Carn Thomas, St Mary's, Isles of Scilly — Noise impact assessment

By

Mike Wood PhD MIOA
ACT Acoustics Ltd.

ACT Acoustics

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Author:	Mike Wood, ACT Acoustics Ltd.
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Contents

Management Summary

Kirkham Board has commissioned ACT Acoustics to provide a noise impact assessment for a proposed residential development at Carn Thomas, Isles of Scilly.

To make our assessment we have undertaken an unattended noise survey of the site. The results of this survey have been used to determine;

- the impact both noise in the area on the proposed residential development; and
- the impact of potential noise sources introduced by the development.

The results of our assessment show that;

- the external noise levels on the noisiest north facades of are low to negligible risk;
- the introduction of air source heat pumps may prove challenging without introducing adverse impact to existing and propose noise sensitive locations; and
- ground source heat pumps may provide a suitable alternative from an acoustic perspective, but will need to be considered on a case-by-case basis.

Based on the results of the above, we see no reason to refuse planning permission on noise grounds due to existing noise. If permission is sought for air and ground source heat pumps, we recommend that the cumulative noise levels from both do not exceed the recommended rating noise levels details within this report.

1. Introduction

1.1. Site address

Carn Thomas, St Mary's, Isles of Scilly

1.2. Location and general area

The location of the proposed development is shown below:

The proposed development includes a mix of 27 new 1-3 bedroom residential dwellings including flats, duplexes and houses.

1.3. Potential noise sources introduced

Potential noise sources introduced include air source and ground source heat pumps (to serve individual houses, the presence of which is to be confirmed). We understand that the solar inverters are also to be installed but these are within the dwellings themselves, and are not likely to adversely affect nearby NSLs. The are therefore not considered further in this report.

Both air source and ground source heat pumps have the potential to cause adverse noise impact if not properly considered. It has not been confirmed at this stage whether or not they will be are to be included in the development. We have nevertheless used the results of the noise survey to provide guidance on how they might be considered as the plan progresses.

1.4. Noise characteristics of area

During our visits to site on the 27 September and 5 October 2022, the noise in the area was dominated by;

- birdsong;
- sea noise; and
- passing cars on the adjacent Telegraph Road and Church Road.

1.5. Approach to the assessment

It was apparent during our visits to the site that that primary source of of noise affecting the development would traffic passing by on the adjacent Telegraph Road. The majority of the background noise was due to natural phenomena (wind and trees, seagulls and birdsong). We therefore needed to assess;

- The noise level from Telegraph Road; and
- The background noise level of the area.

We therefore surveyed the noise close to North of the site. This would allow the simultaneous measurement of both road noise and the residual background noise in the vicinity of the site. The results of survey were then assessed to determine the likely impact of road noise on the proposed development and to provide reasonable noise limits for any noise-making equipment that may be added to the plans at a later date.

1.6. Scope and limitations

The scope of this assessment is limited to the assessment of;

- existing noise sources that may affect the residential amenity of the proposed development; and
- determining the recommended noise limits of any new sources introduced by the development.

Please make sure that you had read an understood the disclaimer at the end of this report.

2. Regulations and standards

2.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was updated in July 2021. The framework replaces the previous NPPF and the Planning Policy Guidance 24 (Planning and Noise). Paragraph 174 of NPPF states:

> *"Planning policies and decisions should contribute to and enhance the natural and local environment by [inter alia]:*
>
> *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans"*

Further, Paragraph 185 states;

> *"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects(including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should [inter alia]:*
>
> a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development — and avoid noise giving rise to significant adverse impacts on health and the quality of life;
> b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason"

The NPPF does not provide any guidance on how noise should be assessed, nor does it provide any criteria with which the adverse effects of noise can be quantified.

2.2. Noise Policy Statement for England

The Noise Policy Statement for England (NPSE) is referred to in the NPPF. Published in March 2010, the NPSE aims to provide clarity regarding current policies and practices as well as enabling noise decisions to be made within the wider context, at the most appropriate level, in a cost effective manner and in a timely fashion. It applies to all forms of noise including environmental noise, neighbour and neighbourhood noise.

