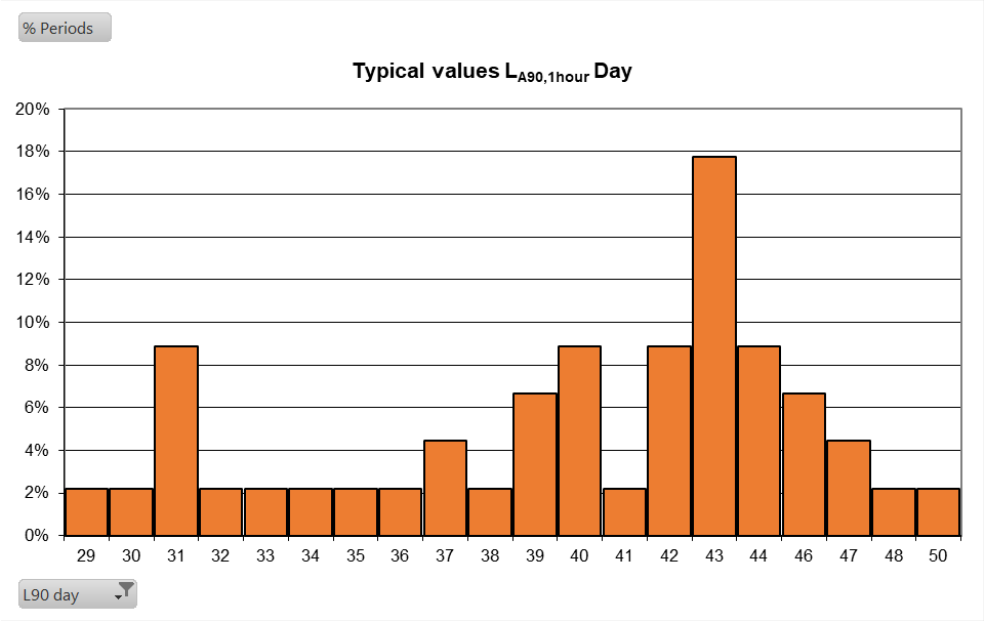


Figure B8: Daytime L_{A90} Statistical