Noise Consultants

Noise Assessment: Bowes Primary Area Quieter Neighbourhood, Enfield

June 2021






Experts in noise and vibration assessment and management

Document Control

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Contents

Tables

Figures

1 Introduction

1.1 This report describes the potential noise impacts associated with the Bowes Low Traffic Neighbourhood scheme in the London Borough of Enfield (LB Enfield), which is being implemented through the Quieter Neighbourhoods project. The assessment has been carried out by Noise Consultants Ltd (NCL) on behalf of Enfield London Borough Council (Enfield LBC). This noise assessment has been delivered in conjunction with an air quality assessment undertaken by NCL's sister company Air Quality Consultants Ltd.

1.2 The scheme was introduced in October 2020 and, in alignment with the Mayor's Transport Strategy 2018 (GLA, 2018), aims to reduce neighbourhood motor traffic within the recently delivered cycling and walking infrastructure in the area, where "*through motor vehicle traffic is discouraged or removed*".

1.3 The assessment has been carried out using traffic data provided by Enfield LBC, consisting of traffic flows measured over two seven-day periods in July and November 2020 (pre- and post-scheme implementation). This has been used to calculate the changes in traffic attributable to the scheme, and to estimate associated impacts on local noise levels. The traffic data were processed into the appropriate format for noise modelling through adjustments to represent an annual mean. Uncertainties associated with this process, as well as with other parameters that would have influenced measured traffic data (i.e., school holidays, the COVID-19 pandemic), have, to some extent, been taken into account within the assessment and conclusions, as discussed further in this report.

1.4 The assessment takes the approach of a comparison of ambient road traffic noise levels with and without the scheme in place. The report describes the modelling and assessment of daytime and night-time noise exposure levels for each scenario in terms of $L_{day,12hr}$, $L_{eve,4hr}$, $L_{night,8hr}$, and $L_{Aeq,16hr}$. These indicators allow consideration of perceptible changes in road traffic noise as a result of the scheme.

1.5 The predicted noise levels with and without the scheme in place, and associated impacts, are also described in **Appendix A2.15**.

1.6 This report has been prepared taking into account all relevant local and national guidance and regulations.

2 Relevant Policy and Guidance

National Noise Policy

Noise Policy Statement for England (NPSE, 2010)

2.1 The Noise Policy Statement for England (NPSE, 2010) sets out the Government's Noise Policy Vision to:

"Promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development".

2.2 This long-term vision is supported by three Noise Policy Aims that can be delivered through effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. These aims are to:

1. *avoid significant adverse impacts on health and quality of life;*
2. *mitigate and minimise adverse impacts on health and quality of life; and*
3. *where possible, contribute to the improvement of health and quality of life.*

2.3 The explanatory note to the NPSE sets out 'effect levels' which are aligned to the Policy Aims. Drawing upon established concepts from toxicology, the NPSE defines the following noise effect levels:

- NOEL - 'No Observed Effect Level';
- LOAEL - 'Lowest Observed Adverse Effect Level'; and
- SOAEL - 'Significant Observed Adverse Effect Level'.

2.4 The explanatory note describes SOAEL as the effect level above which significant adverse effects on health and quality of life occur, aligning this level with the first policy aim.

2.5 LOAEL is described as the level at which adverse effects begin and the second aim of the NPSE refers to a situation where the effect lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8 of the NPSE) however this does not mean that such adverse effects cannot occur.

2.6 NOEL is described as a level of noise exposure below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life.

2.7 The third aim seeks, where possible, to positively improve health and quality of life through the pro-active management of noise while also taking into account the guiding principles of sustainable development, recognising that there will be opportunities for such measures to be taken and that they will deliver potential benefits to society.

2.8 The protection of quiet places and quiet times as well as the enhancement of the acoustic environment will assist with delivering this aim.

2.9 NPSE states that it is not possible have a single, numerical definition of the SOAEL that is applicable to all sources of noise in all situations, since the SOAEL is likely to be different for different noise sources, for different receptors and at different times.

2.10 The setting of LOAELs and SOAELs for transportation sources has however reached a form of consensus following a number of high-profile infrastructure projects in England, namely HS2 and a series of Highways England road schemes which have been successful through the Government's Hybrid Bill and Development Consent Order (DCO) consenting processes.

2.11 In these projects, the setting of SOAEL has been aligned to Government policy and legislation in relation to the provision of noise insulation where it has been argued that significant adverse effects can be avoided through these means. **Table 1** provides a summary of the LOAEL and SOAEL values applied on these projects.

Table 1: LOAELs and SOAELs for Road and Railway Infrastructure Projects

Source / Project	Period	LOAEL	SOAEL
Road Traffic (Highway Agency A14 DCO)	Daytime	50 dB $L_{Aeq, 16hr}$	63 dB $L_{Aeq, 16hr}$
	Night-time	40 dB $L_{Aeq, 8hr}$	55 dB $L_{Aeq, 8hr}$
Rail (HS2)	Daytime	50 dB $L_{Aeq, 16hr}$	63 dB, $L_{Aeq\ 16hr}$
	Night-time	40 dB $L_{Aeq, 8hr}$ 60 dB L_{Amax}	55 dB $L_{Aeq, 8hr}$ 80/85 dB L_{Amax}

Planning Policy

National Planning Policy

National Planning Policy Framework (NPPF, 2019)

2.12 The National Planning Policy Framework (NPPF, 2019) sets out the Government's planning policies for England and how these should be applied. The NPPF provides a framework within which locally-prepared plans for housing and other development can be produced.

2.13 In relation to noise, it states:

"170. Planning policies and decisions should contribute to and enhance the natural local environment by: …

- *preventing new and existing development from contributing to, and being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability ….”*

2.14 The NPPF includes policy which makes reference to ‘significant adverse impacts on health and quality of life’, as per the NPSE. NPPF policy states:

180. Planning policies and decisions should aim to 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:

- *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;…”*

2.15 The NPPF makes reference to the NPSE in respect of achieving these aims.

2.16 Notably, NPPF has also recently introduced the ‘Agent of Change’ principle as follows:

182. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or ‘agent 60 See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010). 53 of change’) should be required to provide suitable mitigation before the development has been completed.

2.17 Whilst the development is in proximity to existing commercial uses, Section 182 is not considered applicable to the proposed development. The existing site comprises residential uses as well as there being significant amounts of residential use nearby. Therefore, potential noise constraints upon nearby business and community facilities will be unchanged.

Planning Practice Guidance – Noise (PPG-Noise, 2019)

2.18 The Planning Practice Guidance (PPG-Noise, 2019) provides further detail about how the effects of noise can be described in terms of perception and outcomes. It aligns this to increasing effect levels as defined in the NPSE. In addition, the PPG-Noise adds a fourth term and corresponding effect level:

- UAEL – ‘Unacceptable Adverse Effect Level'.

Table 2: Planning Practice Guidance – Noise Exposure Hierarchy

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived 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 heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a 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 a material change in behaviour and/or attitude, e.g. avoiding 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 difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Present and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

2.19 This effect level is higher than the significant adverse effect on health and quality of life (SOAEL) and requires that unacceptable adverse effects are to be prevented. In PPG-Noise, prevention is not in the context of Government policy on sustainable development. **Table 2** presents the noise exposure hierarchy described in PPG-Noise.

2.20 This noise exposure hierarchy is based on the principle that once noise or vibration becomes perceptible, the effect on people and other receptors increases as the level increases. PPG-Noise presents example outcomes to help characterise these effects using non-technical language. In general terms, an observed adverse effect is characterised as a perceived change in quality of life for occupants of a building or a perceived change in the acoustic character of an area, whereas a significant observed adverse effect disrupts activities.

2.21 PPG-Noise also provides guidance in terms of what factors may influence whether noise could become a concern, and how adverse effects of noise can be mitigated. Examples of mitigation provided include:

- *"engineering: reducing the noise generated at source and/or containing the noise generated;*
- *layout: where possible, optimising the distance between the source and noise-sensitive receptors and/or incorporating good design to minimise noise transmission through the use of screening by natural or purpose built barriers, or other buildings;*
- *using planning conditions/obligations to restrict activities allowed on the site at certain times and/or specifying permissible noise levels differentiating as appropriate between different times of day, such as evenings and late at night, and;*
- *mitigating the impact on areas likely to be affected by noise including through noise insulation when the impact is on a building".*

Local and Regional Policy

London-Specific Policies

The London Plan

2.22 The London Plan (GLA, 2016) sets out the spatial development strategy for London consolidated with alterations made to the original plan since 2011. It brings together all relevant strategies, including those relating to noise.

2.23 Policy 7.15, '*Reducing and Managing Noise, Improving and Enhancing the Acoustic Environment and Promoting Appropriate Soundscapes*', addresses the spatial implications of the Mayor's Ambient Noise Strategy and how development and land use can help achieve its objectives. It recognises that London Boroughs should have policies in place to manage the impact of noise from noise making uses, and to identify, nominate, and protect Quiet Areas in line with the procedure in Defra's Noise Action Plan for Agglomerations (2006).

2.24 The 'Publication London Plan' is a new version of the new London Plan published in December 2020 (GLA, 2020), incorporating consolidated changes to previous versions suggested by the Mayor of London, as well as addressing the Inspectors' recommendations following the 2019 Examination in Public and subsequent directions from the Secretary of State. Despite not yet being formally approved by the Secretary of State, the Publication London Plan is a material consideration in planning decisions and is afforded considerable weight. Policy D14 on 'Noise' states that:

"In order to reduce, manage and mitigate noise to improve health and quality of life, residential and other non-aviation development proposals should manage noise by:"

2.25 It goes on to detail measures such as:

- *"avoiding significant adverse noise impacts on health and quality of life".*
- *"improving and enhancing the acoustic environment and promoting appropriate soundscapes".*
- *"separating new noise-sensitive development from major noise sources".*
- *"promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver".*

London Environment Strategy

2.26 The London Environment Strategy was published in May 2018 (GLA, 2018a). The strategy considers ambient noise in Chapter 9 with a primary aim of "*reducing the number of people adversely affected by noise*". Policy 9.1.1 aims to *"Minimise the adverse impacts of noise from London's road transport network"*, while Policy 9.3.1 aims to improve *"understanding of the sources and impacts of noise to better target policies and action".* An implementation plan for the strategy has also been published which sets out what the Mayor will do to help achieve the ambitions in the strategy.

Mayor's Transport Strategy

2.27 The Mayor's Transport Strategy (GLA, 2018b) sets out the Mayor's policies and proposals to reshape transport in London over the next two decades. The Strategy focuses on reducing car dependency and increasing active sustainable travel, with the aim of reducing noise and creating healthier streets. It notes that development proposals should *"be designed so that walking and cycling are the most appealing choices for getting around locally".*

Local Policies

2.28 The Core Strategy (Enfield Council, 2010) was adopted in November 2010, and contains one policy which refers to noise. Core Policy 32 refers to pollution and states that Enfield Council:

"…will work with its partners to minimise air, water, noise and light […]. In particular, new development will be required to […] ensure that noise and light pollution is minimized."

Guidance

World Health Organization 'Environmental Noise Guidelines for the European Region' (WHO, 2018)

2.29 The guidelines presented within the World Health Organization's (WHO) '*Environmental Noise Guidelines for the European Region*' (WHO, 2018) complement the WHO '*Guidelines for Community Noise*' (WHO, 1999) and the WHO '*Night Noise Guidelines for Europe*' (WHO NNG, 2009).

2.30 The guidelines recommend noise exposure-response relationships that are mostly related to the noise exposure indicators L_{den} and L_{night}, with the aim of "*protecting human health from exposure to environmental noise originating from various sources: transportation (road traffic, railway, aircraft) noise, wind turbine noise and leisure noise*".

2.31 The guidelines provide source-specific recommendations on noise exposures. **Table 3** presents the recommendations relating to transportation sources from the guidance.

Table 3: Source Specific Recommendations on Noise Exposures

Source	Average Noise Exposure	Night Noise Exposure
Road traffic noise	Below 53 dB L_{den} strongly recommended	Below 45 dB L_{night} strongly recommended
Railway noise	Below 54 dB L_{den} strongly recommended	Below 44 dB L_{night} strongly recommended
Aircraft noise	Below 45 dB L_{den} strongly recommended	Below 40 dB L_{night} strongly recommended

2.32 Notably, the L_{den} parameter in is a compound noise rating indicator, and is representative of the average sound pressure level over all days, evenings, and night in a year, subject to an evening penalty of 5 dB and a night penalty of 10 dB. Whilst the WHO guidelines (2018) adopt the L_{den} as an appropriate indicator for adverse health effects, the $L_{Aeq,T}$ parameter, as advocated in Government policy and legislation is deemed to be the appropriate parameter for the determination of likely adverse impacts on health and quality of life.

Design Manual for Roads and Bridges: Sustainability & Environment Appraisal: LA 111 – Noise and vibration (LA 111, 2020)

2.33 LA 111 Noise and Vibration Revision 2 (formerly HD 213/11, IAN 185/15) provides guidance on the assessment of noise impacts from road schemes. The Design Manual for Roads and Bridges (DMRB) contains advice and information on undertaking noise and vibration assessments on the impact of road projects. This includes assessing changes in traffic on existing roads, where it outlines the magnitude of impact in the short and long term. It also provides guideline significance criteria for assessing the impact of road traffic noise exposure.

