Gartcosh – Phase 2
Noise Impact Assessment

March 2021

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Noise Impact Assessment

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EXECUTIVE SUMMARY

Bellway Homes (West) Ltd commissioned EnviroCentre to conduct a Noise Impact Assessment relating to the proposed Phase 2 of a residential development site in Gartcosh. The proposed site is part of North Lanarkshire Council's Gartcosh Community Growth Area, as defined in the adopted Local Development Plan. The site is therefore considered within the Council's proposed targets to meet housing supply demand.

EnviroCentre have consulted with the local environmental health officer to confirm assessment methodology and criteria. A noise measurement and modelling exercise has been conducted to assess the impact of noise on future residents.

The assessment found that:

- Noise from the nearby Reigart Recycling Centre has a negligible effect on ambient levels and is unlikely to result in any adverse impact
- Road traffic noise levels are predicted to exceed the agreed criteria in worst case (downwind) conditions. Given the location of the primary noise source in relation to the site and the prevailing wind conditions, it is expected that for the majority of the year noise levels will meet the agreed criteria.
- Should North Lanarkshire Council require that noise levels meet the agreed criteria even in rare worst case conditions, a mitigation strategy has been recommended. This strategy finds that internal noise levels meet the agreed criteria during both the daytime and night time. External daytime noise levels exceed the councils stringent 50 dB $L_{Aeq,16h}$ criterion, but meet the WHO upper limit of 55 dB $L_{Aeq,16h}$, which suggests that the majority of the population are protected from serious annoyance.

Given the findings, in accordance with TAN, noise is unlikely to be a determining factor in the decision making process.

Contents

Appendices

Figures

Tables

1 INTRODUCTION

1.1 Scope of Report

EnviroCentre Ltd has been appointed by Bellway Homes to undertake a Noise Impact Assessment (NIA) to support a planning application for Phase 2 of a residential development in Gartcosh (see Drawing No 174059-007 for site location).

This report presents the results of the noise assessment exercise for the proposed development area. Noise monitoring was carried out on site in order to determine the noise levels at the most exposed parts of the proposed development

1.2 Site Location and Proposed Development

The proposed development is contained within the Gartcosh Community Growth Area. This community growth area is detailed in the adopted North Lanarkshire Council Local Development Plan. The site is therefore of strategic interest to the council, with the additional housing being allocated to meet the council's housing supply targets.

The proposed development comprises 107 residential units with associated landscaping and infrastructure. The development site is north of Finart Crescent in currently open fields. This development constitutes Phase 2 of Bellway's proposed development, with Finart Crescent having been constructed as part of Phase 1. It should be noted that Phase 2 is bounded to the west by Lochend Road, although no residential units are proposed in this area. To the east of the site is additional ongoing residential development. To the north of the site is Mount Ellen Golf Course and beyond that, the Reigart Drumcavel recycling centre. Further east are residential properties at Coyle Drive, and beyond that the M73.

Due to the proximity of the M73 east of the site and Lochend Road to the west, with additional consideration of the recycling centre to the north, there is potential for noise to impact residents of the proposed development.

1.3 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

EnviroCentre accept no liability for use of the report for purposes other than those for which it was originally provided, or where EnviroCentre have confirmed it is appropriate for the new context.

2 NOISE GUIDANCE AND DEFINITIONS

2.1 Noise Guidance

A brief description of noise assessment guidance specific to this assessment is provided in the sections below.

2.1.1 PAN 1/2011 Planning and Noise

Advice on the role of the planning system in helping to prevent and limit the adverse effects of noise is provided in Planning Advice Note (PAN) 1/2011 – Planning and Noise[1]. PAN 1/2011 promotes the principles of good acoustic design and a sensitive approach to the location of both noise sensitive and noise generating developments. PAN 1/2011 suggests the input of environmental health officers and professional acousticians from an early stage to avoid unreasonable effects on quality of life and ensuring that development continues to support sustainable economic growth. PAN 1/2011 promotes the application of reasonable criteria to assess noise impact but does not suggest specific target levels, allowing for consideration of contextual and non-acoustic factors. There is a preference for internal noise targets to be met with open windows, however, it is stated that were this is not practicable, closed windows with alternative forms of ventilation may be considered as suitable.

2.1.2 Technical Advice Note (TAN) – Assessment of Noise

The Technical Advice Note (TAN) – Assessment and Noise[2] provides guidance to accompany PAN 1/2011 on appropriate methodology to assess the impact of noise. The recommended assessment method includes an initial identification of noise sensitive receptors and their sensitivity, a quantitative assessment, a qualitative assessment, a determination on the level of significance and recommendations for the decision process, discussed below.

Stage 1: Initial Process

The development is categorised according to whether it has the potential to generate noise *i.e.* a Noise Generating Development (NGD) or be affected by the existing noise *i.e.* a Noise Sensitive Development (NSD).

All Noise Sensitive Receptors (NSRs) that have the potential to be impacted by the proposed development are identified and prioritised according to their level of sensitivity. The NSR could include the proposed development itself if it has been categorised as a NSD.

The proposed development solely comprises residential buildings, which are considered to be high sensitivity NSRs.

Stage 2: Quantitative Assessment

The quantitative assessment method depends on the type of development proposed *i.e.* Noise Sensitive Development (NSD) or Noise Generating Development (NGD). For an NSD like Gartcosh a quantitative assessment should be based on comparing an absolute noise level with an appropriate noise target. The magnitude of the impact is then defined by assessing the magnitude that the

[1] The Scottish Government (2011), *PAN 1/2011 Planning and Noise*.
[2] The Scottish Government (2011), *TAN 1/2011 Technical Advice Note*.

predicted noise level exceeds the assessment criteria for either day or night time periods. The magnitude of impact is quantified from No Change to Major. It should be noted that a negligible adverse impact and a major adverse impact are synonymous with a Lowest Observed Adverse Effect Level (LOAEL) and a Significant Observed Adverse Effect Level (SOAEL) respectively, as used in the Noise Policy Statement for England. Discussion on the derivation of an appropriate range to represent magnitude of impact is provided in Section 3.2.

Stage 3: Qualitative Assessment

The qualitative assessment allows the magnitude of the impact established in Stage 2 to be adjusted accordingly to take into account additional factors. It is based on perception and how noticeable the noise impact is in affecting the amenity value of the NSR. As noise becomes more noticeable, the level of disruption increases leading to significant changes in behaviour with a subsequent loss in the amenities associated with the NSR. For an NSD, the assessment will be based on the effect the existing noise climate may have on the amenity value of the proposed property.

Stage 4: Level of Significance

The level of significance of the noise impact at the NSR is obtained through the relationship of the receptor's sensitivity to noise and the magnitude of the noise impact. Table 2-1 provides a framework for determining the level of significance in relation to the magnitude of the impact and the sensitivity of the receptor.

Table 2-1: Significance of Effects

Magnitude of Impact	Level of Significance for a High Sensitivity Receptor
Major	Large / Very Large
Moderate	Moderate / Large
Minor	Slight / Moderate
Negligible	Slight
No Change	Neutral

The definitions of the levels of significance are described as below;

- Neutral: No effect, not significant, noise need not be considered as a determining factor in the decision making process.
- Slight: These effects may be raised but are unlikely to be of importance in the decision making process.
- Moderate: These effects, if adverse, while important, are not likely to be key decision making issues.
- Large: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance.
- Very large: These effects represent key factors in the decision making process. They are generally, but not exclusively associated with impacts where mitigation is not practical or would be ineffective.

Stage 5: The Decision Process.

Stages 2 to 4 are repeated for all identified NSRs and a Summary Table of Significance is completed which provides an overview of the level of significance of the noise impact on all NSRs..

Additionally, TAN states that industrial rating noise with an excess of less than 5 dB over background results in a low likelihood for complaint, in line with the recommendations of BS 4142, as outlined in Section 2.1.4. Further, TAN states that the impact of industrial noise does not become sufficiently significant to warrant mitigation at exceedances of less than 10 dB.

2.1.3 BS 8233: 2014 Guidance on Sound Insulation and Noise Reduction for Buildings

BS 8233:2014[3] provides guidance on the control of noise from outside buildings, noise from plant and services within buildings and room acoustics for non-critical situations. It provides suggested internal noise levels which should not give rise to sleep disturbance during night time periods or living room disturbance during daytime periods, as detailed in Table 2-2.

Table 2-2: Indoor Ambient Noise Levels for Dwellings

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

If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the facade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilator should be open) during assessment. 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.

2.1.4 BS 4142:2014+A1:2019, Methods for Rating and Assessing Industrial and Commercial Sound

BS 4142:2014+A1:2019 provides methods for rating and assessing sound of an industrial and/or commercial nature. The methods described use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

The standard is applicable to the determination of the following levels at outdoor locations:

a) Rating levels for sources of sound of an industrial and/or commercial nature;
b) Ambient, background and residual sound levels;
c) Investigating complaints;
d) Assessing sound from proposed, new, modified or additional source(s) of sound of an industrial and /or commercial nature; and
e) Assessing sound at proposed new dwellings or premises used for residential purposes.