Analysis –Position 3

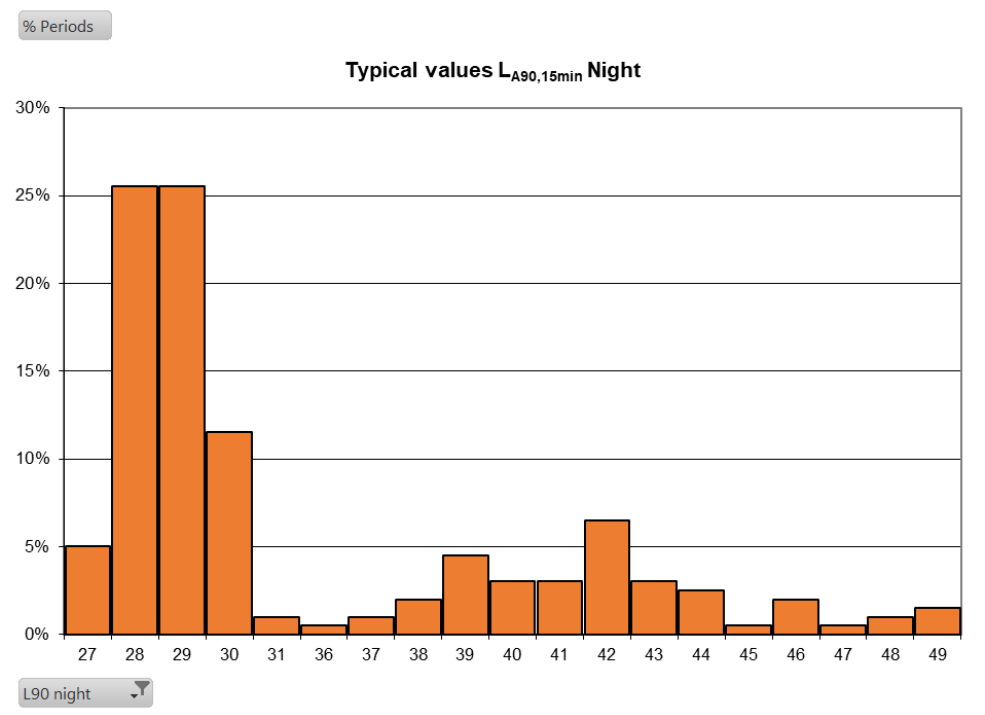