2.34 The change in noise level criteria from road traffic for both short- and long-term impacts advocated in LA 111 are summarised in **Table 4**.

Table 4: DMRB Change in Noise Level Categories

Noise Change Category	Road Traffic Noise
Negligible	<1 dB
Low	1 – 2.9 dB
Medium	3 – 4.9 dB
High	5 – 10 dB
Very High	>10 dB

Subjective Effect of Changes in Ambient Sound Level

2.35 A change in ambient sound level of +10 dB is perceived by the human ear as being twice as loud (Hellman, 1976; Zwicker & Scharf, 1965). Further categories associated with a subjective change in noise levels are advocated by the World Health Organisation (Hansen, 2001) as summarised in **Table 5**.

Table 5: Subjective Effect of Changes in Ambient Sound Level

Change in Sound Level (dB)	Change in Sound Power		Change in Apparent Loudness
	Decrease	Increase	
3	1 / 2	2	Just perceptible
5	1 / 3	3	Clearly noticeable
10	1 / 10	10	Half or twice as loud
20	1 / 100	100	Much quieter / louder

3 Assessment Approach

Proposed Scheme

3.1 Residents in the Bowes Primary & Surrounding Streets Quieter Neighbourhood Area have raised concerns with Enfield Council over traffic issues in the area for many years. In 2019 the Council engaged residents in the Bowes Primary & Surrounding Streets Quieter Neighbourhood Area through a Perception Survey to better understand the issues that they were experiencing. In response, Enfield LBC has implemented a scheme which aims to moderate the speed and volume of traffic and remove through traffic on primary roads within the project area. To that effect, a series of measures have been proposed to divert through traffic from these minor roads onto the 'key distributor roads'.

3.2 The scheme will be delivered in phases, as shown on **Figure 1** below.

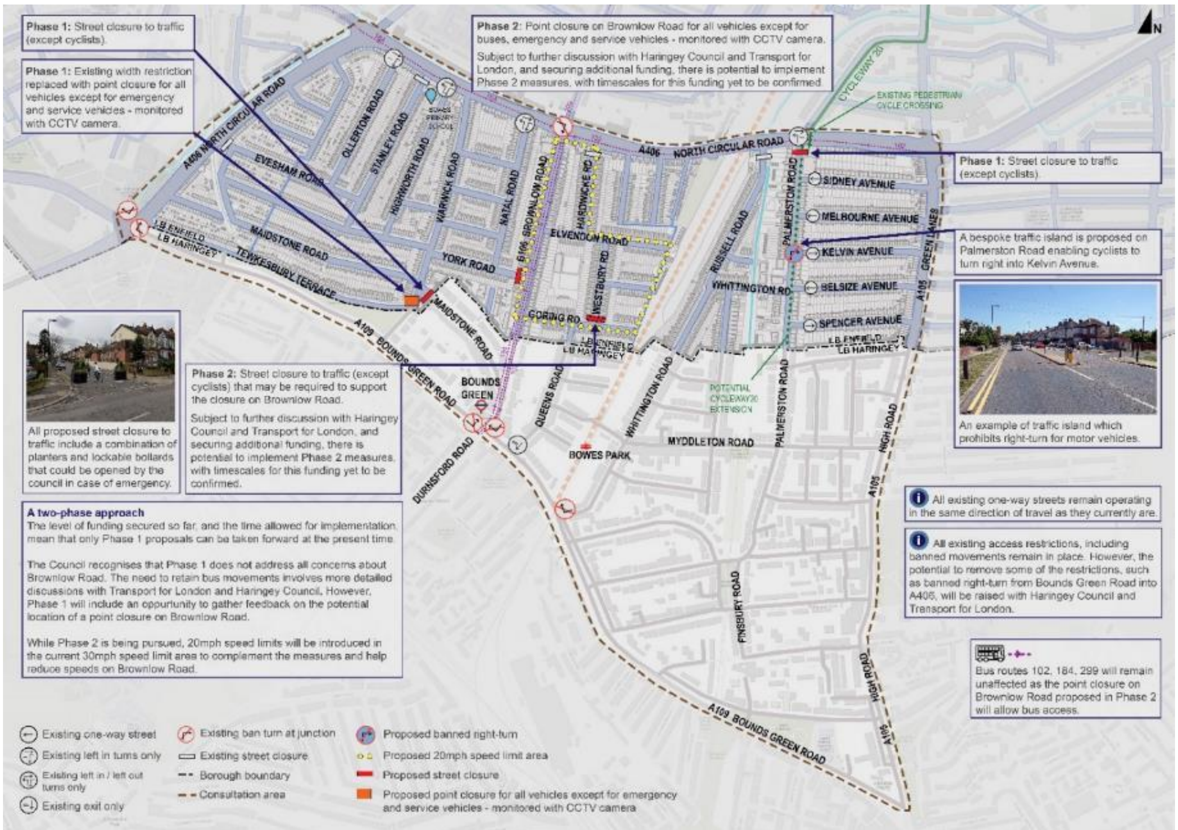

Figure 1: Enfield Quieter Neighbourhood Study Area

3.3 Phase 1 of the scheme started in October 2020, with the road closures to motor vehicles at the following locations:

- Maidstone Road at its junction with Warwick Road
- York Road at its junction with Brownlow Road
- Palmerston Road northbound at its junction with the A406 Bowes Road / North Circular Road

- Existing width restriction on Warwick Road, near its junction with Maidstone Road, replaced with point closure for all vehicles except for emergency vehicles and service vehicles

3.4 In order to monitor the scheme's impact on vehicle flows, Automatic Traffic Count (ATC) Surveys were commissioned by Enfield LBC for a week's duration in mid-July 2020, prior to the scheme being implemented, and a week in mid-November 2020 week, after implementation of the scheme. The ATC survey locations and consultation area are shown in **Figure 2** below.

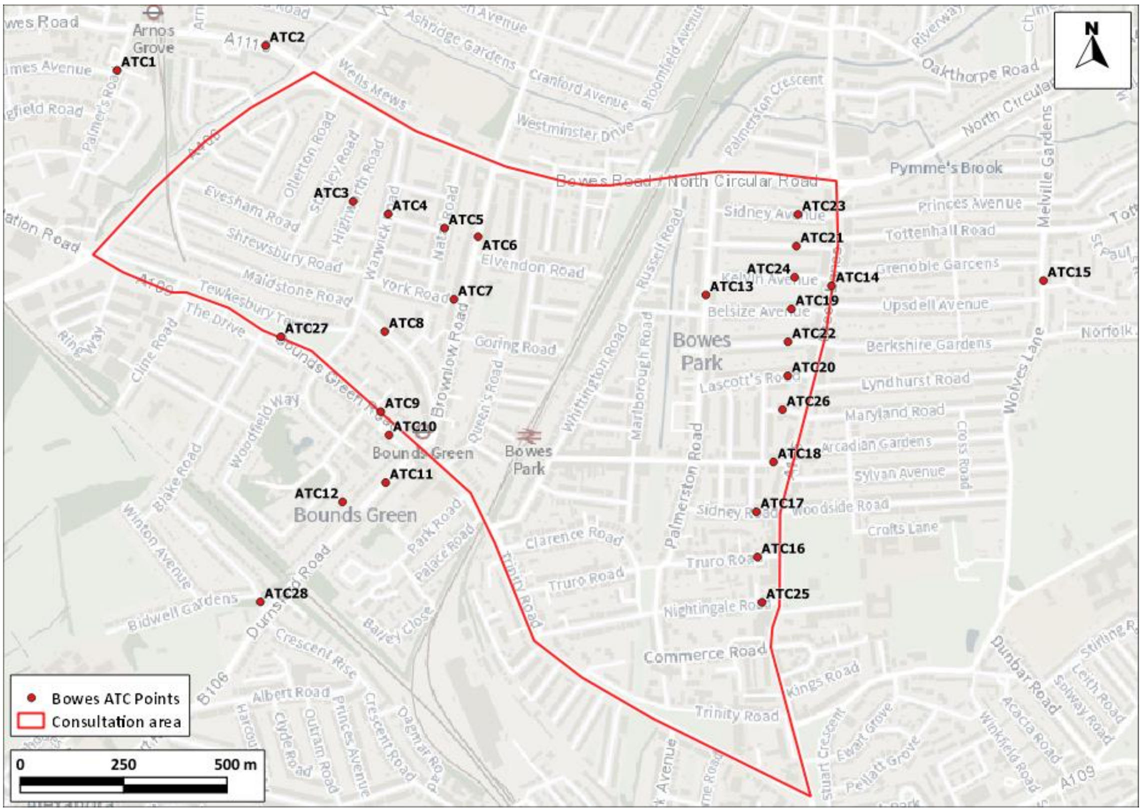

Figure 2: Monitored Roads and Consultation Area

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3.5 In addition, ATCs 34 and 39 located on the A406 North Circular Road, and operated by Transport for London (TfL), were used to supplement Enfield LBC data (ATC34) and in processing the traffic data measured by those ATCs commissioned by Enfield LBC (ATC39). The location of the two TfL ATCs are displayed in **Figure 3**.

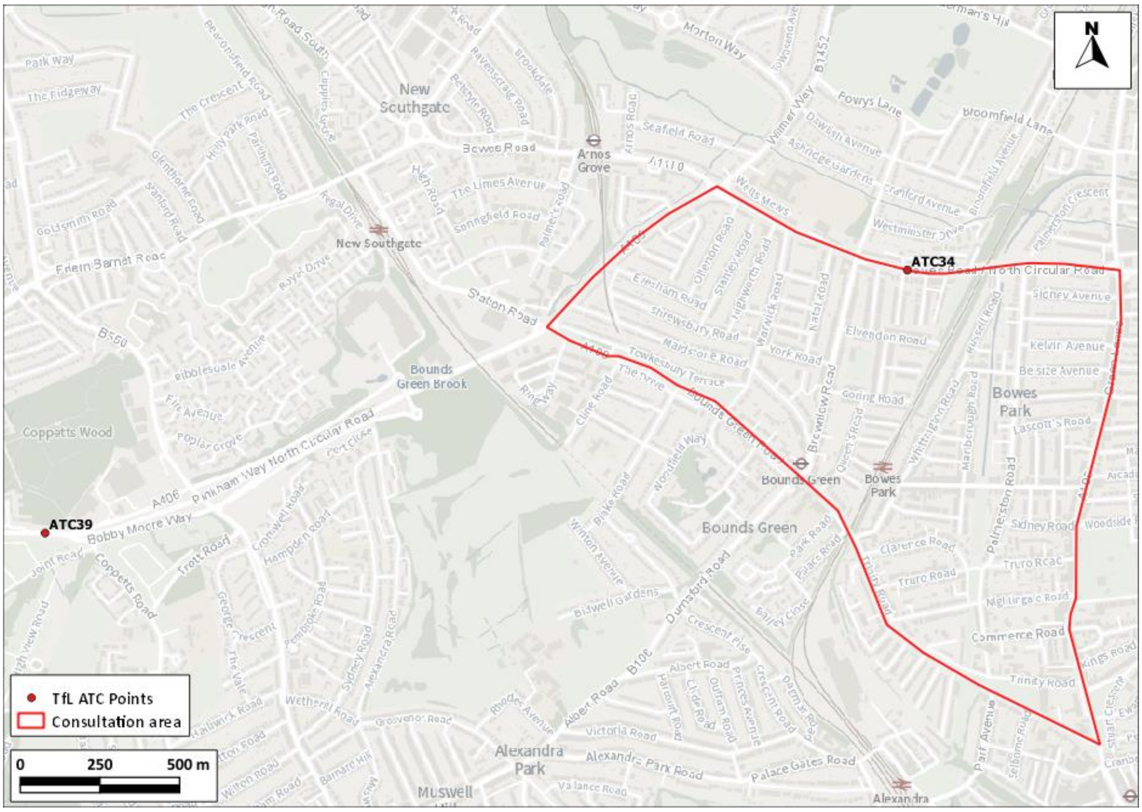

Figure 3: Location of Automatic Traffic Counts 34 and 39

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3.6 The re-distribution of traffic on local roads associated with the scheme may affect road traffic noise levels that local residents and users are exposed to. The impacts of the proposed schemes on noise levels have thus been assessed using environmental noise modelling informed by traffic data obtained by the commissioned survey prior to and after the implementation of the scheme. This approach has been adopted as there are no road traffic noise measurements available for conditions prior to the commencement of the scheme.

Assessment Scenarios

3.7 Noise exposure grids have been modelled with and without the scheme operating in 2020, each for an average day during both a 7-day week and 5-day working week. For each average day, noise modelling has estimated average noise levels (in dB $L_{Aeq,T}$, where T is the period duration) over a 12-hour day (L_{day}, from 07:00-19:00), 4-hour evening (L_{eve}, from 19:00-23:00), and 8-hour night (L_{night}, from 23:00-07:00), as well ad a 16-hour day ($L_{Aeq,16hr}$, 07:00-23:00).

3.8 The relative change in road traffic noise levels in each scenario was calculated to provide an estimation of the difference between noise levels before the scheme and with the scheme, and therefore estimate the impact of the scheme on local noise levels.