The NPSE sets out the long term vision of the UK Government's noise policy. This is supported 'through the effective management and control' of environmental, neighbour and neighbourhood noise within the context of UK Government policy on sustainable development:

- avoid significant adverse effects on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life.

The NPSE introduces the concept of 'effect levels' to relate the impact of noise to stated policy aims.

- No observable effect level (NOEL): This is the level below which no effect can be detected. Below this level, there is no detectable effect on health and quality of life due to noise.
- Lowest observable effect level (LOAEL): This is the level at which adverse effects on health and quality of life can be detected.

- Significant observable adverse effect level (SOAEL): This is the level at which significant adverse health effects start to occur.

The NPSE does not provide any assessment criteria for the various effect levels. These are provided by the UK Government's Planning Practice Guidance on Noise (see below).

2.3. Planning Practice Guidance: Noise

The UK Government has published advice on how planning can manage potential noise impacts in new development. It states:

> *Noise needs to be considered when development may create additional noise, or would be sensitive to the prevailing acoustic environment (including any anticipated changes to that environment from activities that are permitted but not yet commenced). When preparing plans, or taking decisions about new development, there may also be opportunities to make improvements to the acoustic environment. Good acoustic design needs to be considered early in the planning process to ensure that the most appropriate and cost-effective solutions are identified from the outset.*

The guidance goes on to state:

> *At the lowest extreme, when noise is not perceived to be present, there is by definition no effect. As the noise exposure increases, it will cross the "no observed effect" level. However, the noise has no adverse effect so long as the exposure does not cause any change in behaviour, attitude or other physiological responses of those affected by it. The noise may slightly affect the acoustic character of an area but not to the extent there is a change in quality of life. If the noise exposure is at this level no specific measures are required to manage the acoustic environment.*
>
> *As the exposure increases further, it crosses the "lowest observed adverse effect" level boundary above which the noise starts to cause small changes in behaviour and attitude, for example, having to turn up the volume on the television or needing to speak more loudly to be heard. The noise therefore starts to have an adverse effect and consideration needs to be given to mitigating and minimising those effects (taking account of the economic and social benefits being derived from the activity causing the noise).*
>
> *Increasing noise exposure will at some point cause the "significant observed adverse effect" level boundary to be crossed. Above this level the noise causes a material change in behaviour such as keeping windows closed for most of the time or avoiding certain activities during periods when the noise is present. If the exposure is predicted to be above this level the planning process should be used to avoid this effect occurring, for example through the choice of sites at the plan-making stage, or by use of appropriate mitigation such as by altering the design and layout. While such decisions must be made taking account of the economic and social benefit of the activity causing or affected by the noise, it is undesirable for such exposure to be caused.*
>
> *At the highest extreme, noise exposure would cause extensive and sustained adverse changes in behaviour and / or health without an ability to mitigate the effect of the noise. The impacts on health and quality of life are such that regardless of the benefits of the activity causing the noise, this situation should be avoided.*

The UK Government provides the following noise exposure hierarchy to help planners to make objective decisions regarding responses to noise:

Response	***Examples of outcomes***	***Increasing effect level***	***Action***
No Observed Effect Level			
Not present	No effect	No observed effect	No specific measured required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. Can slightly affect the acoustic character of the area but not such that there is a change in the quality of life.	No observed adverse effect	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be hear and cause small changes in behaviour, attitude or other physiological response, e.g. turning up the television; speaking more loudly; where there is no alternative ventilation, having to close windows some of the time because of noise. Potential for some reposted sleep disturbance. Affects the acoustic character of the are such that these is a small actual or perceived change in the quality of life.	Observed adverse effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes at material change in behaviours, attitude of or other physiological response, e.g. avoid certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficultly getting to sleep, premature awakening and difficult in getting back to sleep. Quality of life diminished due to change in acoustic character of area.	Significant observed adverse effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviours, attitude or other physiological response and/or and inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable adverse effect	Prevent

The table does not provide quantitative levels for the above effects.

2.4. ProPG Assessment Method

The ProPG guidance details four elements for an acoustic assessment of sites proposed for residential development. It comprises two stages.