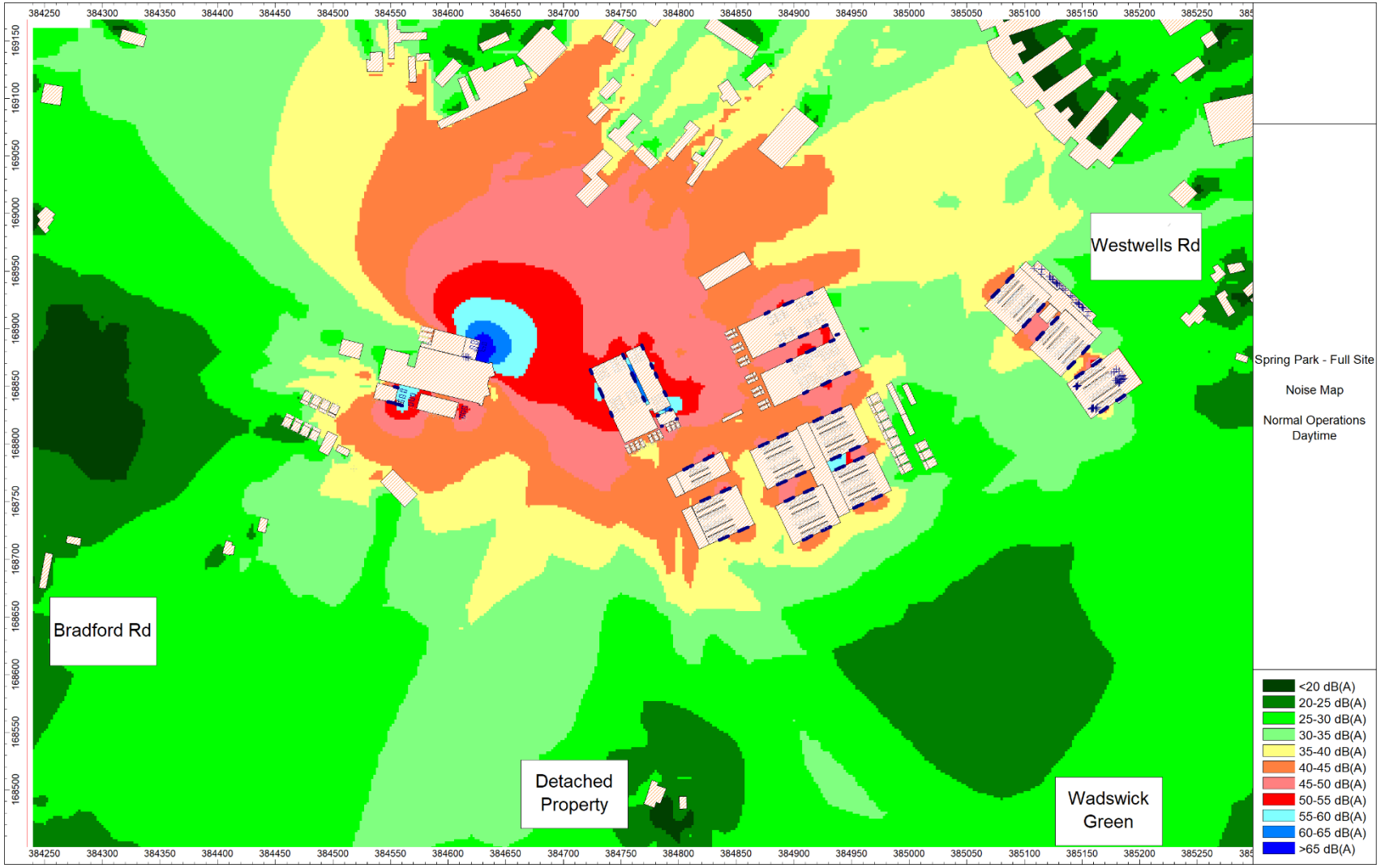
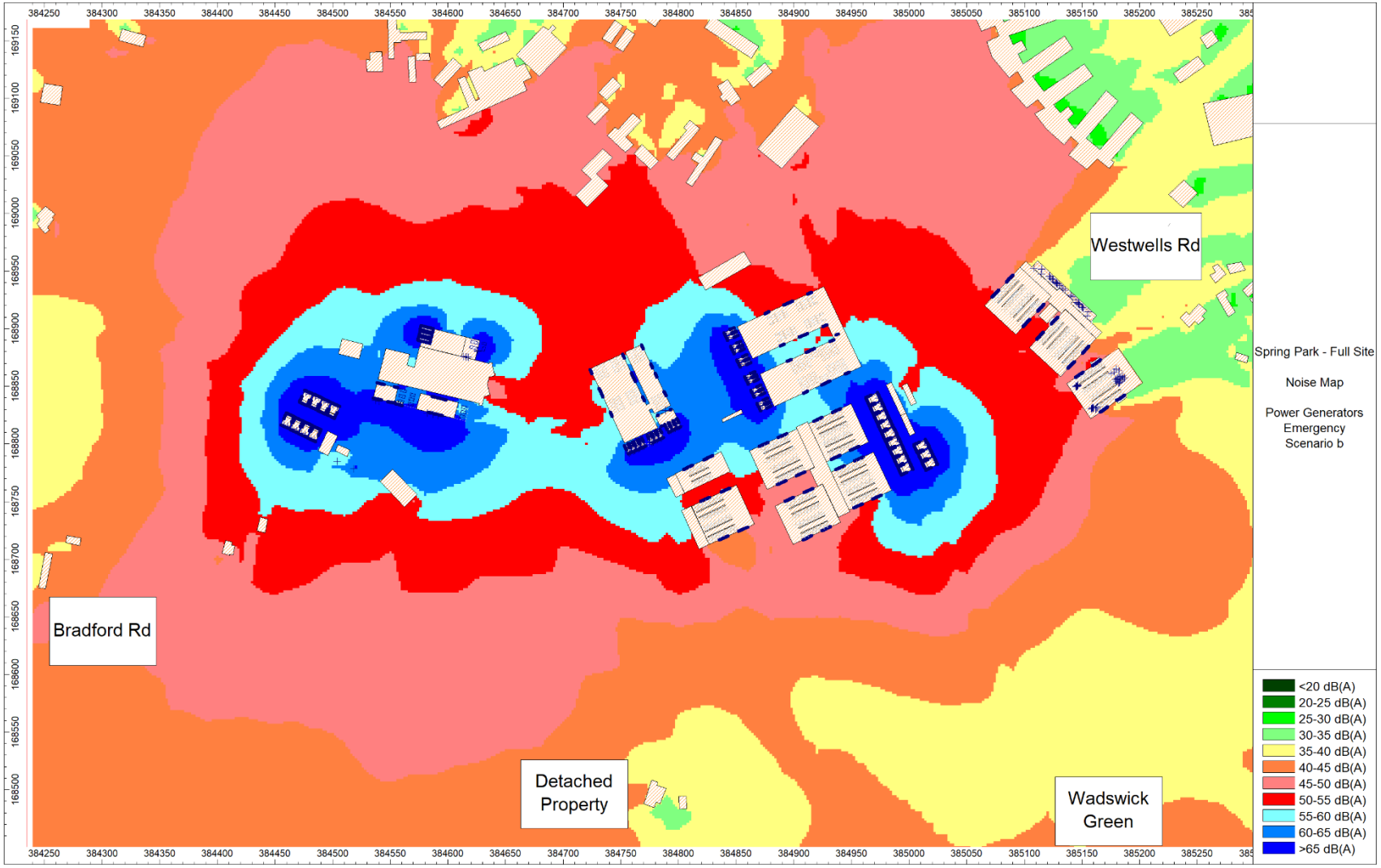