Modelling Methodology

3.9 The model has been developed using the LimA® computational sound modelling software (v2020) and has been configured to calculate levels of noise in accordance with the CNOSSOS-EU:2015 '*Common Noise Assessment Methods for Europe*' (CNOSSOS-EU). Details of the model inputs, assumptions and the verification are provided in **Appendix A2**. Where assumptions have been made, a realistic worst-case approach has been adopted.

3.10 Due to the nature of the scheme, and the associated traffic speeds and bus-only routes, modelling using the UK's current national road traffic noise calculation method, the '*Calculation of Road Traffic Noise*' (CRTN, 1988) would lead to major uncertainties. This methodology is not designed to address such circumstances and was originally conceived to identify locations eligible for noise insulation under the Noise Insulation Regulations 1975.

3.11 NCL's approach has therefore been to base the study on modelling using the road traffic noise calculation method described within CNOSSOS-EU. This method is to be adopted by Defra for all strategic noise mapping in England from 2021. It has specific provisions the noise produced by different vehicle types, including buses, and is designed to address low traffic speeds and flows, as is the case with the Low Traffic Neighbourhood.

3.12 The Design Manual for Roads and Bridges: Sustainability & Environment Appraisal LA 111 Noise and vibration (LA 111) (2020). Provides guidance on undertaking noise and vibration assessments on the impact of road projects. This includes assessing changes in traffic on existing roads, where it outlines the magnitude of impact in the short term and long term.

Traffic Data and Emissions Calculation

3.13 Traffic data for the assessment has been informed by the 26 ATCs commissioned by Enfield LBC, supplemented by data collected by TfL at two traffic counts (ATC34 and ATC39, both situated on the A406 North Circular Road, on Telford Road and Bowes Road respectively).

3.14 The CNOSSOS-EU noise model requires that traffic data is averaged over a whole year. It has therefore been necessary to process the raw traffic data collected over seven days into Annual Average Daily Traffic (AADT) flows; the format required for input into the noise model. The annualisation process addresses seasonal variations in traffic, and how this could have impacted the traffic flows recorded over the two seven-days traffic counts commissioned by Enfield LBC. In this instance, the traffic flows in July would have been affected by COVID-19 restrictions and school holidays (schools were only open to certain year groups in July and many would have already started school holidays), whilst the counts undertaken in November would have been impacted by the COVID-19 national lockdown. Both sets of data are therefore likely to have recorded lower levels of traffic compared to those normally experienced for these times of the year. If the daily traffic flows had been calculated simply by dividing the total seven day traffic volume by seven, the numbers obtained would not have been representative of an average day in 2020 and would instead reflect the conditions specific to the periods in July and November. Annualising the measured data to the full year 'evens out' the data and thus addresses any seasonal variation or lockdown impacts between July and November, allowing for direct comparison between the predicted 'without scheme' and 'with scheme' noise levels.

3.15 AADT flows were calculated for each of the 26 traffic counts for 'without scheme' and 'with scheme' scenarios by annualising measured data to the reference year[1]. Two annualisation factors were calculated using data from TfL's ATC39; one for each scenario considered. ATC39 was selected as it is not located within the study area and traffic flows measured there are not affected by the scheme. It is therefore a 'reference' traffic count, suitable for the annualisation process. For example, in order to annualise the data collected at ATC1 in July 2020 to the reference year, the number of vehicles at ATC39 over the same seven days in July 2020 were compared against the total number of vehicles at ATC39 in the reference year, to obtain an adjustment factor (traffic over 7 days / traffic for the reference year). This factor was then applied to the number of vehicles counted at ATC1 over the seven days in July 2020 to obtain an estimated total number of vehicles for the reference year on that road. The AADT is then obtained by dividing that number by 366 (i.e., the number of days in a leap year, which 2020 was).

3.16 The ATCs provided data on all vehicle movements during each hour of the week, including vehicle speeds and vehicle classifications. The raw traffic data was processed and grouped into the relevant periods and categories necessary for CNOSSOS-EU modelling. Further details about model input, traffic data and how flows have been derived for modelling are presented in **Appendix A2**.

Uncertainty in Road Traffic Modelling Predictions

3.17 There are many components that contribute to the uncertainty of modelling results. The road traffic noise models used in this assessment is dependent upon the traffic data input, which will have inherent uncertainties. In particular, traffic flows used in the models were derived from counts carried out over seven days and annualised to the reference year, as discussed above. It is recognised that the calculated 2020 traffic flows, both pre-scheme and post-scheme, are lower than that of a typical year, which is reflected by the reduction in traffic that has been observed across London due to the COVID-19 pandemic[2]. This noise assessment, however, is primarily a relative study focused on the changes in noise levels associated with the scheme, which will not be significantly impacted by total traffic volumes. This approach has therefore addressed, as best as possible, the uncertainties

[1] For 2020, flows were 'annualised' to the period 25th November 2020 to 24th November 2020, in the absence of traffic data covering the period 25th November to 31st December 2020.

[2] Transport for London, 'Travel in London - Report 13', 2020, https://content.tfl.gov.uk/travel-in-london-report-13.pdf, (accessed 4 June 2021).

relating to the short duration of the traffic surveys and the irregular traffic flows associated with school holidays and the COVID-19 pandemic.

3.18 There are inherent uncertainties within the modelling, including the traffic data as primary input, and as such the results should not be considered exact, but represent the best possible estimates, using the best available data available at the time this report was undertaken.

Assessment Criteria

3.19 Due to the comparative nature of this study, assessment criteria which look at absolute noise levels are not relevant. This study will aim to present the results such as to indicate where differences in noise exposure levels are clearly noticeable on a perceptual basis.

3.20 The change in road noise level criteria used in this assessed are derived from methodologies advocated in LA 111 (2020) (as summarised in **Table 4)** and are presented in full in **Table 6**. A beneficial change was deemed to occur where there was a reduction in noise level, and an adverse change was deemed to occur where there was an increase.

3.21 Due to the aforementioned uncertainties in the modelling inputs and the imperfections of comparing traffic flow at different points in time, it has been deemed that any changes within the range of $L_{Aeq,T}$ < ±3 dB are likely to be within a margin of error. This is in line with the research presented in **Table 5**. These minor changes may well be due to the scheme but may also be due to uncertainties within the processing and comparisons of the road traffic data.

3.22 This assessment has therefore only made firm conclusions regarding the influence of the scheme where modelling has indicated that a road has experienced a change of $L_{Aeq,T}$ ≥ ±3 dB. Such changes are described as a ‘moderate’ or ‘major’ change based on the DMRB guidance. Such changes may be considered ‘significant’.

Table 6: Change in Noise Level Assessment Criteria Derived from DMRB

Noise Change Category	Road Traffic Noise
Major beneficial	≤ -5 dB $L_{Aeq,T}$
Moderate beneficial	-3 to -4.9 dB $L_{Aeq,T}$
Minor beneficial	-1 to -2.9 dB $L_{Aeq,T}$
Negligible	-1 to 1 dB $L_{Aeq,T}$
Minor improvement	1 to 2.9 dB $L_{Aeq,T}$
Moderate improvement	3 to 4.9 dB $L_{Aeq,T}$
Major improvement	> 5 dB $L_{Aeq,T}$

4 Scheme Impact Assessment

4.1 This section presents the changes in annualise daily noise exposure predicted as a result of the scheme. Detailed results of the noise modelling exercise are presented as noise exposure grids in **Appendix A2.15**, and a summary is presented and discussed below.

4.2 The calculated percentage changes in traffic flow are shown in **Figure 4**. Decreases in traffic are illustrated by green shaded points, whilst increases are displayed in red shades. The decreases in traffic correlate with road closures, and the increases occur on roads where traffic has been displaced to. Traffic flow changes detailed by period and vehicle category are provided in **Table A2.4** in **Appendix A2.**

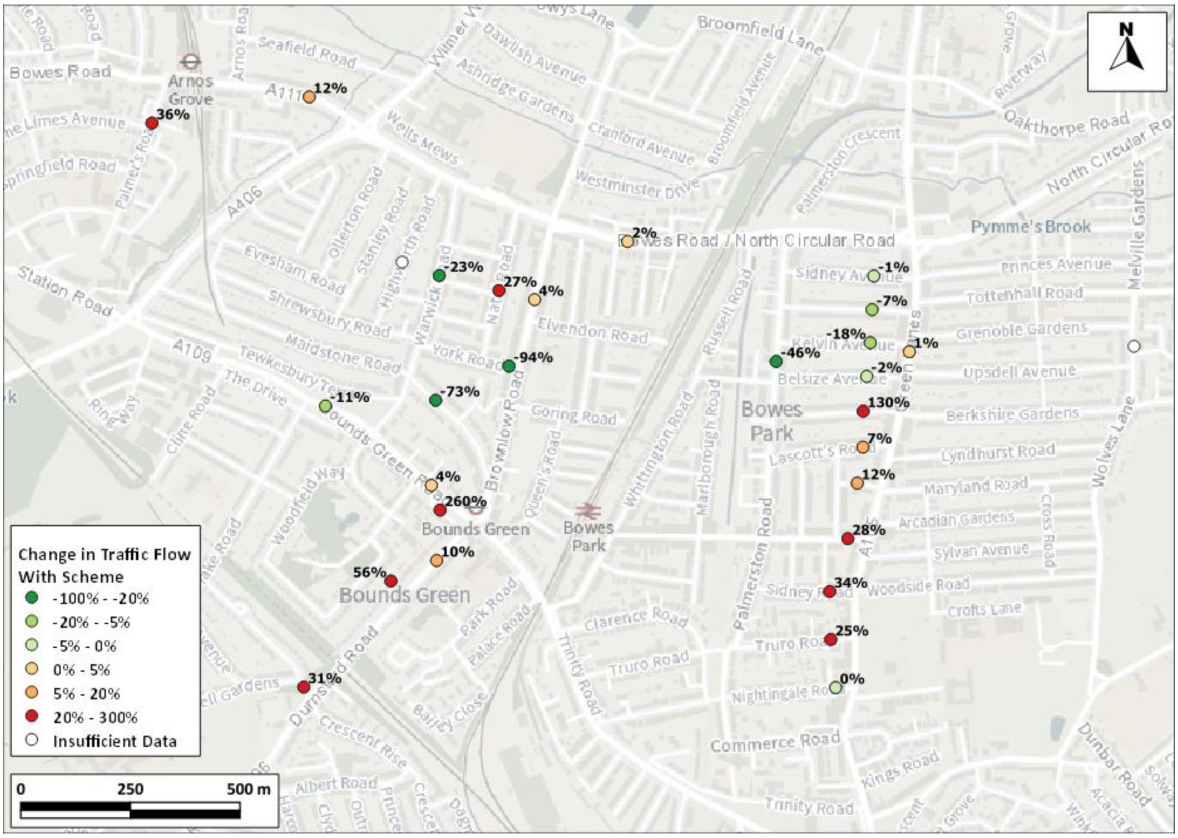

Figure 4: Percentage Change in Total Traffic Flows Resulting from the Scheme

Contains Ordnance Survey data © Crown copyright and database right 2021. Ordnance Survey licence number 100046099. ATC15, situated on Wolves Lane, to the east of the study area, is not included in the above figure, as there was insufficient data at this count.

4.3 **Table 7** presents a summary of the roads which experienced a moderate or major change in noise levels during any of the assessed periods. Beneficial changes are represented by '**<-**' and shaded blue whilst adverse changes are represented by '**>+**' and shaded orange, followed by the criteria threshold in dB. The results are presented for each of the indicators modelled: L_{day}, L_{eve}, L_{night} and $L_{Aeq,16hr}$, each for a 7-day week and a 5-day week.

Table 7: Summary of Significant Changes in Road Noise Exposure (in dB)

	7-day week				5-day week			
	Day	Eve	Night	16-hr	Day	Eve	Night	16-hr
York Road	<-5	<-5	<-5	<-5	<-5	<-5	<-5	<-5
Maidstone Road	<-5	<-5	<-3	<-5	<-5	<-5	<-3	<-5
Palmerston Road			<-3				<-3	
Spencer Avenue	>+3		>+3	>+3	>+3		>+3	>+3
Sidney Road						>+3		
Woodfield Way							>+3	

4.4 Significant changes in road noise exposure are highly likely to have occurred as a result of the scheme at 6 of the 27 modelled roads during at least one of the assessed periods.

4.5 York Road is highly likely to have experienced a consistently major decrease in noise as a result of the scheme, as is Maidstone Road except at night where the decrease was moderate. Palmerston Road is predicted to have experienced a moderate decrease in noise levels only at night, likely because noise from the A406 Bowes Road / North Circular Road and High Road dominate the noise climate during the day.

4.6 Spencer Road appears to have been most adversely affected by the scheme, with moderate increases in noise during all periods except for the evening period. When assessing the 5-day working week, Sidney Road and Woodfield Way demonstrated moderate increases in noise during the evening and night periods respectively.

4.7 The noise grids presented in **Appendix A2.15** show that there were minor decreases predicted on Warwick Road and Kelvin Avenue, and minor increases predicted on Truro Road, Wroxham Gardens / Winton Avenue, and Natal Road. However, as stated above, it is uncertain whether these changes may be predominantly attributed to the scheme, if at all, and they are unlikely to be perceived by residents.

4.8 With the scheme involving road closures on York Road, Maidstone Road and Palmerston Road, the resulting decrease in road traffic noise levels along these roads is as expected.