The first stage is an initial risk assessment of the site. This is followed by stage 2 which is formed of a four-element detailed assessment.

2.4.1. Stage 1

The first stage of the assessment is to assess the risk from the existing noise levels. The risk assessment classifies different areas of the site according their respective noise levels. The noise risk assessment can be produced on the basis of either noise measurement or prediction and should:

> *"aim to describe noise levels over a typical worst case 24 hour day either now or in the foreseeable future".*

Our interpretation of the noise risk levels detailed in the ProPG guidance are shown below:

Risk level	Day range (LAeq)	Night range (LAeq)
Negligible	0 - 52.5	0 - 42.5
Low	52.6 - 62.5	42.6 - 52.5
Medium	62.6 - 72.5	52.6 - 62.5
High	72.6 -	62.6 -

2.4.2. Stage 2

Stage 2 provides a more detailed assessment of the noise.

Element 1: Good Acoustic Design Process

Regarding the application of a 'good acoustic design process', ProPG states the following:

> *2.17 Following a good acoustic design process is an implicit part of achieving good design as required by Government planning and noise policy, set out in the NPSE and NPPF, and as outlined in Supplementary Document 1.*
>
> *2.18 It is imperative that acoustic design is considered at an early stage of the development control process.*
>
> *2.19 A good acoustic design process takes a multi-faceted and integrated approach to achieve optimal acoustic conditions, both internally (inside noise-sensitive parts of the building(s)) and externally (in spaces to be used for amenity purposes).*
>
> *2.20 Good acoustic design should avoid "unreasonable" acoustic conditions and prevent "unacceptable" acoustic conditions (these terms are defined in Element 2). Good acoustic design does not mean over-design or gold plating of all new development but seeking to the optimum acoustic outcome for a particular site.*
>
> *2.21 Good acoustic design is not just compliance with recommended internal and external noise exposure standards. Good acoustic design should provide an integrated solution whereby the optimum acoustic outcome is achieved, without design compromises that will adversely affect living conditions and the quality of life of the inhabitants or other sustainable design objectives and requirements.*
>
> *2.22 Using fixed un-openable glazing for sound insulation purposes is generally unsatisfactory and should be avoided; occupants generally prefer the ability to have control over the internal environment using openable windows, even if the acoustic conditions would be considered unsatisfactory when open. Solely relying on sound insulation of the building envelope to achieve acceptable acoustic conditions in new residential development, when other methods could reduce the need for this approach, is not regarded as good acoustic*

design. Any reliance upon building envelope insulation with closed windows should be justified in supporting documents."

Element 2: Internal noise level guidelines

The ProPG guidance suggests that the ideal internal noise levels are[1]:

Activity	Location	Daytime	Nighttime
Resting	Living Room	35	-
Dining	Dining room / area	40	-
Sleeping (daytime resting)	Bedroom	35	30

An open window typically provides around 10 - 15 dB of noise attenuation. The limits for allowing ventilation through an open window are therefore:

Activity	Location	Daytime	Nighttime
Resting	Living Room	50	-
Dining	Dining room / area	55	-
Sleeping (daytime resting)	Bedroom	50	45

Element 3: External amenity noise assessment

It is recommended that outdoor noise levels in external amenity spaces (such as gardens and recreation areas) should be below the range 50 - 55 dB LAeq16hr. This is to ensure that future residents can enjoy outdoor areas.

Element 4: Assessment of other relevant issues

ProPG also recommends that any other relevant acoustic issues are considered as part of the detailed assessment.

2.5. WHO Guidelines on Community Noise

The World Health Organisation's (WHO) Guidelines on Community Noise were published in 1999 and detail recommended noise levels for a range of contexts. These levels are linked to critical health effects in specific human environments. The levels relevant to this assessment are detailed below:

Specific environment	Critical health effects	LAeq dB	Time base (hours)	LAFmax dB
Outdoor living area	Serious annoyance, day- time and evening	55	16	
	Moderate annoyance, daytime and evening	50	16	-
Dwelling, indoors	Speech intelligibility and moderate annoyance, daytime and evening.	35	16	-
Inside bedrooms	Sleep nighttime.disturbance,	30	8	45
Outside bedrooms	Sleep disturbance, win- dow open (outdoor values)	45	8	60