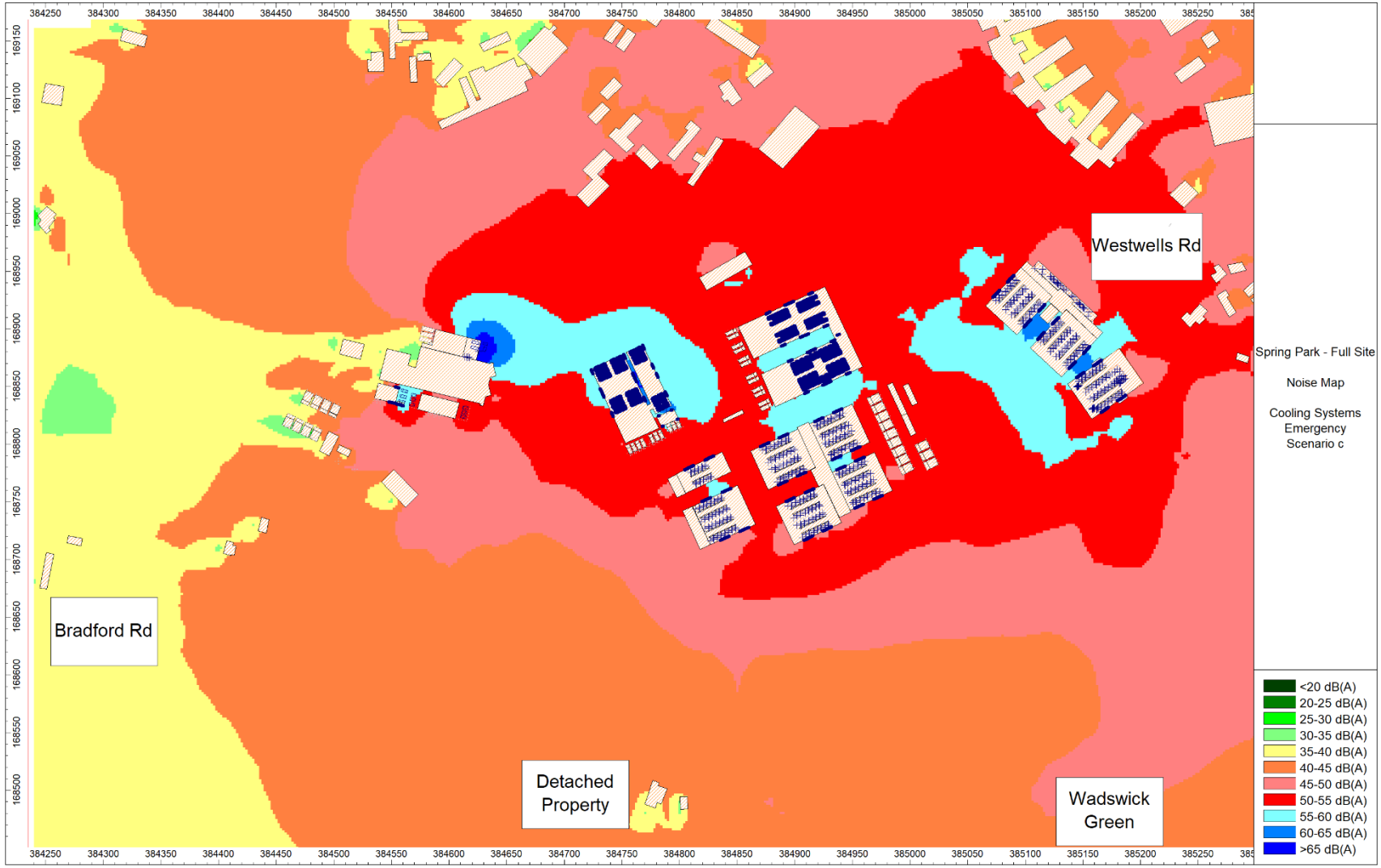
Figure B9: Night-time L_{A90} Statistical Analysis – Position 3