The measured specific sound source is corrected for acoustic features (if present) of intermittency, impulsivity and tonality to give the rated noise level. The assessment considers the impact of the specific sound by subtracting the measured background sound level from the rating level, and considering the following;

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

[3] British Standards Institution (2014), *BS 8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings*.

b) A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
c) A difference of around +5dB(A) is likely to be an indication of an adverse impact, depending on the context.
d) 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.

BS 4142 states:

> *Where a noise-sensitive receptor is introduced and there is extant industrial and/or commercial sound, it ought to be recognized that the industrial and/or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation.*

Additionally, BS 4142 states that it is '*not intended to be applied to the assessment of indoor sound levels'* and should therefore not be used for façade design. While BS 4142 should be used to determine the likelihood of adverse impact, guidance on internal design criteria and mitigation is provided by BS 8233. This suggests that where a new noise sensitive receptor is introduced in proximity to a noise generating source and internal levels are of concern, the recommended criteria of BS 8233 should be followed to supplement the guidance of BS 4142.

2.1.5 Calculation of Road Traffic Noise

CRTN[4] is the standard UK procedure which defines measurement and calculation methods for assessing road traffic noise.

The standard contains a shortened measurement procedure by which daytime $L_{A10,18h}$ noise level can be calculated from the arithmetic average of three consecutive hourly $L_{A10,1h}$ measurements.

2.1.6 World Health Organization Guidelines for Community Noise

In *Guidelines for Community Noise*[5], 55 dB $L_{Aeq,16h}$ was indicated as a criteria threshold below which few people are seriously annoyed for an outdoor living area, during daytime and evening hours. In addition the guidance identifies that negative sleep impacts are avoided at 30 dB $L_{Aeq,8h}$ for continuous noise sources.

2.1.7 REHIS Briefing Note 017 – Noise Guidance for New Developments

The REHIS Briefing Note 017[6] was published by The Royal Environmental Health Institute Scotland to provide noise guidance for new developments. The purpose of the document is to recommend harmonised assessment methodologies and assessment criteria for local authorities.

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[4] The Department for Transport (1988), *The Calculation of Road Traffic Noise*.
[5] World Health Organization (1999), *Guidelines for Community Noise*.
[6] The Royal Environmental Health Institute of Scotland (2014), *REHIS Briefing Note 017 – Noise Guidance for New Developments*.

The Briefing Note recommends fixed noise limits in contradiction to the contextual approach adopted by PAN 1/2011. Alongside the fixed limits, 50 dB $L_{Aeq,16h}$ externally during the daytime and 30 dB $L_{Aeq,8h}$ internally at night time, the Briefing Note recommends a 5 dB range of magnitude from no adverse impact to major adverse impact, suggesting that 55 dB $L_{Aeq,16h}$ externally in the daytime and 35 dB internally at night time represent major adverse impact.

The Briefing Note also recommends that internal noise limits are met assuming windows are open for ventilation, recommending a 10 dB attenuation through partially open window, except in exceptional circumstances. These exceptional circumstances, which derive from the superseded PAN 56, not included in the adopted PAN 1/2011, are defined as promoting sustainable development and providing benefits such as:

a) Reducing urban sprawl
b) Reducing uptake of greenfield sites
c) Promoting higher levels of density near transport hubs, town and local centres
d) Meeting specific needs identified in the local development plan

Concerns have been raised that the recommendations of the REHIS Briefing Note are not in line with those of PAN 1/2011. Of particular concern are the discrepancies between the acceptability of meeting internal noise limits with closed windows and the use of reasonable target criteria informed by current best practice.

Subsequently, the use of the Briefing Note to inform decisions has been successfully challenged at numerous appeals. In light of these developments, REHIS has stated explicitly on the most recent publication of the guidance that it should not be used to inform decisions. The addendum text states:

> *"This Briefing Note, BN017 Noise Guidance for New Developments, contains very useful guidance for both Environmental Health Professionals and developers in relation to the planning process and developments where noise is a concern. It should be noted that the Briefing Note is currently subject to review and until that review is complete it is recommended it is not used as a basis for specific Policy on Planning and Noise Controls. The contents continue to be very relevant but require to be reviewed to reflect the most up to date guidance on specific noise levels in different situations."*

2.1.8 North Lanarkshire Council Noise Guidance for New Developments

North Lanarkshire Council has adopted the key recommendations of the REHIS Briefing Note 017 as Noise Guidance for New Developments. The guidance was adopted without consultation, and as such at three separate appeals the reporters have individually stated that less weight should be placed on the guidance. In 2020 following REHIS's redaction note to The Briefing Note, the NLC NGND was slightly amended and updated online. In late 2020 or early 2021 NLC removed the NGND and any reference to it from their website. It is unclear what the status of the guidance is. In any case, given the findings of the recent appeal decisions, greater weight will be applied to complying with PAN 1/2011 and associated TAN.

2.1.9 IEMA Guidelines for Environmental Noise Impact Assessment

The IEMA Guidelines for Environmental Noise Impact Assessment[7] provide advice on good practice in carrying out NIAs. The guidelines present good practice values relating to LOAEL and SOAEL thresholds for external noise levels associated with railway noise, as summarised in Table 2-3.

Table 2-3: LOAEL and SOAEL Values Recommended in IEMA Guidelines

Period	Time (hours)	LOAEL (dB)	SOAEL
Any Day	07:00 – 23:00	50 dB L_{Aeq}	65 dB L_{Aeq}
Any Night	23:00 – 07:00	40 dB L_{Aeq}	55 dB L_{Aeq}

2.1.10 NANR 316 – Possible Options for the Identification of SOAEL and LOAEL in Support of the NPSE

NANR 316[8] is a literature review commissioned by DEFRA to analyse scientific papers in support of the derivation of LOAEL and SOAEL values for use in the English planning system. As discussed in Section 2.1.2, LOAEL and SOAEL values are synonymous with Negligible and Major Adverse Impacts as recommended in TAN, and is therefore of relevance to the Scottish planning system. The recommended LOAEL and SOAEL values associated with railway noise are summarised in Table 2-4.

Table 2-4: Road Traffic Noise LOAEL and SOAEL Values Recommended in NANR316

Value	Daytime	Night Time
Recommended LOAEL (dB)	56 $L_{Aeq,16h}$	46 $L_{Aeq,8h}$
Range of LOAEL values identified in literature review (dB)	53 – 59 $L_{Aeq,16h}$	51 – 64 $L_{Aeq,8h}$
Recommended SOAEL value (dB)	66 $L_{Aeq,16h}$	56 $L_{Aeq,8h}$
Range of SOAEL values identified in literature review (dB)	64 – 68 $L_{Aeq,16h}$	51 – 64 $L_{Aeq,8h}$

2.2 Noise Definitions

The following definitions relating to noise are used in this report:

Free-field: Sound can propagate from a source to a receiver through a direct path as well as reflected paths. The free-field represents a scenario where there are no contributions from reflections. In environmental assessments this largely refers to the scenario where the contribution from reflections is negligible.

Façade Effect: When sound is reflected back towards its source, off a surface, such a wall, the reflected and incident sound waves sum. One metre from the façade of a building this typically results in an increase in level, compared to that of the free-field, by approximately 3 dB, referred to as the façade effect.

$L_{A10,T}$: The noise level exceeded for 10% of the measurement period, T.

[7] Institute of Environmental Management and Assessment (2014), *Guidelines for Environmental Noise Impact Assessment*, Version 1.2.
[8] DEFRA (2014), *NANR316 – Possible Options for the Identification of SOAEL and LOAEL in Support of the NPSE*.

$L_{Aeq,T}$: Equivalent continuous A-weighted sound pressure level. This is the single number that represents the average sound energy over a given time period, T. It is the sound level of a notionally steady sound that has the same energy as a sound that fluctuates over the specified measurement period.

L_{Amax}: The maximum A-weighted sound pressure level over the specified period.

Octave Band: Sound pressure level is often measured in octave bands, the centre frequencies of the bands are defined by ISO – 31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz, 16kHz to divide the audio spectrum into 10 equal parts. The sound pressure level of sound that has been passed through an octave band pass filter is termed the octave band sound pressure level.

Weighting: Human hearing is most sensitive to frequencies between about 500Hz and 6kHz and less sensitive to frequencies above and below these. In order to measure noise levels representative of human hearing a filter is applied termed a Frequency Weighting which is a prescribed frequency filter provided in a sound level meter. An A-weighted sound pressure level in decibels (denoted as dB(A)) is designed to reflect the sharpness of the human ear, which does not respond equally to all frequencies

3 NIA METHODOLOGY, CONSULTATION & DERIVATION OF APPROPRIATE CRITERIA

This section provides background on the consultation with the environmental health officer and the derivation of appropriate target criteria.