The WHO Night Noise Guidelines (NNG) were published in 2009 and are considered an extension and update to the WHO Guidelines on Community Noise. The NNG presents the conclusions of the WHO regarding the exposure to noise during sleep. It gives the following proposed guidelines:

1. These are based on the noise limits from BS 8233:2014

WHO NNG Target	Lnight,outside dB (2300-0700)
Night noise guidelines (NNG)	40
Interim target	55

The NNG and IT record the overall noise exposure of the population to environmental noise. The two interim targets are for when the night noise guideline cannot be achieved in a short-term period.

3. Survey

3.1. Our subjective impressions of noise

During our visit to site, the prevailing noise environment consisted of;

- Birdsong; and
- Traffic on nearby Telegraph Road.

3.2. Measurement methodology

BS 7445 (Description and measurement of environmental noise: Guide to quantities and procedures) provides guidance on the quantification of environmental noise. It provides the framework within which environmental noise should be quantified.

It comprises three parts;

- Part 1 (2003): provides a guide to quantities and procedures;
- Part 2 (1991): provides a guide to the acquisition of data pertinent to land use.
- Part 3 (1991): provides a guide to the application of noise limits.

BS 7445 also refers BS EN 61672, which details the required equipment necessary for proper measurement. Although BS 7445 does not prescribe the meteorological conditions under which noise measurements should be taken, it makes the following recommendation:

To facilitate the comparison of results (measurements of noise from different sources), it may be necessary to carry out measurements under selected meteorological conditions which are reproducible and correspond to quite stable propagation conditions. [part 2, paragraph 5.4.3.3]

These conditions include:

- Wind speed not exceeding 5 m/s (measured at a height of 3 to 11 m above the ground);
- No strong temperature inversions near the ground; and
- No heavy precipitation.

All measurements were taken in accordance with the above guidance.

3.3. Survey summary results

A summary of the survey results is given below;

Period	LAeq	LA90
07:00 to 19:00	54	35
19:00 to 23:00	47	30
23:00 to 07:00	38	26

3.4. WHO Guidelines on Community Noise

The expected noise levels in rear gardens can be expected to be reduced by around 10 dB or more. If we account for this reduction, the noise levels are well below the annoyance limit:

Period	LAeq	Expected max level in rear gardens	Annoyance limit	Difference
07:00 to 19:00	54	44	50	-6
19:00 to 23:00	47	37	50	-13

3.5. Noise implications for facades (bedrooms)

Bedrooms are the most noise-sensitive room within dwellings, we therefore calculate the results required by the façade to meet the recommended internal levels in BS 8233. Since an open windows provides around 15 dB of noise protection, we also calculate whether the internal noise limits will be met in this case:

Period	LAeq	BS 8233 recommended limit (dB LAeq)	Reduction required by façade (dB)	Met by open window only?
07:00 to 19:00	54	35	19	No
19:00 to 23:00	47	35	12	Yes
23:00 to 07:00	38	30	8	Yes

Where more that 15 dB reduction is required trickle ventilation, or hit and miss vents will be considered appropriate. The above noise reduction of 19 dB during the day (0700 - 1900) can be achieved with standard 4-12-4 glazing with standard trickle ventilation (e.g. Greenwood D-vent of L-vent).

4. Guidance of potential new noise sources

4.1. Representative noise levels of air source heat pumps

At the time of writing, it is not known what type of fixed plant is likely to be used. However, we have included a general guide to noise levels below.

The table below provides a sample of Daikin heating and cooling units that are typically specified for a range of commercial projects:

Manufacturer	Model	SWL dBA Heating	SWL dBA Cooling
Daikin	RZAG125N7V1B	72	69
Daikin	RZAG140N7V1B	72	70
Daikin	RZQSG100L8Y1B	70	70
Daikin	RZAG100N7V1B	69	66
Daikin	RXYSA4A7V1B	67	67
Daikin	RZAG71N7V1B	66	64
Daikin	RZAG60A2V1B	64	64
Daikin	RZAG50A2V1B	63	63
Daikin	RZAG35A2V1B	62	62

The maximum and minimum sound power level for this range of models (considering both modes) are:

- Max: 72 dBA SWL
- Min: 62 dBA SWL

The table below shows the noise levels from the above equipment at different distances[2]:

2. Note that all of these calculations assume 2 reflecting planes (i.e. floor and wall). The directivity factor, Q, is therefore 4.