4.9 In avoiding the road closure between Palmerston Road and the A406 Bowes Road / North Circular Road, motorists making increased use of Spencer Avenue, but also Sidney Road during weekday evenings, have led to moderately increased noise levels at these locations. However, the moderate increase in noise along Woodfield Way during the night of a 5-day week does not seem to be explained by the scheme.

4.10 **Table A3.1** in **Appendix A2.15** shows the absolute predicted noise levels, rounded to the nearest dB, at the sites of each ATC which is presented in **Table 7** as experiencing significant changes. **Table A3.2** and **Table A3.3** provide further absolute noise level results for all the roads modelled. Note that the absolute levels shown may be influenced by the noise from traffic on neighbouring roads.

4.11 The absolute noise levels at calculated at the location of the York Road ATC (ATC7) would give a difference of less than 3 dB with the scheme. This is due to the ATC being located at the entrance to York Road where the influence of traffic on Brownlow Road is likely significant. However, as can be observed in the figures in **Appendix A2.15**, there is a clearer difference of > 3 dB further west along York Road. The situation is the same for the ATC locations at Woodfield Way and Sidney Road which are influenced by noise from B106 Durnsford Road and High Road respectively.

4.12 The noise change grid for an average $L_{Aeq,16hr}$ in a 7-day week is presented **Figure 5**. The grid demonstrates that the overall effect of the scheme on noise with respect to changes of > ±3 dB appears to be beneficial given the numbers of roads and dwellings seeing such changes. This is evidenced by the areas covered by blue (-3 dB to -5 dB change) and purple (greater than -5 dB change), as opposed to areas of orange (+3 dB to +5 dB change).

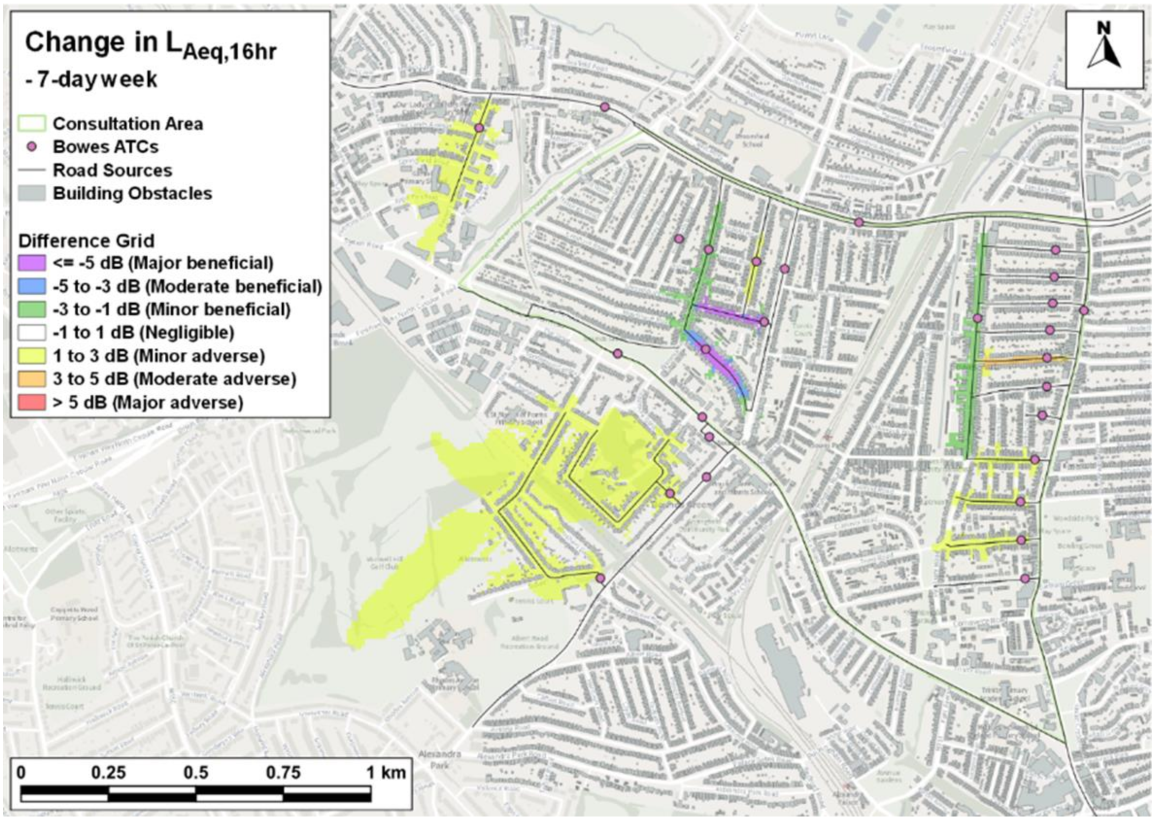

Figure 5: Change in 16-hour Day Noise Levels Due to the Scheme for an Average Day in a 7-day Week.

4.13 There appear to be larger areas with adverse changes of < +3 dB (yellow) than areas with beneficial changes of < -3 dB (green). These are locations where there is a lack of confidence as to whether changes can be attributed to the scheme or if it due to the uncertainty within the data. However, it is recommended that Enfield review the locations where these changes are shown and identify whether these coincide with any adverse feedback received from communities.

4.14 **Figure 6** and **Figure 7** show, as an example, the absolute noise grids for the $L_{Aeq,16hr}$ indicator without and with the scheme respectively for an average day in a 7-day week.

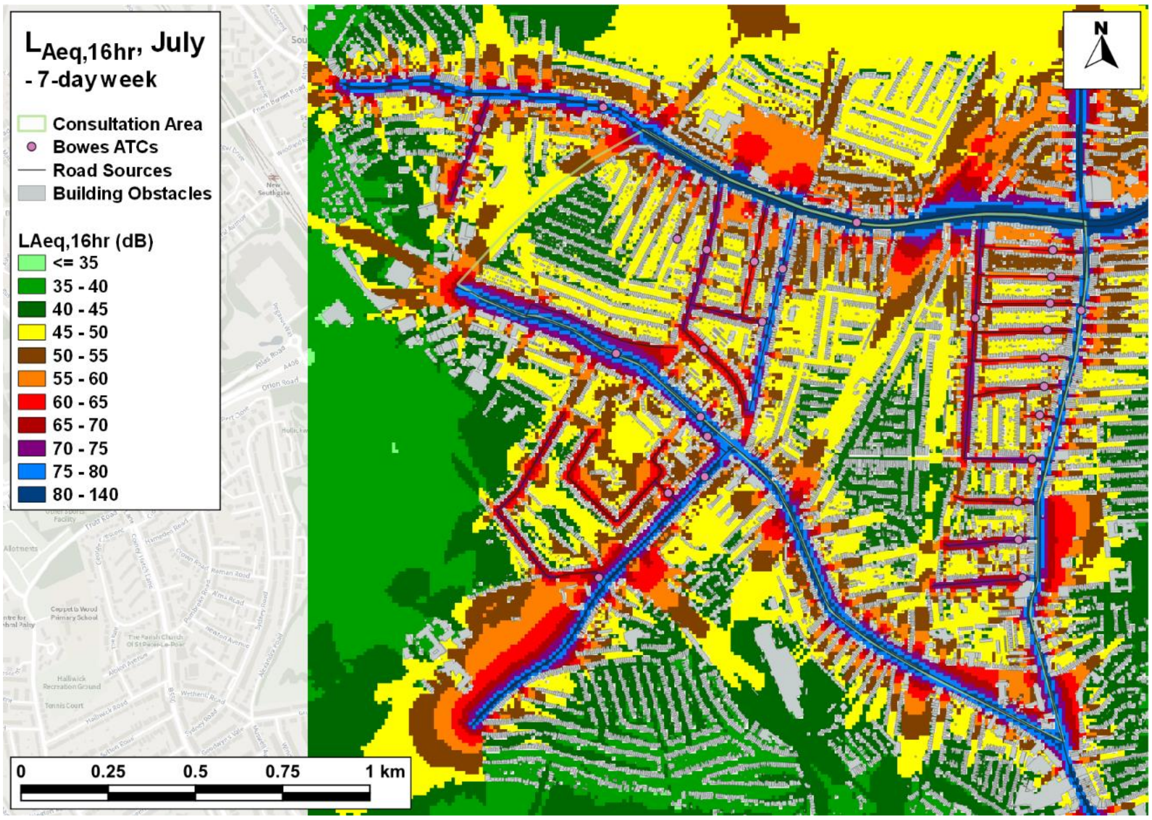

Figure 6: Absolute $L_{Aeq,16hr}$ Noise Grid for July (Without-Scheme Scenario) – 7-day Week

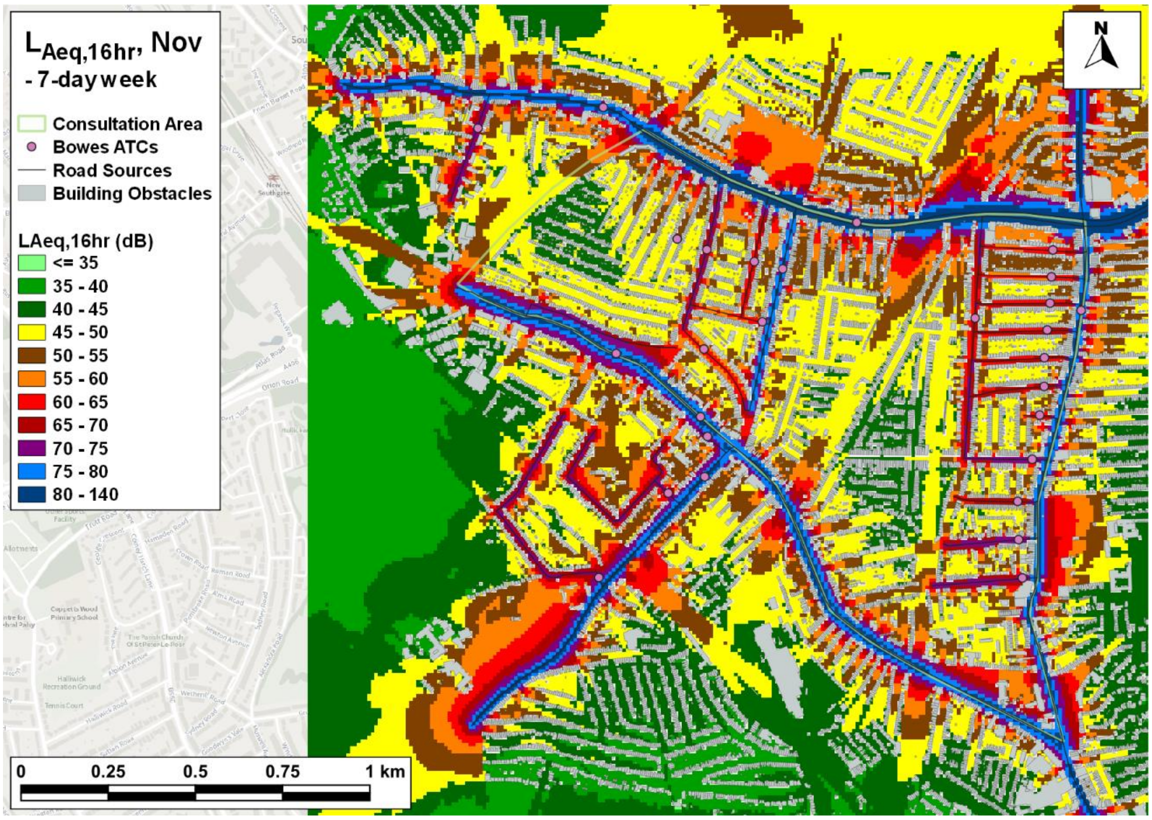

Figure 7: Absolute $L_{Aeq,16hr}$ Noise Grid for November (With-Scheme Scenario) – 7-day Week

5 Summary and Conclusions

5.1 The assessment has considered the local noise impacts of the Bowes Quieter Neighbourhood Scheme. Traffic flows were measured over two seven-day periods in July and November 2020 (pre- and post-scheme implementation). These have been used to estimate the changes in traffic attributable to the scheme. CNOSSOS-EU road noise modelling has then been undertaken using LimA® to estimate the effect that these changes in traffic would have had on local noise levels.

5.2 Implementation of the Quieter Neighbourhood Scheme is predicted to have led to moderate to major decreases in noise levels along Maidstone Road and York Road, as well as moderate decreases on Palmerston Road during the night period. The scheme is predicted to have increased noise levels moderately along Spencer Avenue and on occasion along Sidney Road and Woodfield Way.

5.3 Although the scheme caused small changes to noise levels at other roads, including minor decreases on Warwick Road and Kelvin Avenue, as well as minor increases on Truro Road, Wroxham Gardens / Winton Avenue, and Natal Road, the scale of these are within the margin of error and may not be directly attributable to the scheme.

5.4 There are many uncertainties around the predictions presented in this report. In particular, it is challenging to isolate those changes to traffic flows caused by the scheme from those caused by other factors, such as restrictions to control the COVID-19 pandemic.