3.1 Consultation

Initial consultation with North Lanarkshire Council's Environmental Health Department was conducted in February 2021. The following methodology was agreed:

- Measurement of road traffic noise on Lochend Road in accordance with shortened procedure of CRTN.
- Unattended measurements at eastern boundary of the site to comment on road traffic noise from M73 and from the nearby Reigart recycling premises.
- Model road traffic noise in accordance with CRTN using CadnaA to predict internal and external levels.
    - Validation conducted comparing 2019 baseline traffic (pre-Covid lockdown). Model to also be validated against data for M73 collected by EnviroCentre in 2017.
    - Assessment using year of completion traffic flows
- Assess the impact of road traffic noise against the following targets:
    - 50 – 55 dB $L_{Aeq,16h}$ externally in gardens during the daytime.
    - 30 dB $L_{Aeq,8h}$ internally with both windows open and windows closed.
- Provide mitigation measures if necessary.

EnviroCentre recommended assessing the magnitude of impact against the scales recommended in TAN. The NLC EHO referred to the NLC NGND stating that a preference for a differing magnitude of impact scale. This is discussed in Section 3.2.

The NLC EHO also stated that a 13 dB reduction should be assumed for open windows, along with a preferred target of 50 dB $L_{Aeq,16h}$ externally during the daytime and an internal daytime target of 35 dB $L_{Aeq,16h}$. Further, the EHO requested the collection of data which confirmed that noise from the recycling centre does not contribute greatly to the overall noise environment, noting that nearby construction activities were active.

3.2 Considerations Regarding Magnitude of Impact

PAN 1/2011 states that noise impact criteria must be applied reasonably. The accompanying TAN defines the impact associated with major, moderate, minor and negligible adverse impact. In particular, the definition of major adverse impact is the same definition endorsed by DEFRA for a significant observed adverse effect level[8]. As described in Section 2.1, the onset of significant observed adverse effect, or major adverse impact, is commonly quoted in the literature as being in the region of 65 dB $L_{Aeq,16h}$. Further, WHO state that at levels below 55 dB(A) the majority of the population are protected from becoming seriously annoyed and literature states that the lowest observed adverse effect level is in the region of 50 – 56 dB $L_{Aeq,16h}$.

In accordance with TAN, a major adverse impact would equate to a Large / Very Large level of significance, which is sufficient to recommend that the application is rejected on noise grounds alone. Based on the NLC NGND, levels or 55 dB $L_{Aeq,16h}$ and marginally above would constitute a major

adverse impact. However the literature presented suggests that this threshold would actually be met at approximately 65 dB $L_{Aeq,16h}$, and that levels of approximately 55 dB $L_{Aeq,16h}$ constitute a negligible or slight adverse impact, i.e. only slightly above the lowest observed adverse effect level.

Given the above, the recommended magnitude of impact scales have not been not adopted for this assessment, as they are not justified and are excessively onerous. The magnitude of impact scales relating to the widely recognised significant observed adverse effect level presented in the literature are instead used to inform the magnitude of impact scale. Relating to the daytime, the threshold for significant observed adverse effect level is reported in NANR316 and the IEMA guidelines to be approximately 65 dB $L_{Aeq,16h}$. Given an agreed criterion of 50 dB $L_{Aeq,16h}$, this results in a scale for magnitude of impact over 15 dB. While this scale appears more lenient than that recommended in TAN, it is slightly more onerous due to the fact that the scale in TAN assumes a criterion of 55 dB $L_{Aeq,16h}$ rather than the 50 dB $L_{Aeq,16h}$ criterion adopted here. Relating to night time, NANR316 recommends a range of 10 dB from LOAEL to SOAEL, and this scale is therefore adopted. It should be noted that this is more onerous than the scale recommended in TAN and by the IEMA guidelines. The adopted range of magnitude scales are shown in Table 3-1.

Table 3-1: Proposed Scales for Ranges of Magnitude

Magnitude of Impact	Daytime	Night Time
No Change	<0	<0
Negligible adverse impact	≥0 but <5	≥0 but <3
Minor adverse impact	≥5 but <10	≥3 but <5
Moderate adverse impact	≥10 but ≤15	≥5 but ≤10
Major adverse impact	>15	>10

4 NOISE MONITORING

Noise monitoring was split between measurements on the development site and measurements off-site of A752 Lochend Road. On the development site, a mix of attended and unattended measurements were carried out towards the eastern site boundary. The monitoring period began at 17:03 on the 25th of February and ended at 14:46 on the 26th February 2021, with the attended portion occurring between 09:00 and 11:00 on the morning of the 26th February. The purpose of this survey was to determine the noise levels at the most exposed portion of the site from the M73 and determine the influence of the recycling centre on the noise environment.

Noise measurements of A752 were carried out between 11:30 and 13:30 on 26th February 2021 according to the shortened measurement procedure in CRTN. These measurements were carried out in order to validate the traffic data provided by Tetra Tech which was used in the 3D noise model constructed in CadnaA. Details of the traffic data are provided in Section 6.1.

4.1 Noise Monitoring Locations

The surveys were conducted at two measurement locations, the details of which are provided in Table 4-1 and shown in Drawing No. 174059-008, Appendix A.

Table 4-1: Noise Monitoring Location

Location ID	Coordinates	Measurement Location Notes
01	270373 669005	Positioned at the north eastern extent of the site, at the location of the garden predicted to be exposed to greatest noise from both the M73 and the recycling centre.
02	269791 668807	Positioned 9.5m west from the nearside carriageway of A752 Lochend Road on the grass.

4.2 Measurement Details and Observations

Measurements at Location 01 were conducted with a Class 1 Norsonic Nor140 sound level meter (serial number 1403301), with measurements of A752 Lochend Road carried out using a Class 1 Norsonic Nor118 (serial number 31675). The sound level meters were calibrated before and after the respective measurement campaigns with a Norsonic NOR-1251 calibrator (serial number 30796), with less than 0.2 dB drift noted for each meter. Measurements were conducted 1.4 metres above ground.

The measurement durations, weather conditions and observations are detailed in Table 4-2.

Table 4-2: Noise Monitoring Conditions and Observations

ID	Start time	End Time	Attended/ Unattended	Duration (hh:mm)	Weather	Observations
01	25/02/21 17:03	26/02/21 14:46	Unattended	21:43	Installed following showers although dry throughout measurements. North-westerly wind at the start of measurements, moving towards south-westerly overnight, with speeds between 3 and 5 m/s a. Temperatures between approximately 4 and 7°C.	Road traffic noise dominated levels, with noise from the M73 most prominent. Some traffic noise was also heard from Drumcavel Road to the north and occasionally from cars accessing Bellway's Phase 1 site to the south. During the attended measurements on the morning of the 26th, operations at the recycling centre were observed to start and stop for periods of up to 30 minutes at a time. Recycling centre operations were audible when in progress but were not seen to raise ambient levels at the measurement position. Noise heard consisted of metallic scraping and clangs from movement and dumping of materials and a faint ringing believed to come from processing plant or similar. Some vehicle movements from the south associated with Bellway's ongoing Phase 1 operations were also heard but were not seen to affect ambient levels when present.
	26/02/21 09:00	26/02/21 11:00	Attended	02:00	Approximately 3 oktas cloud cover, clouds gathering and clearing over course of measurement. Wind approx. 3-5 m/s. 6^0 C	
02	26/02/21 11:31	26/02/21 14:31	Attended	03:00	Clear skies at start of measurement, with coverage up to 4 oktas gathering and clearing during measurement, Wind approx. 2-4 m/s 7^0 C	Road traffic noise from A752 dominated levels. Noise from a helicopter overhead was heard at 13:31 and again at 14:07 but did not influence measured road traffic levels. Ambient background levels consisted of occasional rustling of trees and bushes and distant bird calls

4.3 Measured Noise Levels

4.3.1 Location 02 – Lochend Road CRTN

Table 4-3 presents the hourly results of the three hour shortened measurement campaign in accordance with CRTN.

Table 4-3: Measured CRTN Values

Location ID	Measurement	Time	Period (hh:mm)	$L_{Aeq,1h}$ (dB)	$L_{A10,1h}$ (dB)
01	1	11:30	01:00	66.2	70.3
	2	12:33	01:00	67.1	70.9
	3	13:33	01:00	66.7	70.6

In accordance with CRTN, the $L_{A10,18h}$ is derived by subtracting 1 dB from the $L_{A10,3h}$ value. The $L_{Aeq,16h}$ value is then determined by subtracting 2 dB from the $L_{A10,18h}$ value in accordance with BS 8233:2014. The processed results are presented in Table 4-4.

Table 4-4: Derived $L_{Aeq,16h}$ Values

Location	$L_{A10,3h}$ (dB)	$L_{A10,18h}$ (dB)	$L_{Aeq,16h}$ (dB)
01	70.6	69.6	67.6

Note that this procedure assumes a relationship between L_{A10} and L_{Aeq} of 3 dB, however measured levels show a relationship of 4 dB. This suggests that the derived $L_{Aeq,16h}$ value is higher than would be measured over a full day period.

4.3.2 Location 01 Measurements

The hourly L_{Aeq} and L_{A10} values measured at Location 01 are presented in Figure 4-1.