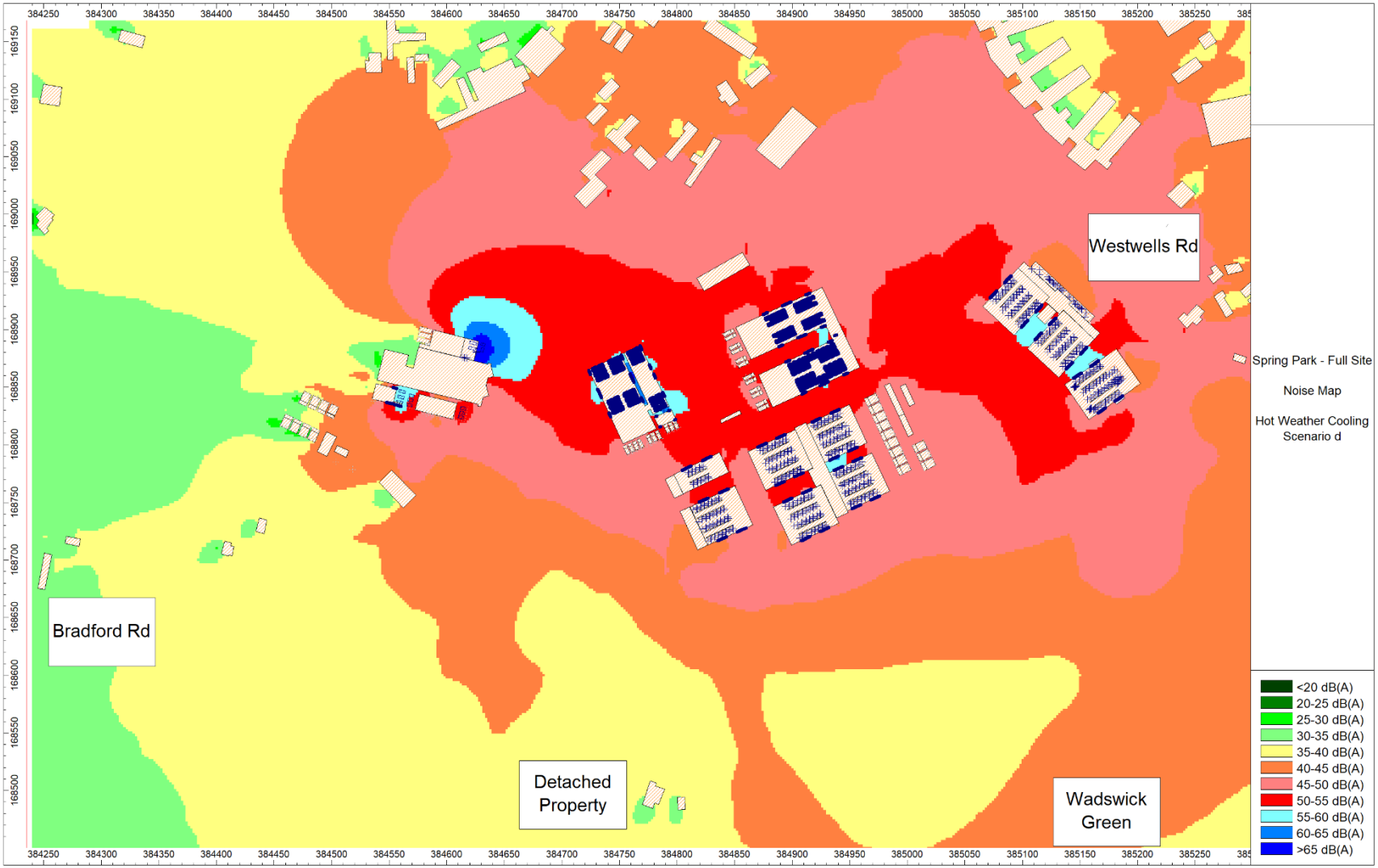
Appendix C – Noise Maps

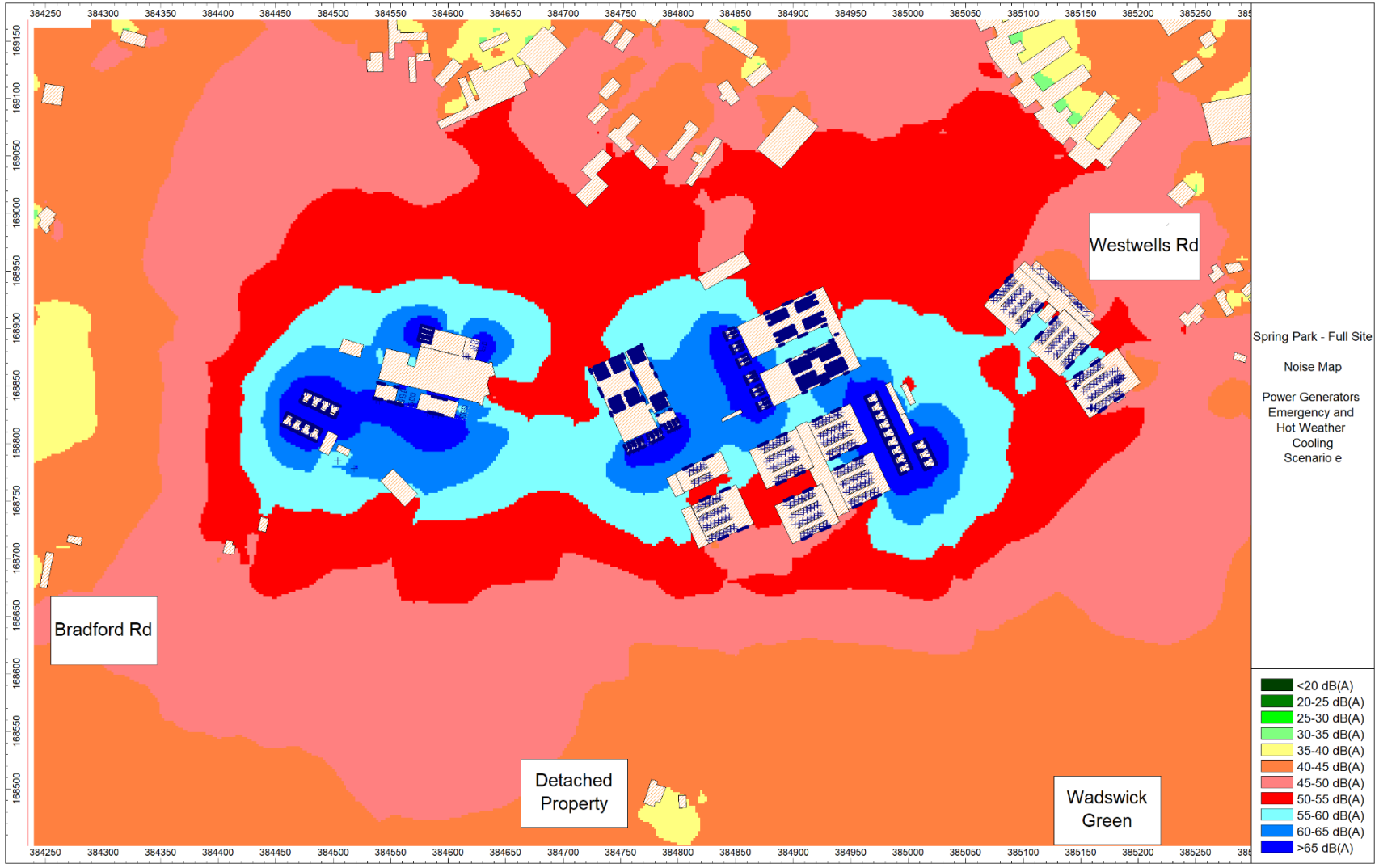

Westwells Rd
Bradford Rd
Detached Property
Wadswick Green
Spring Park - Full Site
Noise Map
Normal Operations
Daytime
<20 dB(A)
20-25 dB(A)
25-30 dB(A)
30-35 dB(A)
35-40 dB(A)
40-45 dB(A)
45-50 dB(A)
50-55 dB(A)
55-60 dB(A)
60-65 dB(A)
>65 dB(A)


Westwells Rd
Bradford Rd
Detached Property
Wadswick Green
Spring Park - Full Site
Noise Map
Normal Operations
Night-time
<20 dB(A)
20-25 dB(A)
25-30 dB(A)
30-35 dB(A)
35-40 dB(A)
40-45 dB(A)
45-50 dB(A)
50-55 dB(A)
55-60 dB(A)
60-65 dB(A)
>65 dB(A)


Westwells Rd
Bradford Rd
Detached Property
Wadswick Green
Spring Park - Full Site
Noise Map
Power Generators Emergency Scenario b
<20 dB(A)
20-25 dB(A)
25-30 dB(A)
30-35 dB(A)
35-40 dB(A)
40-45 dB(A)
45-50 dB(A)
50-55 dB(A)