6 Glossary

AADF	Average Annual Daily Flows
A-weighting	Frequency weighting applied to measured sound in order to account for the relative loudness perceived by the human ear.
CNOSSOS-EU	Common Noise Assessment Methods in Europe
CRTN	Calculation of Road Traffic Noise
dB	Decibel. The logarithmically scaled measurement unit of sound.
Defra	UK Government Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
$L_{Aeq,T}$	A-weighted equivalent continuous sound level over a given time period. It is the sound level of a steady sound that has the same energy as a fluctuating sound over the same time period.
L_{day}	A-weighted equivalent continuous sound level over a 12-hour daytime period.
L_{eve}	A-weighted equivalent continuous sound level over a 4-hour evening period.
L_{night}	A-weighted equivalent continuous sound level over an 8-hour night-time period.
NCL	Noise Consultants Limited
TfL	Transport for London

7 Appendices

A1 Professional Experience

James Trow, BSc (Hons) MIOA MIEnvSc

Mr Trow is the Managing Director at NCL. He holds a First-Class Bachelor of Science degree in Acoustics from Salford University and is a Full Corporate Member of the Institute of Acoustics and a Member of the Institution of Environmental Sciences. He has over 17 years' experience working exclusively in the field of environmental noise delivering high profile projects in both the public and private sector. His experience includes technical leadership roles, policy and research work, and delivery of strategic noise mapping and action planning projects and major EIA. He has been involved in noise mapping projects since 2003 and contributed to some of the earliest UK feasibility studies for the deliver of Directive 2002/49/EC. He has developed techniques, coding solutions, QA procedures and systems to allow the scalability of noise calculations.

Jonathan Phillips, MEng (Hons) AMIOA

Mr Phillips is a Consultant with NCL, having joined the company in September 2019. Prior to joining, he completed an MEng (Hons) degree in Acoustical Engineering at the University of Southampton, specialising in virtual acoustics. Prior to joining NCL he worked briefly as an intern at Audioscenic, and between his studies he undertook placements at Ion Acoustics and Hoare Lea. He has undertaken numerous noise modelling assessments, including road traffic noise and airport noise, as well as many industrial and residential noise assessments. He is an Associate Member of the Institute of Acoustics.

A2 Modelling Methodology

Model Inputs

A2.1 The model has been developed using the LimA® computational sound modelling software (v2020). A model employing the CNOSSOS-EU methodology requires the user to provide various input data, including noise source definitions for traffic along each section of road along with the characteristics of the road section. This includes the AADF for each vehicle category, average daily speeds for each vehicle category, direction of traffic, road surface type, road classification (urban, highway or speedway), the width of the road, and the slope of the road in the direction of traffic.

A2.2 The model also considers terrain and building obstacles. Terrain data was obtained from the UK Environment Agency’s LiDAR Composite Digital Terrain Model (DTM) 2019 and LiDAR Composite Digital Surface Model (DSM) 2017 datasets (public sector information licenced under the Open Government Licence v3.0), whilst building shapes were obtained from the Ordnance Survey (OS) MasterMap Topography layer. Building heights were obtained by intersecting the difference between the DSM and DTM with the building heights.

A2.3 Constant model input parameters are summarised in **Table A2.1** and other dynamic parameters are discussed below.

Table A2.1: Summary of Model Inputs and Assumptions

Model Parameter	Value Used
Terrain Effects Modelled	Yes
Building Obstacles Modelled	Yes
Road Surface Type	Porous asphalt
Road Gradient	0 %
Road Classification	All Urban except sources along the A406 Bowes Road / North Circular Road which is defined as a Highway
Direction of Traffic	Majority of sources defined as bi-directional, except where one-way systems are in operation and the A406 Bowes Road / North Circular road which is divided.
Ground Absorption Coefficient	0.5 (Mixed ground)
Receptor Grid Height	1.5 m
Receptor Grid Resolution	10 m

Traffic Data

A2.4 Traffic counts have been provided by Enfield LBC, who commissioned the ATC survey for the scheme. The survey involved a week of ATC data measured in mid-July, representing traffic flows without the scheme, a week of ATC data from mid-November with the scheme in place. Each individual vehicle count provided the vehicle classification, speed, direction, and the time of recording. In order to convert the traffic count data into a format appropriate for road traffic noise modelling according to the CNOSSOS-EU methodology a series of calculations and assumptions had to be made, which are set out in this section.

Normalised Mean Daily Traffic Flow Calculations

A2.5 The noise model requires traffic data to be input in daily flow values. In order to calculate an annual average from the weekly average, a normalisation factor was applied. The factor was calculated using traffic count ATC39, operated by TfL, and situated along the A406 Telford Road / North Circular, 1.7 km away from the consultation area boundary. The count is judged to be far enough away not to be impacted by the scheme to any major degree, but close enough to be representative of typical AADF variation in the study area. The factor was calculated by dividing the annual total ATC39 for the year between 25 November 2019 and 25 November 2020, by the period total, for each respective survey period. This factor was applied to the period total at each of the Enfield LBC ATCs to approximate annual totals. This method therefore provides values which, to some extent, consider the annual variations in 2020 traffic, resulting from factors external to the scheme, such as COVID lockdown impacts and school holidays.

Traffic Speeds

A2.6 Noise modelling is based on average speeds on each section of road. The ATC data provided the speed of each vehicle movement, which can be averaged to a speed appropriate to that point for modelling purposes. This speed is, however, only applicable at a specific point on the road and will not necessarily be representative of speed along the whole road link. Moreover, average speeds pre- and post-scheme were reviewed, and it was not possible to correlate the variation in speeds with that in traffic data; it could have been expected to see average speeds decrease with increased traffic, and vice versa. Measured speeds were therefore not directly used as average speeds for modelling purposes. Instead, average traffic speeds were estimated based on road layout, proximity to junctions and traffic lights, speed limits, and professional judgement.

A2.7 For example, where a section of road leads to a traffic light, vehicles will be stopped and thus idling for some time when the light is red, but under a green light, vehicles will travel at normal speed along that section of road. As such, for modelling purposes, these sections of roads are typically modelled at 20 kph, which correspond to a weighted average speed throughout the day. On sections of road situated away from junctions, average speeds were determined based on the applicable speed limits. Although the measured speeds were not used, as discussed above, they were reviewed against those determined following the procedure described above to ensure there were no major discrepancies between measured and estimated average speeds along the road network considered in this study.

A2.8 Details of the average speeds used in the model are provided in **Figure A2.1**.

Vehicle Classifications

A2.9 The noise emissions calculated within the model are determined by vehicle type, according to the five vehicle categories defined in the CNOSSOS-EU methodology. The ATC data provides a breakdown of movements in terms of the fifteen classifications shown in **Table A2.2**. Prior to modelling, these classifications were converted to the CNOSSOS-EU categories according to the assumptions given in **Table A2.2**. Any bicycle movements were excluded from the model as they do not have any associated noise emissions.

Table A2.2: Conversion of Measured Vehicle Classifications to CNOSSOS Categories

<table>
<tr><th colspan="4">Vehicle Classifications from ATC Survey</th><th colspan="2">Adopted CNOSSOS-EU Categories</th></tr>
<tr><th>Class</th><th>Code</th><th colspan="2">Description</th><th>Category</th><th>Description</th></tr>
<tr><td>1</td><td>SV</td><td colspan="2">Short - car, light van</td><td rowspan="2">1</td><td rowspan="2">Light vehicles: Passenger cars, delivery vans ≤ 3,5 tons, including trailers and caravans</td></tr>
<tr><td>2</td><td>SVT</td><td colspan="2">Short towing – trailer, caravan, boat etc</td></tr>
<tr><td>3</td><td>TB2</td><td colspan="2">Two axle truck or bus</td><td>2</td><td>Medium heavy vehicles: delivery vans > 3.5 tons, buses, etc. with two axles</td></tr>
<tr><td>4</td><td>TB3</td><td colspan="2">Three axle truck or bus</td><td rowspan="9">3</td><td rowspan="9">Heavy duty vehicles, touring cars, buses, with three or more axles</td></tr>
<tr><td>5</td><td>T4</td><td colspan="2">Four axle truck</td></tr>
<tr><td>6</td><td>ART3</td><td>Three axle</td><td rowspan="4">articulated vehicle or rigid vehicle & trailer</td></tr>
<tr><td>7</td><td>ART4</td><td>Four axle</td></tr>
<tr><td>8</td><td>ART5</td><td>Five axle</td></tr>
<tr><td>9</td><td>ART6</td><td>Six+ axle</td></tr>
<tr><td>10</td><td>BD</td><td colspan="2">B-double or heavy truck and trailer</td></tr>
<tr><td>11</td><td>DRT</td><td colspan="2">Double road train / heavy tuck & two trailers</td></tr>
<tr><td>12</td><td>TRT</td><td colspan="2">Triple road train / heavy truck & 3+ trailers</td></tr>
<tr><td>14</td><td>M/C</td><td colspan="2">Motorcycle</td><td>4b</td><td>Motorcycles, tricycles and quadricycles</td></tr>
<tr><td>15</td><td>CYCLE</td><td colspan="2">Cycle</td><td colspan="2">Ignore</td></tr>
</table>

A2.10 Traffic data measured by TfL at ATC34 does not consider vehicle classification. Therefore, proportions of each vehicle category at ATC34 have been informed by data taken from the London Atmospheric Emissions Inventory (LAEI) at a location on A406 Bowes Road / North Circular Road which contained vehicle classification counts.

Missing Data

A2.11 Several ATCs included periods of missing data. This is not unusual and could be due to cars parked on the device's tube for long periods of time. Where possible, assumptions have been made in order to account for these missing data. Otherwise, these sources of the model have been omitted. A list of missing data and their respective omissions or assumptions made are shown in **Table A2.3**.

Table A2.3: Summary of Missing ATC Data

Count	Missing Data	Action Taken
ATC3	For July period: No traffic count data.	ATC3 and the associated road source was omitted from the model
ATC4	For July period: Sunday, Monday, and Tuesday missing from week's data. This is replaced with data from Friday from the week prior and Saturday and Sunday from the week following.	The average daily flows at the location, for both 7- and 5-day weeks, are assumed to be represented by the remaining data. Change in daily flows accounted for in annualisation factor.
ATC14	For July period: Tuesday missing from week's data and replaced with Sunday data from following week.	The average daily flows at the location, for both 7- and 5-day weeks, are assumed to be represented by the remaining data. Change in daily flows accounted for in annualisation factor.
ATC15	For November period: Missing periods of data from Wednesday, Friday, and Saturday.	ATC15 and the associated road source was omitted from the model.
ATC17	For July period: Tuesday missing from week's data and replaced with Saturday data from following week.	The average daily flows at the location, for both 7- and 5-day weeks, are assumed to be represented by the remaining data. Change in daily flows accounted for in annualisation factor.
ATC18	For July period: Data missing from Sunday night to Monday morning, and from Saturday night to Sunday midday.	The average night-time and day-time flows at the location for the 7-day week are assumed to be represented by the remaining data. Change in daily flows accounted for in annualisation factor.
ATC23	For July period: Missing data from Wednesday afternoon.	The average daytime flows at the location, for both 7- and 5-day weeks, are assumed to be represented by the remaining data. Change in daily flows accounted for in annualisation factor.
ATC25	For July period: Tuesday missing from week's data, and replaced with Saturday data from following week	The average daytime flows at the location, for both 7- and 5-day weeks, are assumed to be represented by the remaining data. Change in daily flows accounted for in annualisation factor.

Road Lines and Widths

A2.12 A network of roads in and around the consultation area were selected according to proximity to the ATC and reasonable representation by the measured traffic flows. For the roads of interest, road widths were obtained from the OS MasterMap Highways Network dataset. The road lines were then converted to acoustic line sources and attributed with the relevant road and traffic data as discussed in the sections above.

Data Summary

A2.13 The percentage change in traffic flows at each ATC, based on the annualised values used in this assessment, are summarised in **Table A2.4** by time of day and vehicle category.