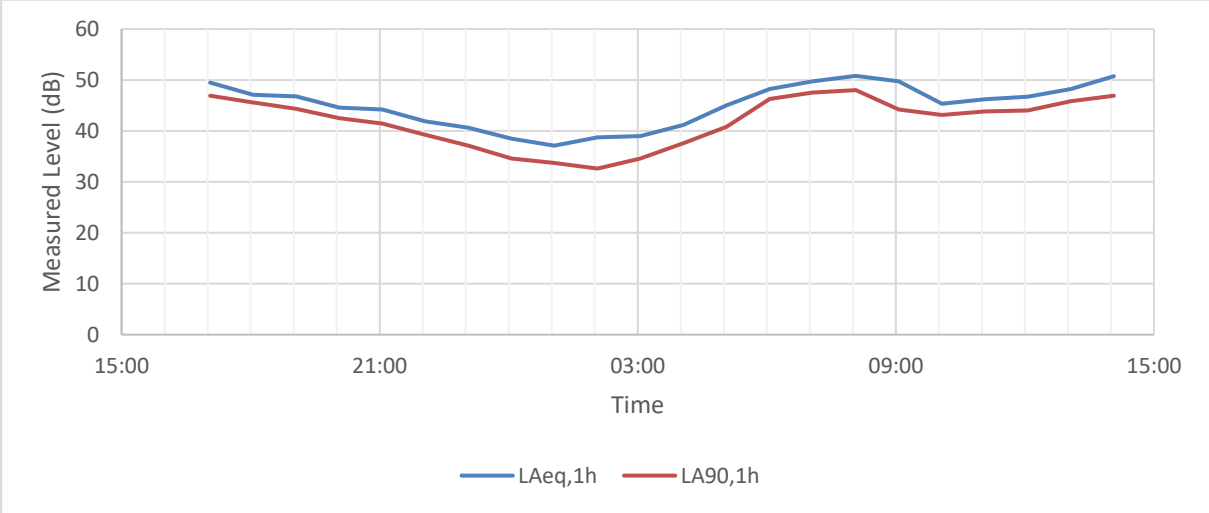


Figure 4-1: Measured $L_{Aeq,1h}$ and $L_{A90,1h}$ Values at Location 01

A period of the measurements on 26 February were attended to comment on the audibility of the recycling centre. On arrival the recycling centre was operational, but between 09:50 and 10:20 there were no noise generating activities. After 10:20 noise generating activities resumed. The measured values between these times are presented in Table 4-5. Also presented is the measured night time $L_{Aeq,8h}$ value.

Table 4-5: Results of Unattended / Attended Measurements

Start Time	End Time	Measured $L_{Aeq,T}$	Measured $L_{A90,T}$	Reigart Recycling Centre audible
23:00	07:00	42.7 dB $L_{Aeq,8h}$	37.1 dB $L_{A90,8h}$	No
09:50	10:20	45.9 dB $L_{Aeq,30min}$	43.5 dB $L_{A90,30min}$	No
10:20	11:00	44.9 dB $L_{Aeq,40min}$	43.1 dB $L_{A90,40min}$	Yes

4.4 Additional Historic Validation Measurements

Due to the ongoing Covid-19 related lockdown, and the subsequent impact on traffic flows, additional validation measurements sourced from other projects have been included for validation purposes. It should be noted that government published traffic data[9] suggests that car movements are at approximately 60% of normal flows, LGVs are approximately 80% of normal flows and HGVs are approximately normal. Overall, traffic flows are approximately two-thirds of normal flow, which suggests road traffic noise should be within 2 dB of normal conditions. As the shortened CRTN measurement was conducted outwith peak times in accordance with the guidance, it is expected that measured road traffic noise levels will only be marginally impacted.

The additional measurement positions are shown in Table 4-6, with Location 03 previously conducted by EnviroCentre, although for an unpublished report, and Location 04 sourced from a neighbouring development[10]. The additional validation measurement locations are shown in Drawing 174059-008, Appendix A.

Table 4-6: Additional Validation Measurements

Location	Coordinates	dB $L_{Aeq,16h}$
03	270460 668499	76.3
04	269754 668926	64.0

[9] DfT, https://www.gov.uk/government/statistics/transport-use-during-the-coronavirus-covid-19-pandemic, accessed 03/03/2021.
[10] Waterman (2018), *Land at Heathfield Farm, Drumcavel Road, Gartcosh, Muirhead, Glasgow G69 9EU – Assessment of Site Suitability for Residential Development – Noise & Vibration, November 2018*, 19/00274/PPP.

5 REIGART RECYCLING CENTRE NOISE

The Reigart Recycling Centre is operational between 07:00 and 20:00 on Mondays to Fridays, 07:30 - 17:00 on Saturdays and 10:00 – 14:00 on Sundays. As such all noise is considered to be during the daytime.

The subjective impression of noise from the recycling centre was that while audible, was not of sufficient magnitude of subjective quality to result in adverse impact. The EHO requested in consultation that measurements were conducted to show whether the recycling centre had any tangible effect on measured noise levels.

The results presented in Table 4-5 show that noise levels during operations at the recycling centre were 1 dB lower than during the period of no noise activities. Field notes acknowledged that a degree of construction noise was audible from the Phase 1 site, although levels were not noted to affect the measured $L_{Aeq,T}$ values due to their frequency and intermittency. The findings suggest that noise levels at the most exposed NSR are dominated by distant traffic noise. As a result, any noise from the recycling centre, while audible, has a negligible impact on measured noise levels. This finding satisfies the request of the EHO.

This finding is further clarified by an indicative BS 4142 assessment. As noise levels were measured to be slightly higher when the recycling centre was not generating audible noise, the noise from the recycling centre must be greater than 5 dB below the residual noise. This suggests that the specific level is less than 40.7 dB. Based on the observation of slightly impulsive noise, resulting in a 3 dB penalty, this suggests that in a worst-case and highly conservative assessment, the rating level must be no higher than 43.7 dB L_{Ar}. Given the background level presented in Table 4-5 of 43.5 dB $L_{A90,T}$, this suggests that an exceedance in accordance with BS 4142 is likely to be 0 dB or less. In accordance with TAN and BS 4142 this result strongly suggests a low likelihood of adverse impact from the recycling centre. Given this finding, no further assessment of recycling centre noise will be conducted.

6 NOISE MODEL INPUT PARAMETERS

6.1 Traffic Data

Traffic data has been provided by Tetra Tech. Data have been supplied for the years of 2019 and 2022. Data from 2019 have been used to validate the noise model. Data from 2022, which include development generated traffic and committed development, have been used for the assessment. The provided data are shown in Table 6-1.

Table 6-1: Provided Traffic Data

Road	Year	18 Hour AAWT (06:00 – 23:00)		8 Hour AAWT (23:00 – 07:00)	
		Count	%HGV	Count	%HGV
M73	2019	49,982	12.6	2,604	13.2
	2022	54,532	12.1	2,841	12.1
Lochend Road	2019	10,419	9.5	543	9.5
	2022	15,189	6.8	791	6.8
Johnston Road	2019	3,141	16.7	164	16.7
	2022	3,616	15.1	188	15.1

6.2 Noise Sensitive Receptors

The proposed masterplan, shown in Drawing 174059-009, Appendix A, has been provided and included in the noise model.

External daytime noise levels have been calculated at 1.5m height in each garden. Internal daytime levels are calculated at the most exposed façade at 1.5m height. Internal night time noise levels are calculated at the most exposed façade at 4m height, representative of first floor bedrooms. The receptor positions are shown in Drawing 174059-011, Appendix A. As requested by the EHO, internal levels with partially open windows have been calculated assuming a 13 dB reduction from free-field levels.

6.3 Noise Model Assumptions

A number of assumptions and input parameters have been used during the CadnaA modelling exercise, as detailed below:

- The models use existing ground heights for the development site, as procured from open source LiDAR data;
- Ground absorption has been assumed to be 0.75 for soft ground, 0 for hard ground and 0.5 representing mixed soft and hard surfaces;
- Reflections have been calculated in accordance with CRTN;
- A façade effect of +2.5dB(A) has been applied to all proposed noise sensitive receptors in accordance with CRTN.

6.4 Model Validation

The model has been validated against measured data. Modelling for validation purposes has been conducted assuming no development to the site A comparison between measured and modelled levels is presented in Table 6-2. The predicted noise levels are within approximately 2 dB of measured levels, showing good correlation.

Table 6-2: Validation of Road Traffic Noise Model

Location	Measured Level (dB)	Modelled Level (dB)	Difference (dB)
01	67.6 $L_{Aeq,16h}$	65.4 $L_{Aeq,16h}$	-2.2
02	42.7 $L_{Aeq,8h}$	41.6 $L_{Aeq,8h}$	-1.1
03	76.3 $L_{Aeq,16h}$	75.7 $L_{Aeq,16h}$	-0.6
04	64.0 $L_{Aeq,16h}$	64.7 $L_{Aeq,16h}$	+0.7

7 BASELINE NOISE MODEL RESULTS

This section presents the unmitigated external daytime and internal day and night time noise levels.

7.1 Baseline External Daytime Noise Levels

The noise model has been run to calculate external noise levels for all NSRs. The results have been tabulated to show the magnitude of impact and level of significance in Table 7-1.