55-60 dB(A)
60-65 dB(A)
>65 dB(A)


Westwells Rd
Bradford Rd
Detached Property
Wadswick Green
Spring Park - Full Site
Noise Map
Cooling Systems Emergency Scenario c
<20 dB(A)
20-25 dB(A)
25-30 dB(A)
30-35 dB(A)
35-40 dB(A)
40-45 dB(A)
45-50 dB(A)
50-55 dB(A)
55-60 dB(A)
60-65 dB(A)
>65 dB(A)


Westwells Rd
Bradford Rd
Detached Property
Wadswick Green
Spring Park - Full Site
Noise Map
Hot Weather Cooling Scenario d
<20 dB(A)
20-25 dB(A)
25-30 dB(A)
30-35 dB(A)
35-40 dB(A)
40-45 dB(A)
45-50 dB(A)
50-55 dB(A)
55-60 dB(A)
60-65 dB(A)
>65 dB(A)


Westwells Rd
Bradford Rd
Detached Property
Wadswick Green
Spring Park - Full Site
Noise Map
Power Generators Emergency and Hot Weather Cooling Scenario e
<20 dB(A)
20-25 dB(A)
25-30 dB(A)
30-35 dB(A)
35-40 dB(A)
40-45 dB(A)
45-50 dB(A)
50-55 dB(A)
55-60 dB(A)
60-65 dB(A)
>65 dB(A)