	Source of 72 dBA SWL (Q=2)	Source of 62 dBA SWL
Noise level (SPL dBA) at 1 m	67	57
Noise level (SPL dBA) at 2 m	61	51
Noise level (SPL dBA) at 5 m	53	43
Noise level (SPL dBA) at 10 m	47	37
Noise level (SPL dBA) at 20 m	41	31

4.2. Representative noise levels of ground source heat pumps

We understand that, if ground source heat is used, a Kensa ground source heat pump is likely to be installed.

Ground source heat pumps tend to produce noise in the range 40 — 45 dB LAeq at 1 m, so are quieter than air source heat pumps. However, we recommend that the ground source heat pumps are assessed once the precise location and type of each pump is known.

4.3. Proposed noise limits for ground and air source heat pumps

We recommend that the cumulative noise level of all ground and air source pumps not exceed:

Period	Proposed rating noise level, BS 4142 (LArTr)
07:00 to 19:00	35
19:00 to 23:00	30
23:00 to 07:00	26

Note: the noise limits are based on the levels required to achieve a cumulative noise level equal to the background noise level. These levels must include any acoustic feature correction (described below).

Based on the above levels, GSHPs may prove to be more practical from an acoustic perspective, as even quiet ASHPs are likely to exceed the nighttime noise levels (even at a distance of 20 m or more).

4.4. Allowances for acoustic feature corrections

In addition to the calculation of the specific noise level (L_s), BS 4142 requires acoustic feature corrections to be considered.

Acoustic feature corrections are applied as follows:

Feature	Correction (dB)
Tonality	+2 if just perceptible, +4 if clearly perceptible and +6 if highly perceptible.
Impulsivity	+3 if just perceptible, +6 if clearly perceptible and +9 if highly perceptible.
Intermittency	+3 if intermittency is readily distinguishable agains the background noise.

It may be reasonable to assume that neither ASHPs or GSHPs require acoustic feature corrections, however these will need to be considered on a case-by-case basis.

5. Conclusion

We have assessed the proposed site to determine;

- the impact both noise in the area on the proposed residential development; and
- the impact of potential noise sources introduced by the development.

The results of our assessment show that;

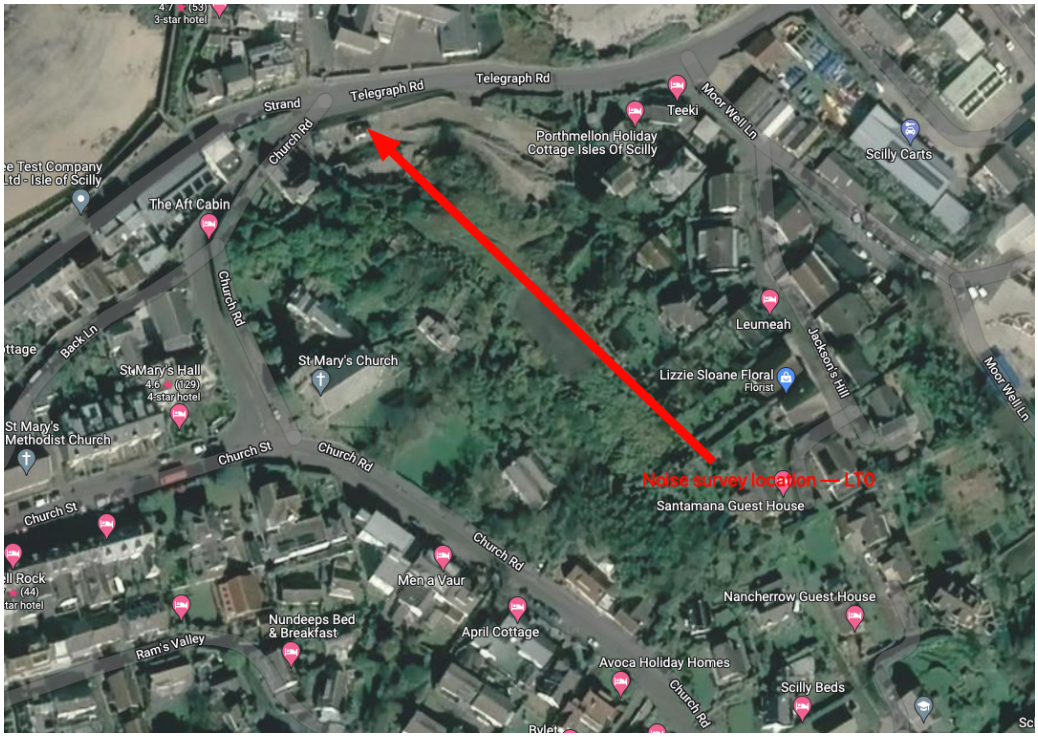
- the external noise levels on the noisiest north facades of are low to negligible risk;
- the introduction of air source heat pumps may prove challenging without introducing adverse impact to existing and propose noise sensitive locations; and
- ground source heat pumps may provide a suitable alternative from an acoustic perspective, but will need to be considered on a case-by-case basis.