Table 7-1: Predicted Distribution of Baseline External Noise Levels

Range of Noise Levels (dB $L_{Aeq,16h}$)	Magnitude of Impact	Level of Significance	Number of Properties
<50	No Adverse Impact	Neutral	83
50 – 55	Negligible Adverse Impact	Slight	18
55 – 60	Minor Adverse Impact	Slight / Moderate	6
60 – 65	Moderate Adverse Impact	Moderate / Large	0
>65	Major Adverse Impact	Large / Very Large	0

The maximum external level is predicted to be 56.2 dB $L_{Aeq,16h}$. It should be noted that this level would only occur during downwind propagation. Given that the prevailing wind direction means that the proposed development will typically be upwind of the M73, the dominant noise source, for the majority of time levels will typically be in the region of 5 – 10 dB lower than the model given the distance between the M73 and the proposed site. In any case, should the council require mitigation to attenuate levels in these worst case conditions, a proposed scheme is presented in Section 8.

In accordance with TAN, the predicted levels in the worst case and unlikely downwind conditions suggest a level of significance of up to Slight / Moderate, defined as such:

> "Moderate: These effects, if adverse, while important, are not likely to be key decision making issues.
>
> Slight: These effects may be raised but are unlikely to be of importance in the decision making process."

7.2 Baseline Internal Levels

Internal daytime noise levels have been predicted based on an open window scenario, with the results presented in Table 7-2.

Table 7-2: Predicted Distribution of Internal Daytime Levels

Range of Noise Levels (dB $L_{Aeq,8h}$)	Magnitude of Impact	Level of Significance	Number of Properties (windows open)
<35	No Adverse Impact	Neutral	64
35 – 40	Negligible Adverse Impact	Slight	34
40 – 45	Minor Adverse Impact	Slight / Moderate	9
45 – 50	Moderate Adverse Impact	Moderate / Large	0
>50	Major Adverse Impact	Large / Very Large	0

The highest internal daytime noise level assuming open windows is predicted to be 42.9 dB $L_{Aeq,16h}$. As above, this would only occur in conditions with an easterly wind, and it is expected for the majority of time noise levels will be 5 – 10 dB lower than the model, given the distance between the M73 and the proposed site. As above, mitigation will be explored should this be required.

Internal night time noise levels have been predicted based on an open window scenario, with the results presented in Table 7-3.

Table 7-3: Predicted Distribution of Internal Night Time Levels

Range of Noise Levels (dB $L_{Aeq,8h}$)	Magnitude of Impact	Level of Significance	Number of Properties (windows open)
<30	No Adverse Impact	Neutral	101
30 – 33	Negligible Adverse Impact	Slight	6
33 – 35	Minor Adverse Impact	Slight / Moderate	0
35 – 40	Moderate Adverse Impact	Moderate / Large	0
>40	Major Adverse Impact	Large / Very Large	0

The maximum internal night time noise level is predicted to be 30.9 dB $L_{Aeq,8h}$. Again, this would only occur during relatively rare downwind conditions. Additionally, BS 8233:2014 states that internal levels can be relaxed by 5 dB when development is considered necessary or desirable. As this development is within a community growth area within the adopted local development plan, the residential properties are therefore considered necessary and desirable, and therefore internal levels of 31.4 dB $L_{Aeq,8h}$ with open windows should be satisfactory. A mitigation plan is explored if this is considered necessary.

In accordance with TAN, the predicted internal levels in the worst case and unlikely downwind conditions suggest a level of significance of up to Slight / Moderate, defined as such:

> "Moderate: These effects, if adverse, while important, are not likely to be key decision making issues.
>
> Slight: These effects may be raised but are unlikely to be of importance in the decision making process."

8 PROPOSED MITIGATION AND MITIGATED RESULTS

The following section details the predicted mitigation necessary to meet noise criteria should this be considered necessary and predicted levels with recommended mitigation in place.

Table 8-1 summarises the process of designing mitigation in accordance with the principles of good acoustic design, as recommended in PAN 1/2011. The table provides an explanation of whether it is possible to implement each aspect of good acoustic design, and if so how it has been or is proposed to be implemented.

Table 8-1: Practicable Good Acoustic Design Mitigation Options

Good Acoustic Design Principle	In Relation to Site	Recommended?
Reduce / relocate existing sources	The noise sources are outside of the control of the proposed development, and therefore cannot be controlled. It should be noted that with increased proportion of electric vehicles in the future, noise from Lochend Road is likely to reduce.	Not possible
Increase distance to source	The residential units are located within the red line boundary as far from Lochend Road as possible, and approximately half way between the western noise source, the M73, and the eastern source, Lochend Road. The layout includes the SuDS pool to the north of the site, closest to the recycling centre. Leaving this northern section of the site free from residential units therefore increase the distance to the source as far as practicable.	Yes, already considered in site design as far as practicable.
Use topography / existing features to screen noise	The M73 is largely located in a cutting, which reduces the noise level from the motorway to the site. The site gently slopes down towards the recycling centre, and therefore topography cannot be used to further reduce levels from this site.	Not possible
Less sensitive elements of development screen more sensitive elements	The site comprises residential housing, and therefore there are no less sensitive buildings which could be used to screen noise levels.	Not possible
Use of layout to reduce propagation throughout the site	The layout has been designed with an eastern row of housing that mitigates levels for the remainder of the development. While it is acknowledged that this row of houses will be subject to slightly higher levels than those behind, the design of the development with a continuous front row aids the mitigation of noise levels for properties located behind. Given the distance from the M73 in particular, without significantly increasing the distance and moving the development closer to Lochend Road, it is inevitable that the eastern row of houses will be subject to higher noise levels.	Yes, already considered in site design.

Good Acoustic Design Principle	In Relation to Site	Recommended?
Use of housing orientation to reduce exposure of noise sensitive rooms	The development solely comprises houses. Excluding the placement of bathrooms and kitchens, the developer has limited ability to dictate the placement of noise sensitive rooms. Additionally, given the magnitude of exceedances and the fact that the site is within a community growth area designated to meet NLC's housing land supply, this form of mitigation is considered to be excessive given its impact on placemaking and quality of development.	Not practicable
Acoustic barriers	Should NLC require that noise levels meet the proposed criteria in downwind conditions, even though these conditions are rare, acoustic barriers in the form of enhanced garden fences are recommended to mitigate external noise levels where practicable.	Recommended if deemed necessary
Building envelope	The building envelope can and will be used to mitigate internal noise levels.	Recommended

It is clear from Table 8-1 that good acoustic design principles have been incorporated into the site design as far as practicable, in terms of the use of existing topography and site layout. The only remaining mitigation options available to further reduce noise levels are acoustic barriers and building envelope design.

8.1 Proposed Mitigation

As discussed in Section 7, as is standard practice the results present the worst case noise levels for down wind propagation. Given the distances involved and the fact that prevailing wind direction means that typically the development would be upwind of the M73, it is expected that typical noise levels will be 5 – 10 dB below those presented. However, should the council require some mitigation to attenuate levels even in the worst case conditions, a strategy is presented herein.

A mitigation plan has been developed in the form of enhanced garden barriers, as shown in Drawing 174059-012, Appendix A. It should be noted that due to the distance of the M73 from the proposed development, mitigation is not as effective as it would be for a closer noise source, hence the heights required to attenuate levels by 2 – 3 dB. It should also be noted that barriers at this location, as close to the receiver as feasible, only result in a maximum reduction at the ground floor façade of 0.7 dB. This suggests that it is not practical to design feasible mitigation which would sufficiently attenuate internal noise levels during the daytime to meet the 35 dB $L_{Aeq,16h}$ criterion. This effect is even more pronounced for night time levels at first floor height, where any barrier would need to be significantly tall just to achieve the necessary 1.4 dB reduction. Given all other mitigation options have been explored as part of the good acoustic design process, a closed window approach is considered necessary. Note that windows should not be sealed and should remain openable at the discretion of the occupants. Further, this should be acceptable as it is in line with the recommendations of PAN 1/2011, particularly given that the site is allocated within the NLC Local Development Plan as a Community Growth Area, and is therefore necessary for the council to meet their housing supply targets.

Note that to meet the internal noise targets, a closed window would need to achieve a reduction of 21 dB. In accordance with Annex G.1 of BS 8233:2014, this is far below the value that suggests a rigorous calculation method is necessary. Given the residential properties will be fitted with double

glazed windows, this level of sound reduction will be met comfortably, even with trickle ventilators open. Should the council require a rigorous break-in calculation to prove this, this can be provided.

The enhanced garden barriers must be constructed either of specialist acoustic design or of materials with a minimum surface density of 15 kg/m^2. The construction of the barrier should be homogeneous with no gaps through the structure and it should be installed flush with the ground. The barrier should be constructed to ensure its acoustic performance does not deteriorate with time and should therefore be resistant to rot and non-hygroscopic. The barriers may be constructed using a range of or combination of the following materials:

- Timber fencing with overlapping boards with a thickness of at approximately 30mm, depending on the wood;
- Stone;
- Brickwork;
- Concrete;
- Specialist metal construction with perforated outer sheet backed with acoustically absorbent material; or
- Earth bunding.

8.2 Mitigated Results

8.2.1 External Noise

The noise model has been run to calculate mitigated external noise levels for all NSRs. These have been tabulated to show the magnitude of impact and level of significance in Table 8-2.