Table A2.4: Percentage Change of Annualised Traffic Flows with Scheme Implemented

	Percentage Change in Traffic Flow by Period and CNOSSOS-EU Vehicle Category											
Period	**Day (07:00-19:00)**				**Evening (19:00-23:00)**				**Night (23:00-07:00)**			
Category	**1**	**2**	**3**	**4B**	**1**	**2**	**3**	**4B**	**1**	**2**	**3**	**4B**
ATC1	61%	35%	44%	82%	-29%	-1%	-20%	95%	-19%	-6%	-6%	37%
ATC2	30%	-8%	98%	-1%	-11%	-20%	177%	15%	-20%	-26%	65%	-14%
ATC4	-25%	-28%	-4%	47%	-38%	-3%	22%	8%	17%	94%	22%	33%
ATC5	25%	31%	76%	106%	18%	79%	25%	21%	51%	-15%	22%	-20%
ATC6	11%	4%	121%	19%	-22%	-14%	387%	14%	-9%	-26%	579%	-23%
ATC7	-96%	-99%	-52%	-34%	-96%	-84%	0%	-45%	-97%	-86%	-100%	-41%
ATC8	-78%	-85%	0%	1430%	-82%	-76%	-100%	548%	-80%	-79%	-7%	181%
ATC9	8%	19%	9%	14%	-14%	16%	-16%	17%	-9%	21%	-18%	-22%
ATC10	372%	228%	22%	250%	311%	36%	-100%	40%	160%	8%	-100%	22%
ATC11	18%	4%	110%	22%	-22%	-29%	312%	-2%	10%	-35%	483%	-28%
ATC12	61%	-15%	1211%	51%	11%	-29%	489%	19%	76%	34%	179%	50%
ATC13	-45%	-81%	399%	6%	-57%	-81%	139%	-9%	-60%	-76%	19%	-24%
ATC14	6%	44%	-12%	33%	-16%	58%	-5%	32%	-22%	49%	-60%	-20%
ATC16	32%	30%	42%	25%	-15%	3%	100%	4%	30%	43%	89%	-4%
ATC17	38%	47%	-6%	37%	27%	86%	-100%	17%	-6%	74%	-100%	0%
ATC18	32%	99%	-57%	29%	-1%	31%	-53%	18%	22%	44%	-31%	11%
ATC19	-1%	-20%	291%	21%	-9%	-11%	111%	2%	1%	-14%	133%	-18%
ATC20	15%	22%	-22%	-12%	-17%	-13%	22%	-17%	-13%	50%	0%	-41%
ATC21	-4%	3%	322%	49%	-22%	-43%	-100%	0%	-29%	-8%	-28%	-26%
ATC22	139%	152%	160%	73%	121%	168%	22%	12%	128%	278%	31%	-14%
ATC23	9%	35%	-20%	33%	-18%	-21%	22%	-34%	-36%	55%	56%	-51%
ATC24	-12%	-19%	439%	11%	-37%	-40%	364%	-16%	-41%	-5%	333%	-66%
ATC25	1%	22%	57%	15%	-10%	0%	-10%	-2%	-9%	7%	0%	-8%
ATC26	25%	24%	56%	11%	-26%	47%	133%	-53%	-38%	31%	22%	-42%
ATC27	-5%	5%	-22%	-8%	-24%	-25%	-100%	8%	-33%	-38%	-100%	31%
ATC28	38%	70%	433%	-25%	-32%	22%	608%	-39%	-21%	0%	181%	13%
ATC34E	11%	11%	11%	11%	-8%	-8%	-8%	-8%	-7%	-7%	-7%	-7%
ATC34W	8%	8%	8%	8%	-12%	-12%	-12%	-12%	-11%	-11%	-11%	-11%

A2.14 **Figure A2.1** shows the road network included within the model, along with the average speed at which each link was modelled. Traffic Directions for one-way road sources are shown as left-sided arrows.

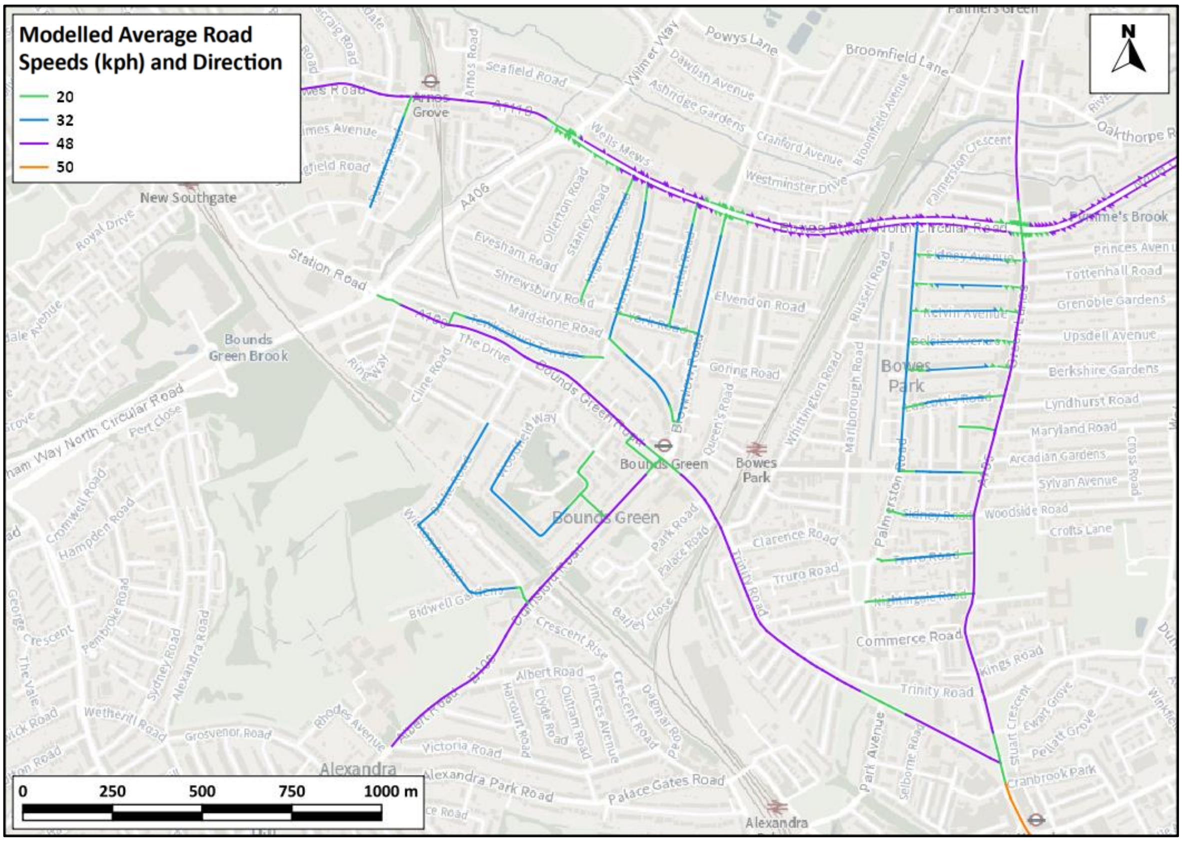

Figure A2.1: Modelled Road Network with Average Vehicle Speeds.

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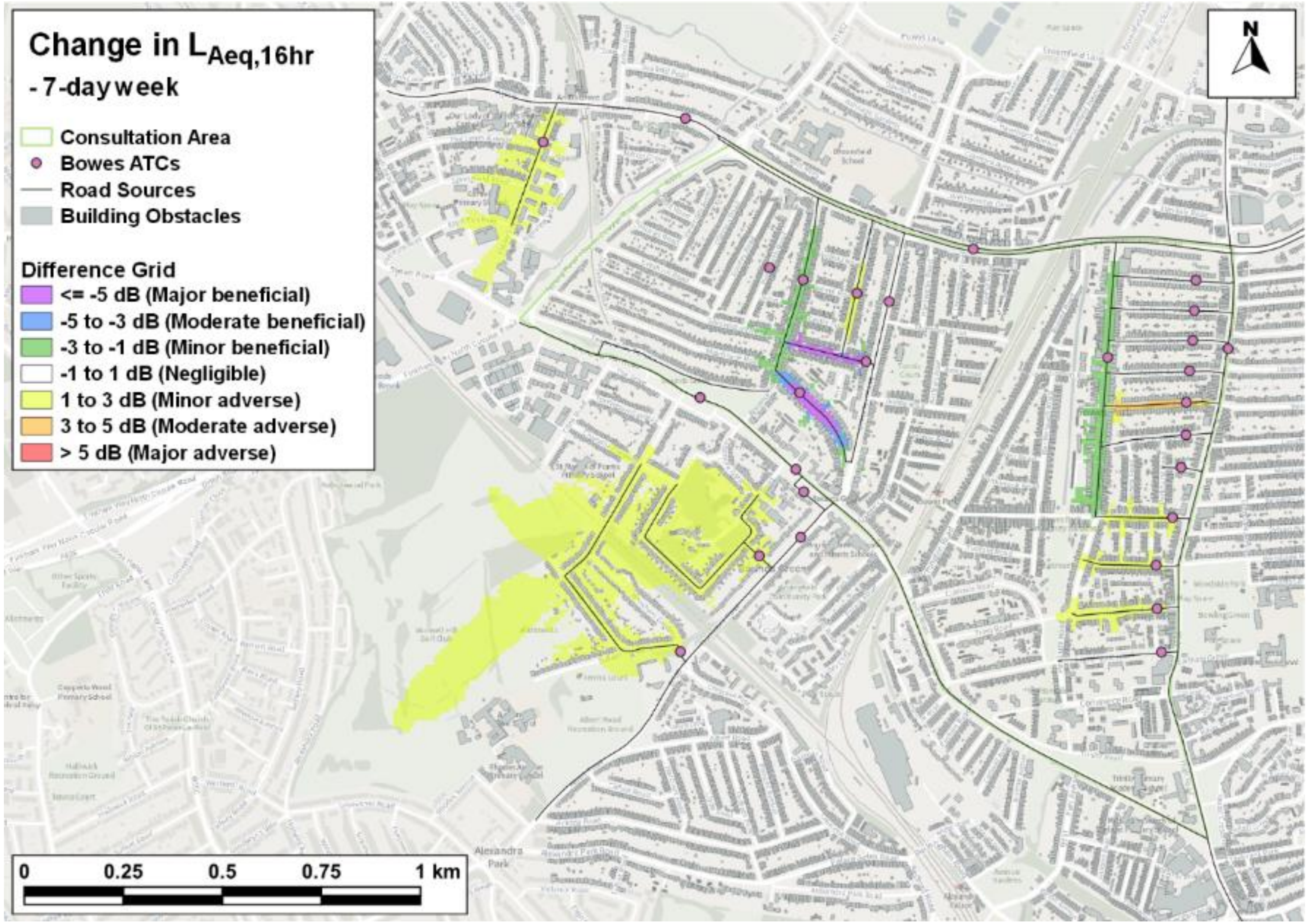
Post-processing

A2.15 CNOSSOS-EU models were calculated in LimA® for the ‘July Base’ and ‘November with Scheme’ scenarios for each of the L_{day}, L_{eve} and L_{night} indicators. The model predicts the $L_{Aeq,T}$ in decibels (dB) at each square within the receptor grid. Once calculated, the L_{day} and L_{eve} results were combined to derive the $L_{Aeq,16hr}$ grids. The absolute differences were then calculated by subtracting the ‘July Base’ scenarios from the ‘November with Scheme’ scenarios, the results of which are presented in **Appendix A2.15**.

A3 Modelling Results



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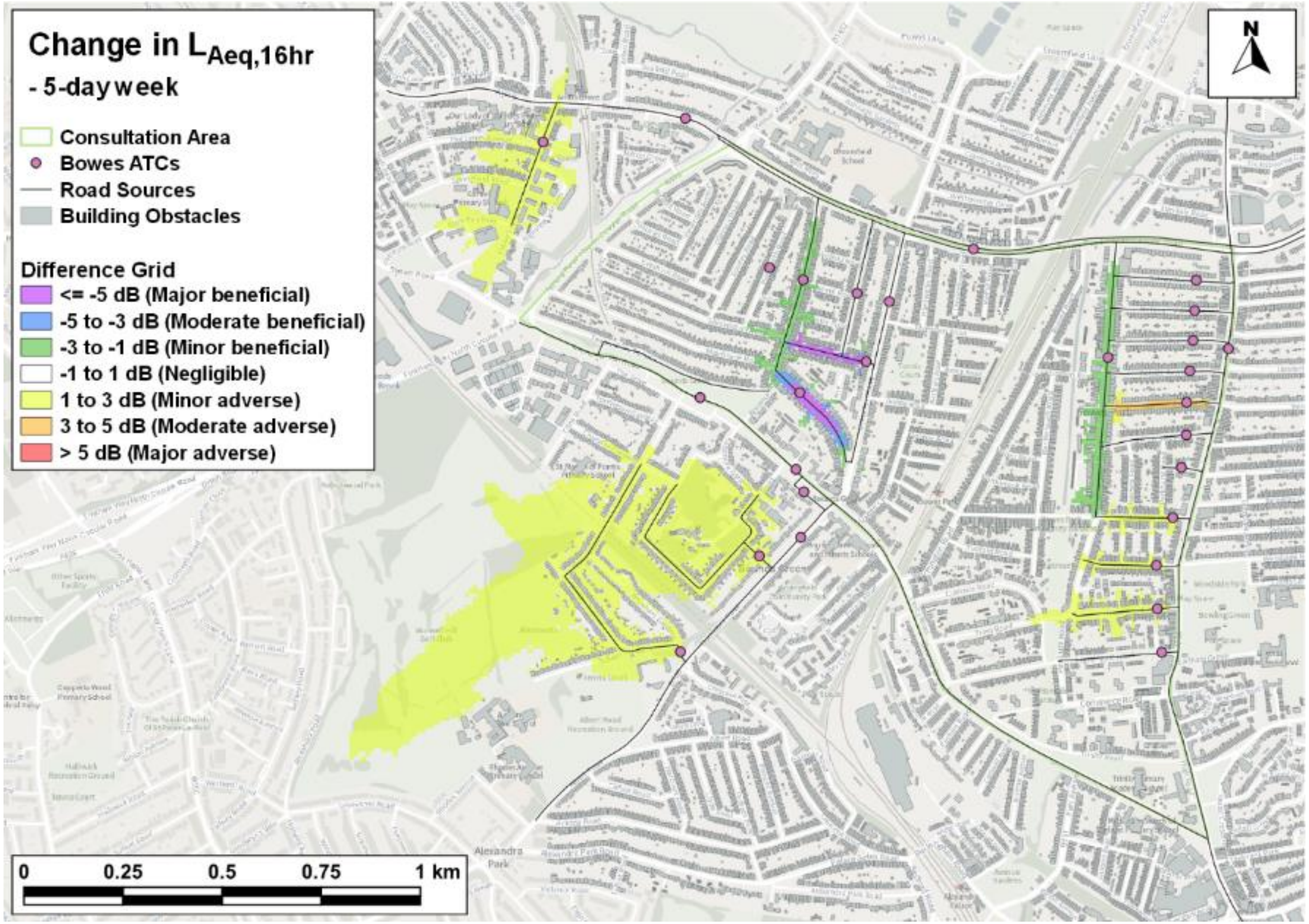