Based on the results of the above, we see no reason to refuse planning permission on noise grounds due to existing noise. If permission is sought for air and ground source heat pumps, we recommend that the cumulative noise levels from both do not exceed the recommended rating noise levels details within this report.

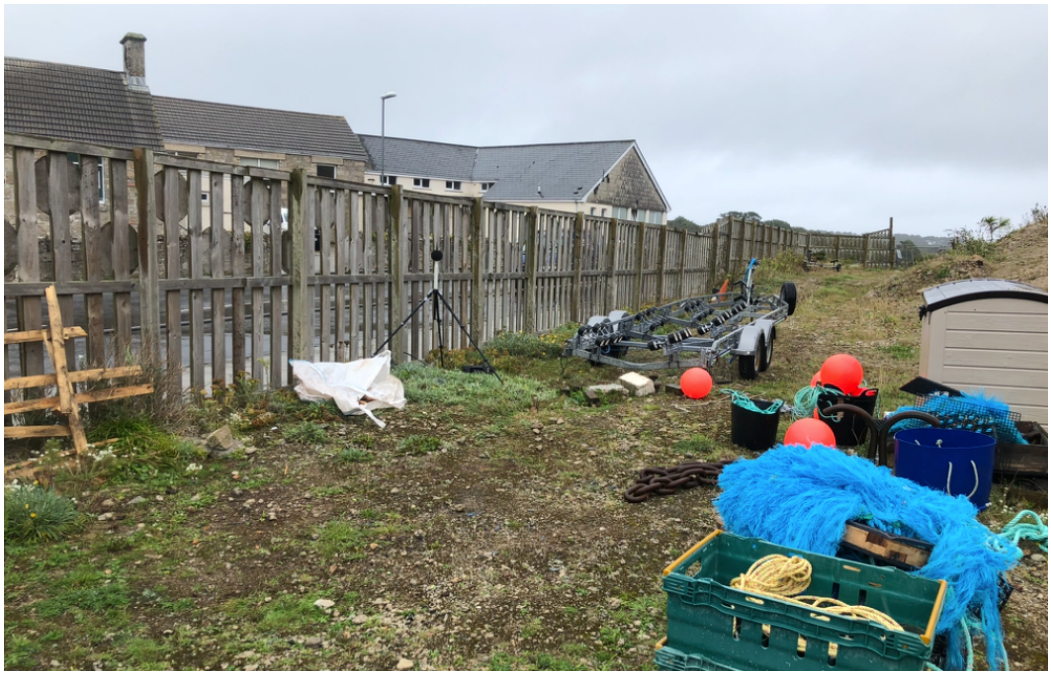
6. Appendix

6.1. Survey locations: Maps and photographs

Map showing the location of equipment:



Photograph of equipment on location:



6.2. Detailed survey results

	LA90 — 07:00 to 19:00	LA90 — 19:00 to 23:00	LA90 — 23:00 to 07:00	Day
2022-09-28	41	39	34	Wednesday
2022-09-29	38	34	25	Thursday
2022-09-30	-	41	22	Friday
2022-10-01	-	30	36	Saturday
2022-10-02	30	28	26	Sunday
2022-10-03	35	-	21	Monday

	LAeq — 07:00 to 19:00	LAeq — 19:00 to 23:00	LAeq — 23:00 to 07:00	Day
2022-09-28	51	51	36	Wednesday
2022-09-29	58	47	42	Thursday
2022-09-30	-	48	37	Friday
2022-10-01	-	44	42	Saturday
2022-10-02	53	46	39	Sunday
2022-10-03	55	-	36	Monday

Based on the above, we judge the typical noise levels to be:

Period	LAeq	LA90
07:00 to 19:00	54	35
19:00 to 23:00	47	30
23:00 to 07:00	38	26

6.3. Typical noise levels

The below table shows typical noise levels for reference:

Source	dBA SPL
Jet aircraft at a 50m distance	140
Threshold of pain	130
Threshold of discomfort	120
Chainsaw at a 1m distance	110
Disco, 1m from speaker	100
Diesel truck at a 10m distance	90
Kerbside of busy road at a 5m distance	80
Vacuum cleaner at a 1m distance	70
Conversational speech at a 1m distance	60
Average home	50
Quiet library	40
Quiet bedroom at night	30
Background in TV studio	20
Rustling leaves in the distance	10
Threshold of human hearing	0

6.4. Acoustic glossary

We have provided a list of common acoustic terminology below. We hope this helps the reader understand some of the more technical (and non-technical) terms. However, in the case of any confusion, please don't hesitate to get in touch and we will be happy to explain further.

- *Sound:* The audible transmission of vibrations through air or water.
- *Noise:* Unwanted sound. Sound that causes disturbance.
- *Ground-borne Vibration:* Vibration transmitted through the ground. Has the potential cause disturbance, even damage at sufficient levels. Typically measured as Vibration Dose Values (VDVs).
- *Re-radiated Noise (or 'Ground-borne Noise'):* Ground-borne vibration can cause walls, floors and ceilings to radiate noise. This is often referred to as ground-borne noise. Mechanical plant may also generate noise by similar means.
- *Cross-talk:* Sound transmission between rooms via ventilation ducting.
- *Decibel (dB):* The standard unit for defining sound pressure levels. The range of normal hearing is between 0 dB and 130 dB Where 130 dB is the upper threshold of pain. A change of 1dB in sound pressure levels is barely perceptible and 3dB is normally the minimum audible difference. A change of 5dB is clearly audible. A change of 10dB roughly corresponds to a halving or doubling of perceived loudness.
- *dBA (A-weighted decibel):* A-weighted decibels use a frequency weighting to correspond to how the human ear hears sound.
- *Hz (Hertz):* Hz is the unit of frequency, equal to one pressure fluctuation cycle per second. Frequency is related to the pitch of a sound.
- $L_{Aeq,t}$*:* The equivalent average sound pressure level over time *t* (A-weighted).
- L_{A90}*:* The average equivalent noise level this is exceeded for 90% of the time. This is usually referred to as the background noise level.
- L_s*:* The specific noise level. This is the average equivalent noise level of the source under consideration with the effect of all other noise sources removed.
- L_a*:* The ambient noise level. This is the average equivalent noise level of the source under consideration *including* the effect of all other noise sources.
- L_r*:* The residual noise level. This is the average equivalent noise level all other noise sources with the effect of the noise *source* removed.
- L_{ArTr}*:* The noise rating level including the effect of any noise penalties

- *Nighttime (BS 4142):* Period between 23:00 - 07:00
- *Daytime (BS 4142):* Period between 07:00 - 23:00

6.5. Equipment information: SVAN 971 (MOLES 1) (location LT0)

Name	***Component Type***	***Serial Number***	***Calibration due***
SVAN 971	Sound level meter	44496	16th March 2023
SV18	Pre-amplifier	48906	16th March 2023
7052E	Microphone	61097	16th March 2023
B&K	Calibrator	829693	16th March 2023

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