Table 8-2: Predicted Distribution of Mitigated External Noise Levels

Range of Noise Levels (dB $L_{Aeq,16h}$)	Magnitude of Impact	Level of Significance	Number of Properties
<50	No Adverse Impact	Neutral	83
50 – 55	Negligible Adverse Impact	Slight	24
55 – 60	Minor Adverse Impact	Slight / Moderate	0
60 – 65	Moderate Adverse Impact	Moderate / Large	0
>65	Major Adverse Impact	Large / Very Large	0

It can be seen that all properties would meet the upper WHO criterion of 55 dB $L_{Aeq,16h}$ with the proposed mitigation. The highest predicted external level is 54.9 dB $L_{Aeq,16h}$. In line with WHO, this suggests external levels will protect the majority of the population from serious annoyance. In line with TAN, the magnitude of impact suggests a Slight level of significance, defined as:

> "*These effects may be raised but are unlikely to be of importance in the decision making process.*"

8.2.2 Internal Noise

Internal daytime noise levels have been calculated with windows closed assuming passive ventilation open. The distribution of predicted noise levels and corresponding magnitude of impact is shown in Table 8-3.

Table 8-3: Predicted Distribution of Mitigated Internal Daytime Levels

Range of Noise Levels (dB $L_{Aeq,8h}$)	Magnitude of Impact	Level of Significance	Number of Properties (windows open)	Number of Properties (windows closed)
<35	No Adverse Impact	No Change	64	107
35 – 40	Negligible Adverse Impact	Slight	34	0
40 – 45	Minor Adverse Impact	Slight / Moderate	9	0
45 – 50	Moderate Adverse Impact	Moderate / Large	0	0
>50	Major Adverse Impact	Large / Very Large	0	0

The maximum internal noise level with open windows is found to be 42.2 dB $L_{Aeq,16h}$. Note that this is only a reduction of 0.7 dB from the scenario without mitigation. Given mitigation cannot be located any closer than at the end of the garden, this suggests that an unreasonably high barrier would be necessary to provide sufficient attenuation to meet the internal target during the daytime. Given this finding, and that a closed window approach is acceptable in accordance with PAN 1/2011, the finding that all properties would meet the internal daytime criterion with closed windows should be sufficient. Note that the resultant level of significance is therefore Neutral, defined as:

> "*No effect, not significant, noise need not be considered as a determining factor in the decision making process.*"

Internal night time noise levels have been calculated with windows closed assuming passive ventilation open. The distribution of predicted noise levels and corresponding magnitude of impact is shown in Table 8-4.

Table 8-4: Predicted Distribution of Mitigated Internal Night Time Levels

Range of Noise Levels (dB $L_{Aeq,8h}$)	Magnitude of Impact	Level of Significance	Number of Properties (windows open)	Number of Properties (windows closed)
<30	No Adverse Impact	Neutral	101	107
30 – 33	Negligible Adverse Impact	Slight	6	0
33 – 35	Minor Adverse Impact	Slight / Moderate	0	0
35 – 40	Moderate Adverse Impact	Moderate / Large	0	0
>40	Major Adverse Impact	Large / Very Large	0	0

As with the daytime scenario, any barrier to mitigate internal night time noise levels would require to be significantly high. This would not be proportional to the exceedance of the night time criterion of 0.9 dB, which should be acceptable given that the site is within a community growth area within the adopted local development plan, therefore essential in meeting the council's housing supply target. Given the unlikelihood of this exceedance due to prevailing winds, and the fact that a closed window approach is acceptable, the internal night time noise levels therefore have a level of significance of Neutral, defined above.

9 CONCLUSIONS

Bellway Homes (West) Ltd commissioned EnviroCentre to conduct a NIA relating to the proposed Phase 2 of a residential site in Gartcosh. The proposed site is part of North Lanarkshire Council's Gartcosh Community Growth Area, as defined in the adopted Local Development Plan. The site is therefore considered within the council's proposed targets to meet housing supply demand.

EnviroCentre consulted with the local environmental health officer to confirm assessment methodology and criteria. The environmental health officer recommended a stringent scale for determining magnitude of impact. However, EnviroCentre have provided a literature review to show that this stringent scale is more onerous than government adopted findings. A magnitude of impact scale in line with that recommended in TAN, Scottish government produced guidance for adopted policy, is therefore used instead.

A noise monitoring exercise was conducted to determine the noise levels within the site and associated with local noise sources. The monitoring exercise found that noise levels associated with the Reigart Recycling Centre had a negligible impact on overall ambient noise levels, satisfying a requirement of the EHO. An indicative BS 4142:2014 assessment was conducted to further verify this finding, and it was shown that noise from the recycling centre is not likely to result in any adverse impact.

A noise propagation model was constructed in CadnaA using supplied traffic data. The noise model was validated against measured values as well as historic data from before any Covid-19 related lockdown. The validation exercise found good correlation, with modelled levels generally within 2 dB of those measured.

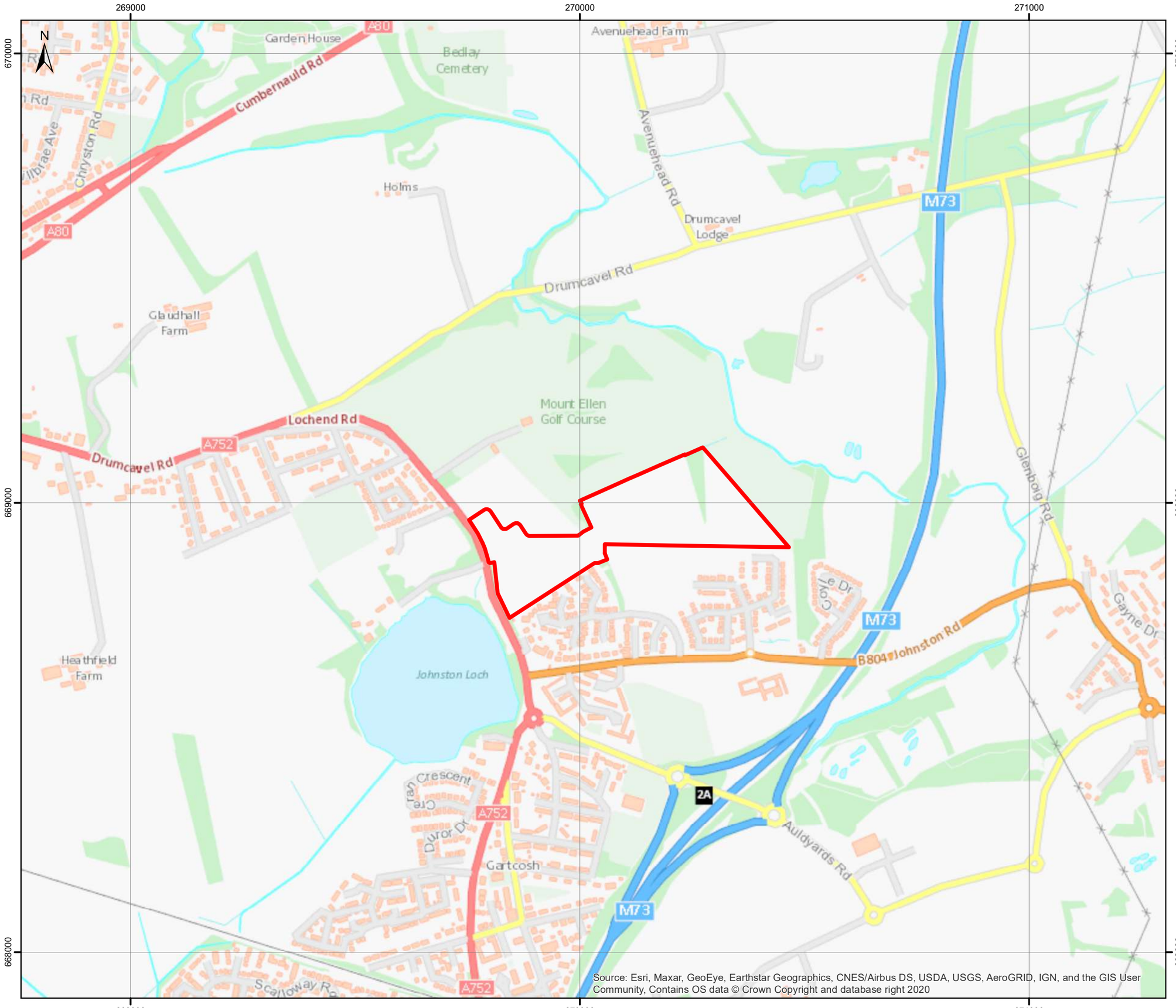
The findings of the noise modelling exercise showed that during worst case (downwind) conditions, the proposed criterion for external daytime noise levels as well as internal daytime and night time noise levels with open windows would not be met. However, the magnitudes of exceedances, when read in conjunction with the primary noise source and the prevailing wind conditions are likely to be rare, and it is expected that the agreed criteria would be met for the majority of the time.