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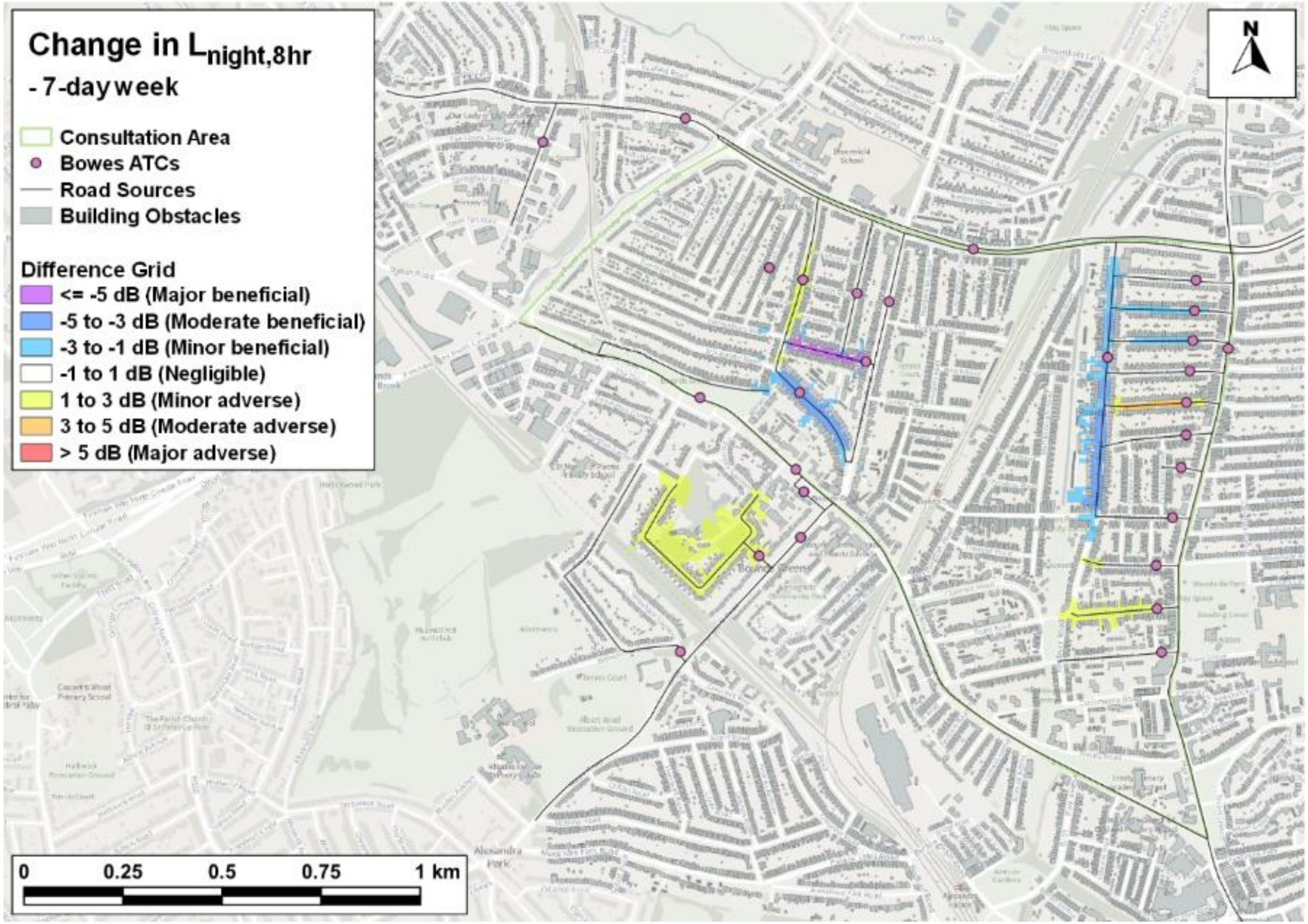

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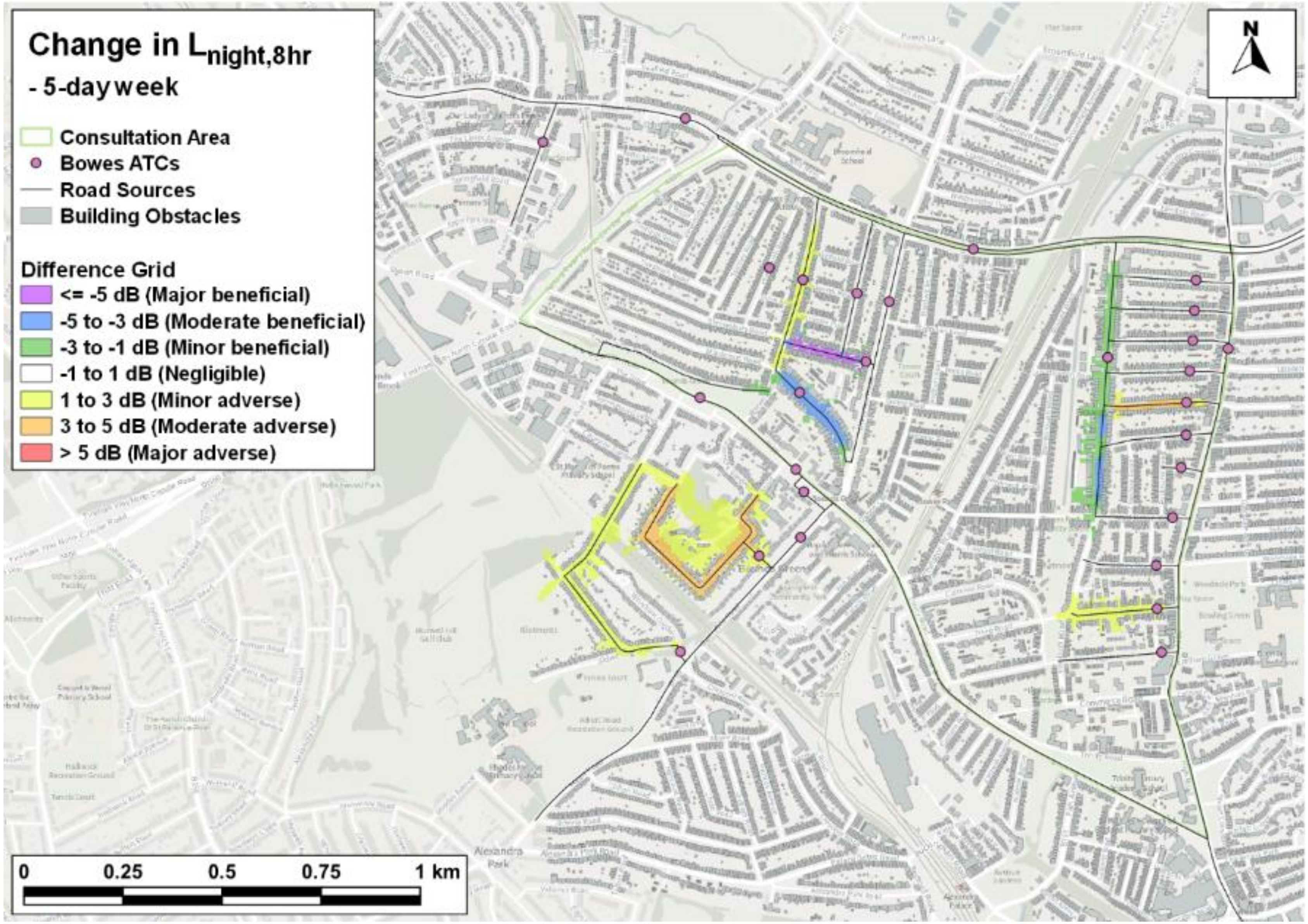

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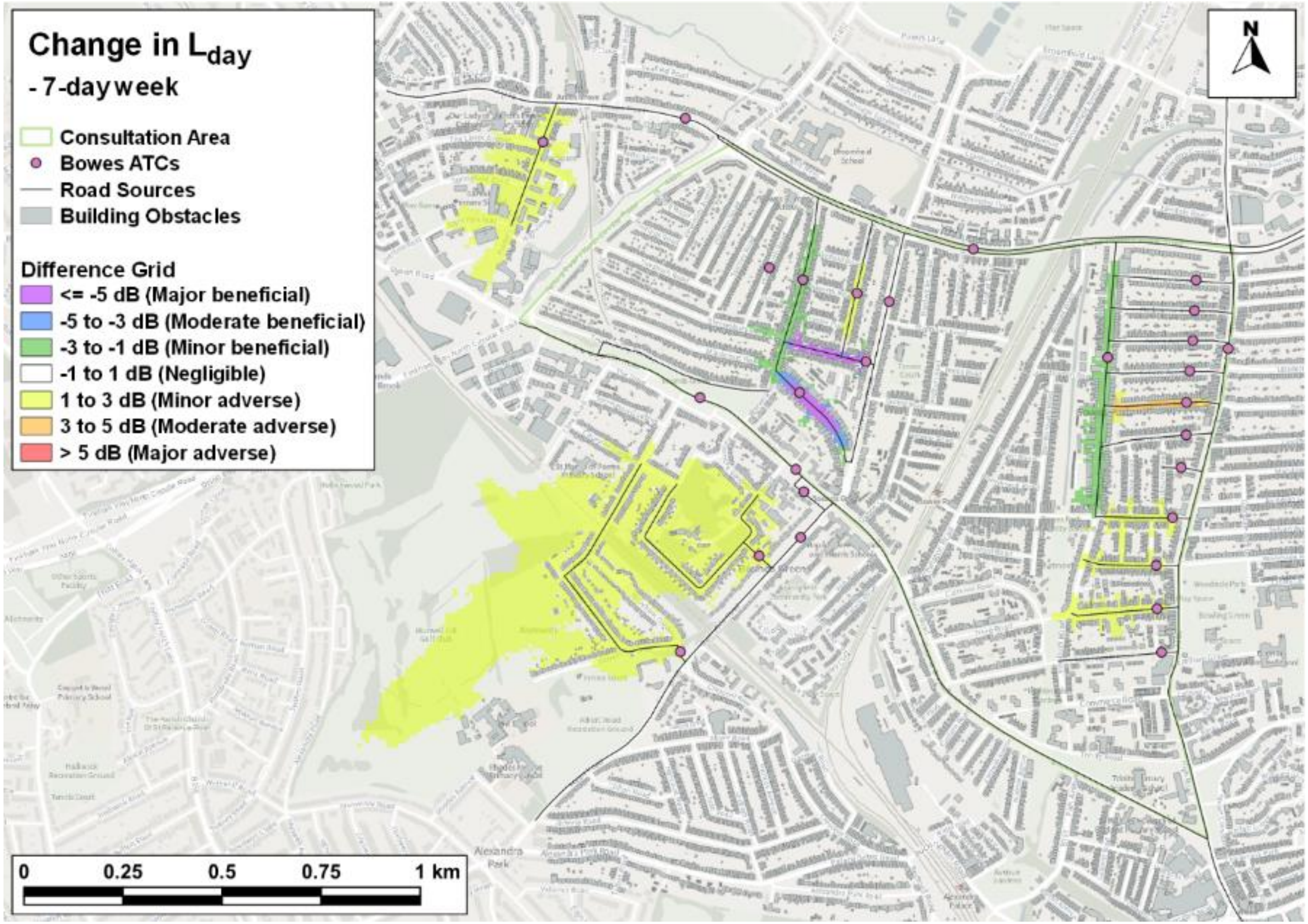