Should the council require that mitigation is installed to attenuate levels such that the criteria are met even in rare worst-case conditions, a strategy has been recommended. Note that the principles of good acoustic design have been followed throughout. It was found that mitigating internal daytime and night time noise levels by an appropriate margin is not practicable, and that a closed window approach would be necessary. This approach is acceptable in accordance with PAN 1/2011, and should be read in conjunction with the predicted exceedances with open windows, particularly for night time, where the exceedance of the target is less than 1 dB.

Should the mitigation strategy be deemed necessary, predicted internal levels are found to meet the criteria in all circumstances. External levels exceed the proposed 50 dB $L_{Aeq,16h}$ criterion, but meet the WHO upper limit of 55 dB $L_{Aeq,16h}$, below which the majority of the population are protected from serious annoyance. In accordance with TAN, the maximum level of significance is therefore Slight, i.e. noise is unlikely to be a determining factor for this application.

APPENDICES

A DRAWINGS



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Legend

Site Boundary

Do not scale this map

Client
Bellway

Project
Gartcosh Community Growth Area

Title
Phase 2
Site Location

Status
FINAL

Drawing No.	Revision	Date
174059-007	-	2 March 2021
Drawn	**Checked**	**Approved**
AJL	CC	AJL

Scale
1:8,000 @A3

0 40 80 160 240 Metres

Rev	Date	Amendment	Initials
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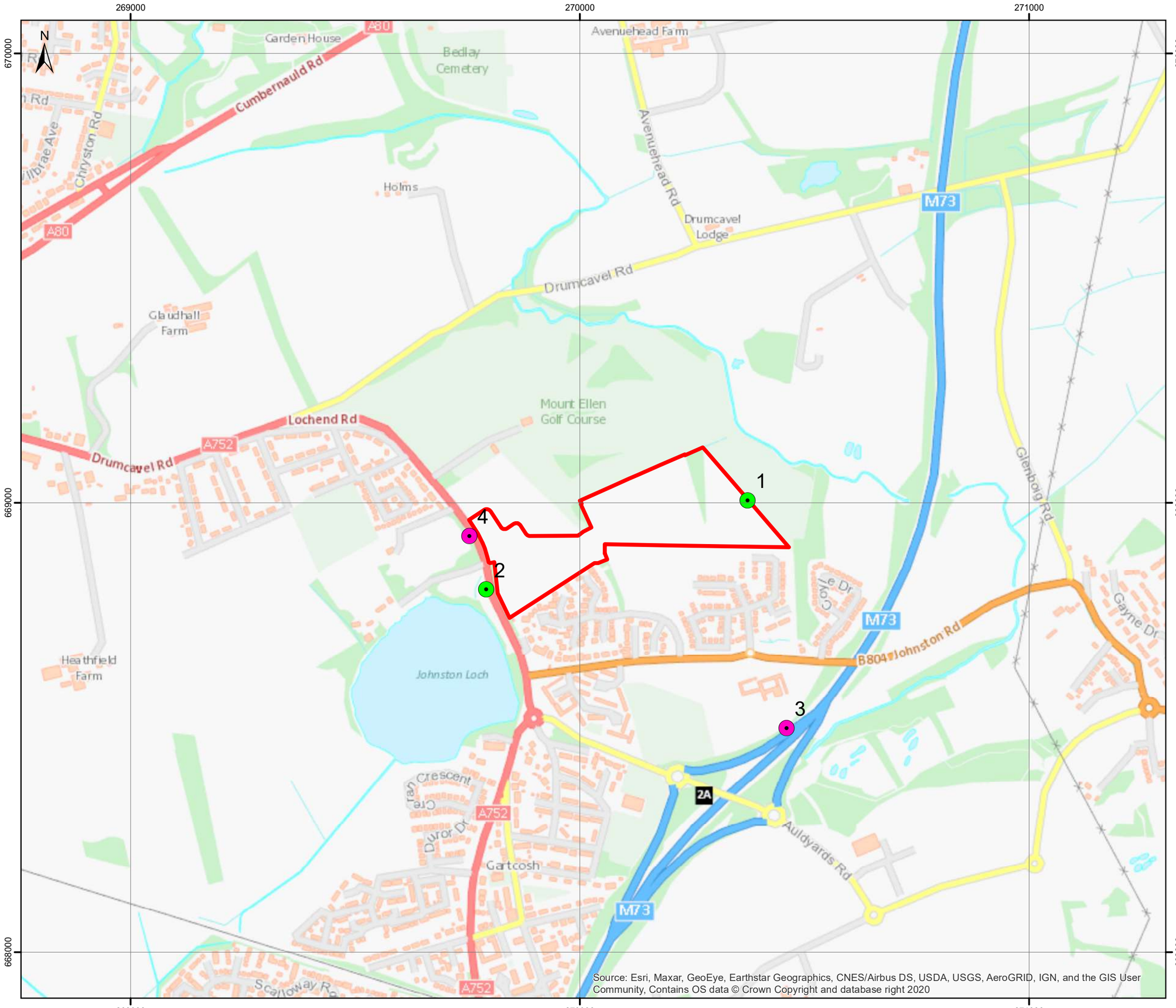

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Legend

- Site Boundary
- Noise Measurement Locations
- Additional Calibration Points

Do not scale this map

Client
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Project
Gartcosh Community Growth Area

Title
Phase 2
Noise Measurement and Validation Positions

Status
FINAL

Drawing No.	Revision	Date
174059-008	-	2 March 2021
Drawn	**Checked**	**Approved**
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Scale
1:8,000 @A3
0 40 80 160 240 Metres

Rev	Date	Amendment	Initials
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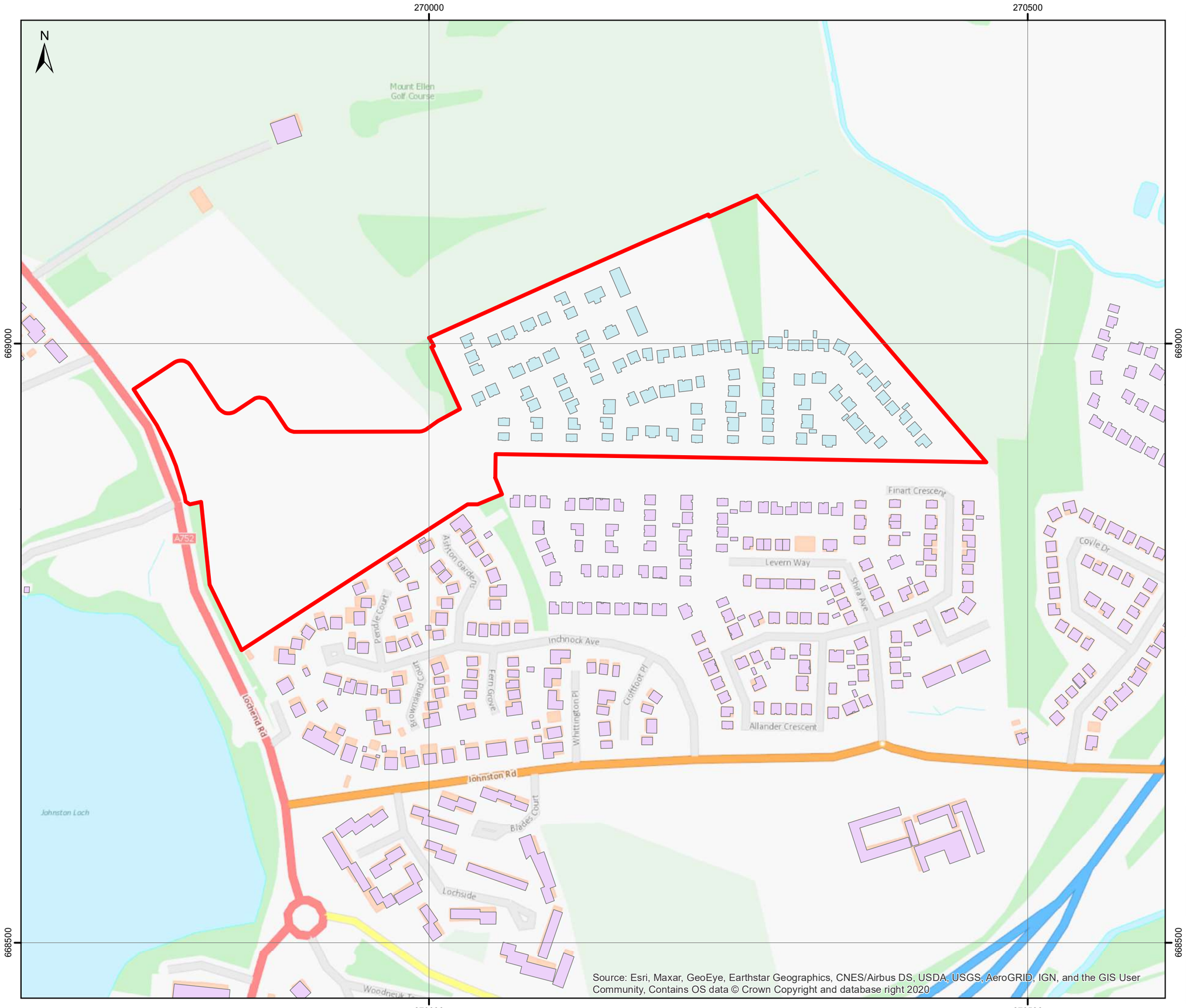