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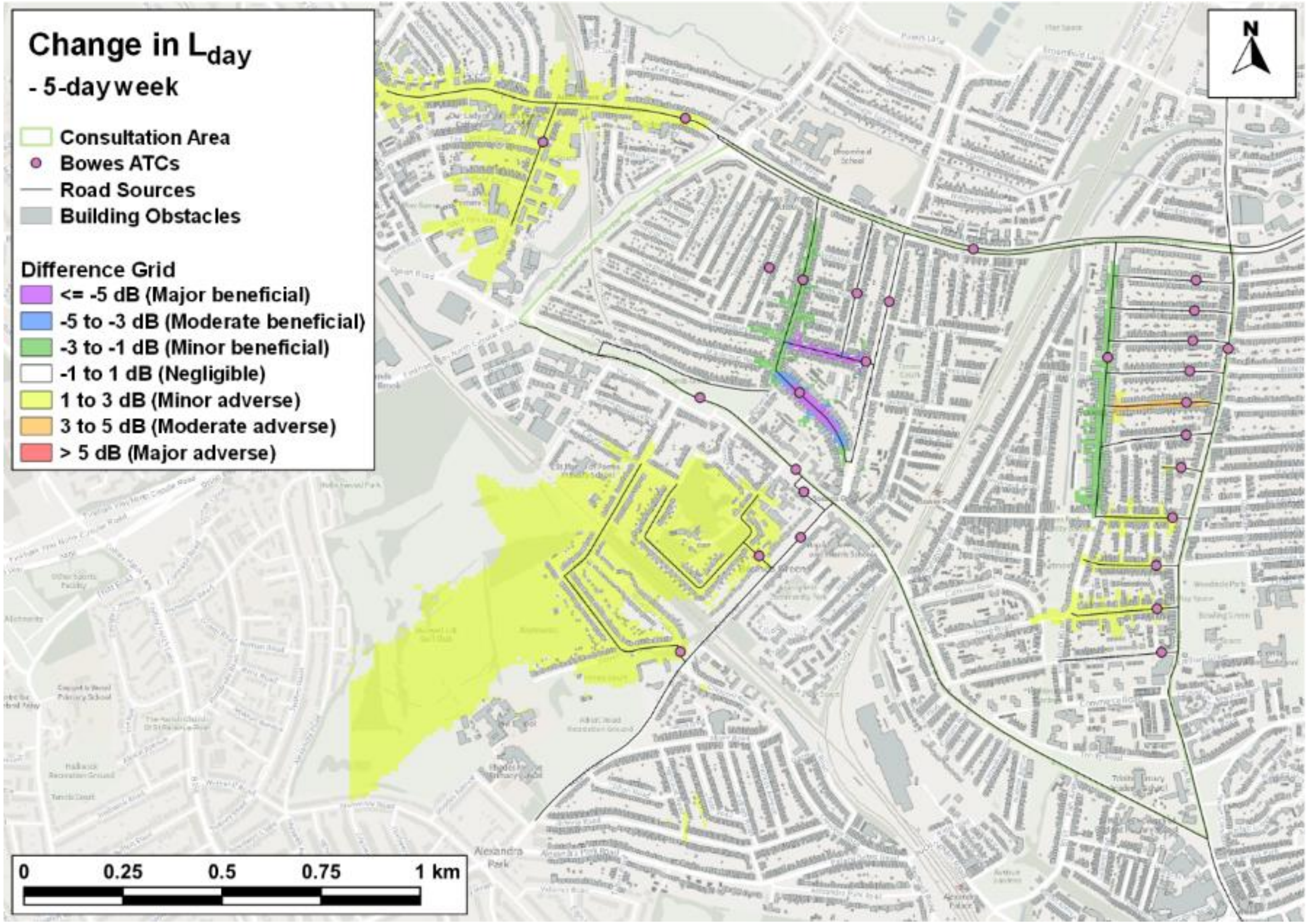

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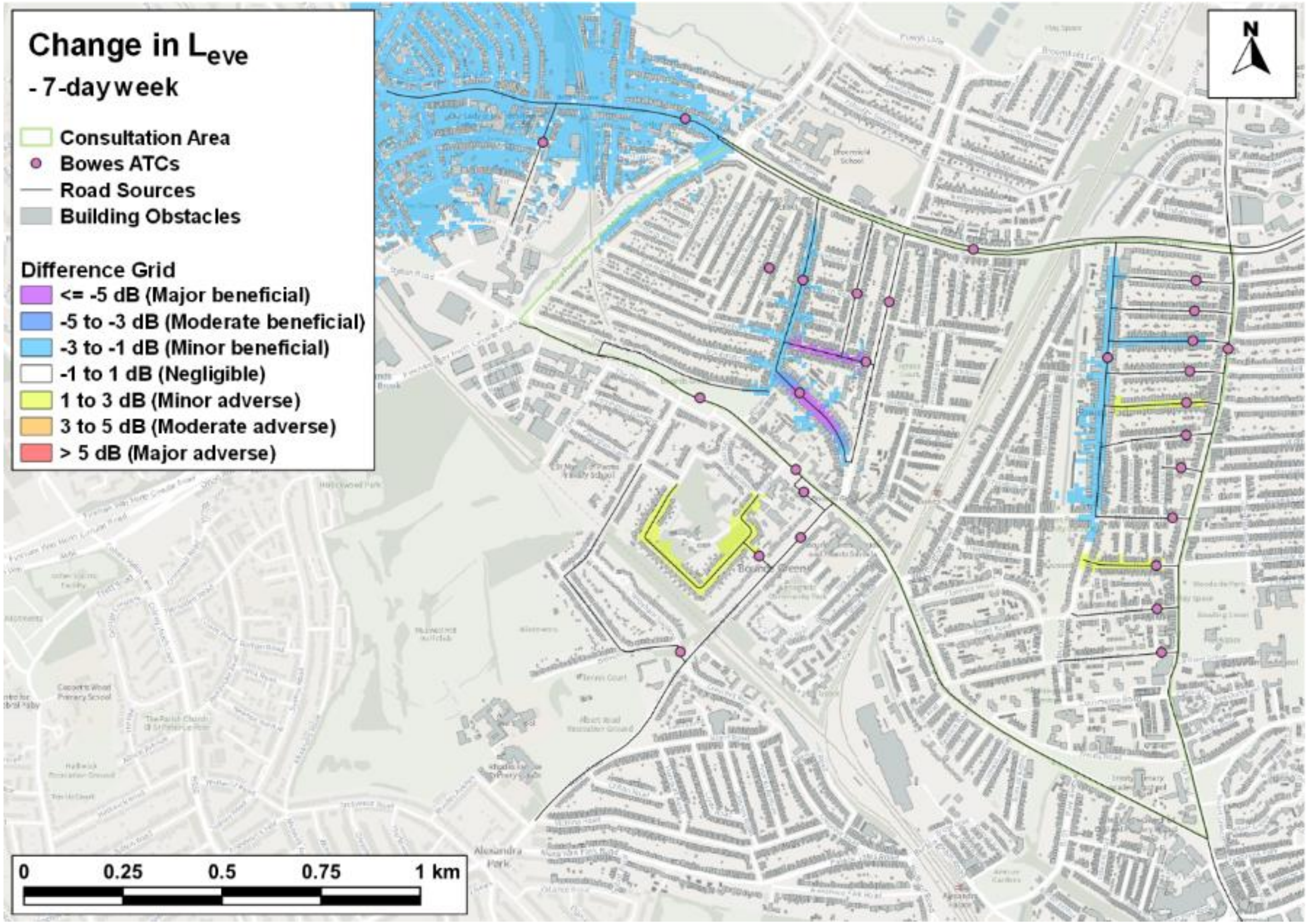

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Table A3.1: Absolute Noise Levels Before (July) and With the Scheme (November) for Road with Largest Predicted Changes, dB $L_{Aeq,T}$

		July				November			
		L_{day}	L_{eve}	L_{night}	$L_{Aeq,16hr}$	L_{day}	L_{eve}	L_{night}	$L_{Aeq,16hr}$
7-day week	**York Road**	73	67	64	72	71	64	62	70
	Maidstone Road	70	63	61	69	65	58	56	64
	Woodfield Way	70	62	59	69	72	63	61	71
	Palmerston Road	71	64	61	70	69	61	57	68
	Spencer Avenue	64	58	55	63	68	60	58	67
	Sidney Road	66	59	57	65	67	61	58	66
5-day week	**York Road**	74	67	65	73	72	65	62	71
	Maidstone Road	70	63	61	69	65	58	56	64
	Woodfield Way	71	63	59	70	73	63	62	72
	Palmerston Road	72	64	61	71	70	62	58	69
	Spencer Avenue	64	58	55	63	68	61	58	67
	Sidney Road	66	60	57	65	67	62	58	66

Table A3.2: Absolute Noise Levels for 7-day Week, dB dB $L_{Aeq,T}$

	July				November			
	L_{day}	L_{eve}	L_{night}	$L_{Aeq,16hr}$	L_{day}	L_{eve}	L_{night}	$L_{Aeq,16hr}$
Palmers Road	73.7	66.9	65.9	72.8	75.6	66.0	65.2	74.5
A1110 Bowes Road	81.3	77.9	74.9	80.7	82.2	75.2	74.0	81.3
Warwick Road	74.2	66.8	61.5	73.2	73.0	65.3	62.7	72.0
Natal Road	62.7	56.4	53.6	61.7	63.8	57.2	54.2	62.8
Brownlow Road	79.1	72.9	70.5	78.2	79.7	72.5	70.4	78.7
York Road	73.4	67.0	64.3	72.5	71.3	64.4	62.0	70.3
Maidstone Road	70.0	63.3	60.7	69.1	64.7	58.0	55.9	63.7
Bounds Green Road	83.0	76.9	76.0	82.1	83.4	76.4	75.8	82.5
Rhys Avenue	73.3	67.1	66.3	72.4	73.9	66.8	66.2	72.9
Durnsford Road	81.4	74.8	71.8	80.5	82.2	74.0	72.1	81.1
Woodfield Way	70.1	62.4	59.2	69.1	72.3	63.1	61.1	71.2
Palmerston Road	71.2	64.1	61.0	70.2	69.3	61.4	57.5	68.2
Green Lanes	83.3	78.6	77.9	82.5	83.7	78.3	77.4	82.9
Sidney Avenue	64.1	59.5	57.7	63.4	64.7	58.7	56.8	63.8
Melbourne Avenue	64.8	58.6	56.1	63.9	64.9	57.9	54.9	64.0
Spencer Avenue	64.1	57.6	55.0	63.1	67.6	60.3	58.0	66.6
Myddleton Road	70.0	64.6	61.6	69.2	71.3	64.6	61.9	70.4
Kelvin Avenue	68.9	62.8	59.8	68.0	68.6	61.5	58.8	67.6
Belsize Avenue	65.3	59.0	55.8	64.4	65.3	58.9	55.8	64.4
Lascott's Road	69.0	62.8	59.9	68.1	69.6	62.1	59.5	68.6
Marquis Road	65.8	59.8	57.3	64.9	66.8	59.7	56.7	65.8
Sidney Road	65.7	59.4	57.3	64.7	67.0	60.6	57.8	66.0
Truro Road	72.8	65.9	63.6	71.9	74.0	65.5	64.8	73.0
Nightingale Road	72.0	64.9	63.6	71.1	72.4	64.6	63.3	71.4
Wroxham / Bidwell Gdns	73.7	66.3	63.0	72.7	75.2	66.1	63.6	74.1
Tewkesbury Terrace	83.2	77.1	76.2	82.3	83.6	76.6	76.0	82.7
A406 Bowes Road / North Circular	88.2	84.7	83.2	87.5	88.5	84.3	82.7	87.8

Table A3.3: Absolute Noise Levels for 5-day Week, dB dB $L_{Aeq,T}$

	July				November			
	L_{day}	L_{eve}	L_{night}	$L_{Aeq,16hr}$	L_{day}	L_{eve}	L_{night}	$L_{Aeq,16hr}$
Palmers Road	74.2	67.2	66.2	73.3	76.4	66.0	65.5	75.3
A1110 Bowes Road	81.5	75.6	75.0	80.6	82.5	75.3	74.2	81.6
Warwick Road	74.9	67.2	60.9	73.9	73.3	65.3	62.8	72.3
Natal Road	63.1	56.5	53.5	62.2	64.0	57.4	54.2	63.1
Brownlow Road	79.4	72.9	70.7	78.4	80.0	72.6	70.8	79.0
York Road	73.8	66.9	64.5	72.8	71.5	64.6	62.3	70.5
Maidstone Road	70.4	63.2	60.8	69.4	65.1	57.7	56.1	64.1
Bounds Green Road	83.3	76.8	76.3	82.3	83.7	76.4	76.1	82.7
Rhys Avenue	73.6	67.1	66.7	72.7	74.1	66.8	66.6	73.1
Durnsford Road	81.7	74.8	71.9	80.7	82.5	74.2	72.6	81.5
Woodfield Way	70.7	62.6	59.3	69.6	72.8	63.3	61.6	71.8
Palmerston Road	71.6	64.3	61.0	70.6	69.7	61.8	58.0	68.7
Green Lanes	83.3	78.6	77.9	82.5	83.7	78.3	77.5	82.8
Sidney Avenue	64.0	59.6	57.5	63.3	64.8	58.8	56.8	63.9
Melbourne Avenue	64.9	58.5	55.8	64.0	65.1	57.7	55.0	64.1
Spencer Avenue	64.1	57.8	54.9	63.1	67.8	60.5	58.2	66.8
Myddleton Road	70.3	64.6	61.7	69.5	71.5	64.6	62.1	70.6
Kelvin Avenue	69.2	63.0	59.9	68.3	68.8	61.8	59.1	67.9
Belsize Avenue	65.4	59.2	55.9	64.5	65.4	59.2	56.1	64.5
Lascott's Road	69.1	62.8	59.7	68.2	69.9	62.0	59.5	68.8
Marquis Road	66.1	59.9	57.5	65.2	67.1	59.5	56.7	66.1
Sidney Road	66.2	59.7	57.4	65.3	67.3	62.0	57.7	66.4
Truro Road	73.4	65.3	64.3	72.3	74.7	66.2	65.7	73.7
Nightingale Road	72.9	65.2	64.0	71.9	72.8	64.7	63.6	71.8
Wroxham / Bidwell Gdns	74.1	66.4	63.1	73.1	75.6	66.1	64.0	74.5
Tewkesbury Terrace	83.5	77.0	76.5	82.5	83.9	76.6	76.3	82.9
A406 Bowes Road / North Circular	88.2	84.6	83.1	87.5	88.6	84.2	82.9	87.9

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