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Legend

- Site Boundary
- Proposed Development
- Existing Buildings

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Project
Gartcosh Community Growth Area

Title
Phase 2
Proposed Site Design

Status
FINAL

Drawing No.	Revision	Date
174059-009	-	2 March 2021
Drawn	**Checked**	**Approved**
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Scale
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Rev	Date	Amendment	Initials
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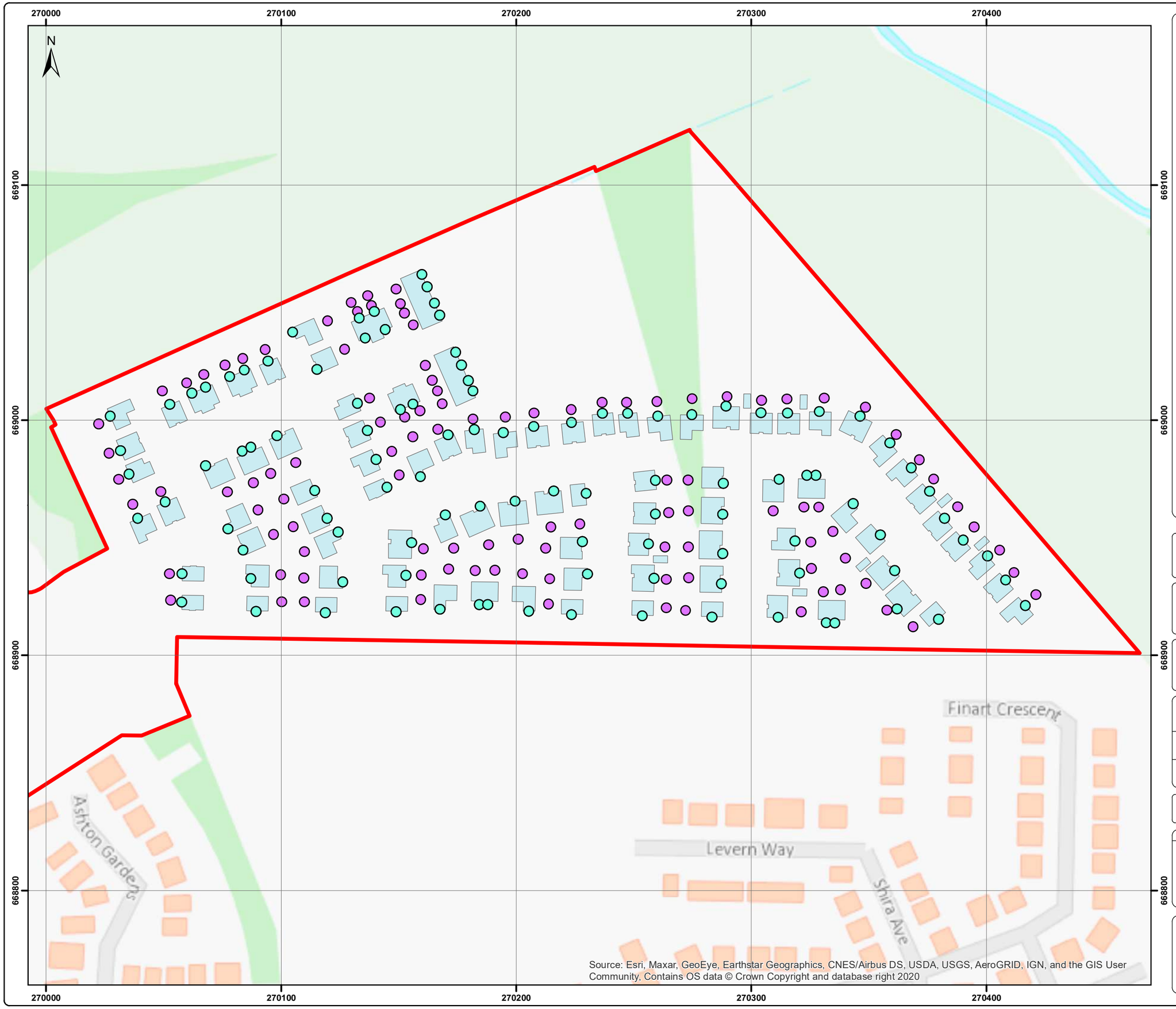

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Legend

- Site Boundary
- Facade NSRs
- External NSRs
- Proposed Development

Do not scale this map

Client
Bellway

Project
Gartcosh Community Growth Area

Title
Phase 2
Noise Sensitive Receptor Locations

Status
FINAL

Drawing No.	Revision	Date
174059-011	-	2 March 2021
Drawn	**Checked**	**Approved**
AJL	CC	AJL

Scale
1:1,500 @A3
0 5 10 20 30 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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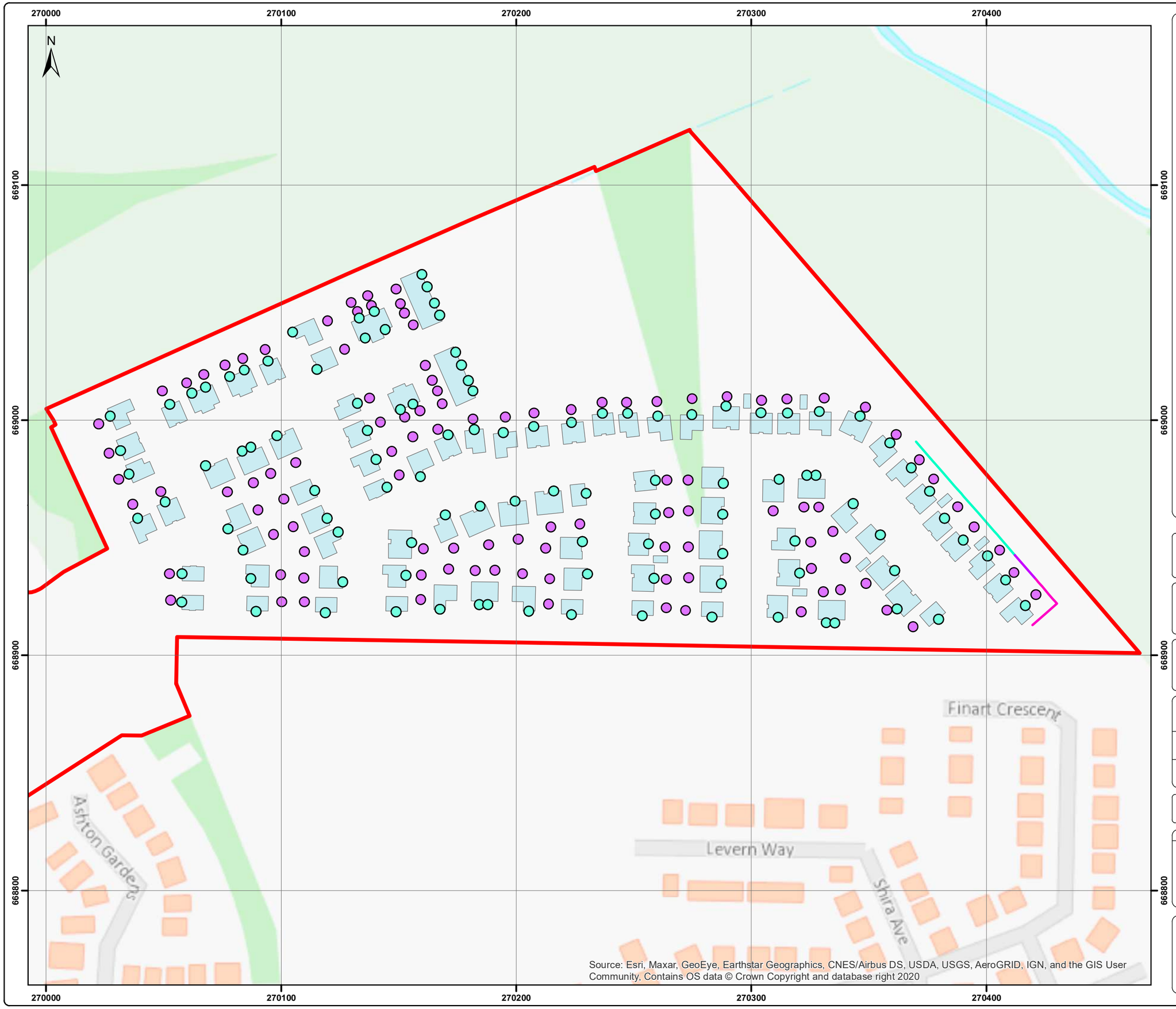

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Legend

- Site Boundary
- Facade NSRs
- External NSRs
- Proposed Development

Barriers (m)

- 2.1
- 2.2
- 2.4

Do not scale this map

Client
Bellway

Project
Gartcosh Community Growth Area

Title
Phase 2
Noise Mitigation

Status
FINAL

Drawing No.	Revision	Date
174059-012	-	2 March 2021
Drawn	**Checked**	**Approved**
AJL	CC	AJL

Scale
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0 5 10 20 30 Metres

Rev	Date	Amendment	Initials
-	-	-	-

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