

9 Noise and Vibration

9.1 Introduction

- 9.1.1 This Chapter, which has been prepared by Waterman, provides further environmental information pursuant to the s.73 ES and presents the findings of updated noise modelling specifically of the operational noise and vibration impacts arising from the Scheme with detailed design of Phase 1A (North) elements in place (hereafter referred to as 'the Development') on existing and future sensitive receptors. The updated noise modelling has been undertaken on the basis of the outputs of further traffic modelling undertaken to inform the detailed highway design (the BXC – Detailed Design Model (BXC - DDM)).
- 9.1.2 A statement of conformity against the s.73 ES is provided for the noise and vibration construction impacts as these remain valid. There has been no change in the Indicative Construction Programme (ICP) or Construction Impact Assessment Addendum (CIA) which accompanied the s.73 (taking into account Planning Condition 4.2 of the 2014 Permission which amended the sub-phasing), as detailed in **Chapter 4**. The construction activities spatially and temporally therefore remain consistent with those reported in Chapter 9: Noise and Vibration of the s.73 ES Chapter.
- 9.1.3 Further baseline noise monitoring has also been undertaken since the s.73 ES was prepared which is presented in this Chapter.
- 9.1.4 This Chapter is supported by:
- **Appendix 9.1: Description of Noise and Vibration Units and Noise Monitoring Data** which presents the 2014 noise monitoring data and Appendix F of the s.73 ES is also appended to this for background information purpose;
 - **Appendix 9.2: Temporary Bus Station and Bus Stops Noise Assessment;**
 - **Appendix 9.3: Operational Road Traffic Noise Assessment;**
 - **Appendix 9.4: Planning Condition 29.1 Acoustic Design Report: Plots 53 and 54** (Buro Happold);
 - **Appendix 9.5: Traffic Data for Noise Modelling Phase 1A North;** and
 - **Appendix 9.6: M1/A406 Noise Assessment.**

9.2 Policy, Legislation and Guidance

- 9.2.1 A summary of national, regional and local planning policy and guidance documents of relevance to this assessment is provided below. Those documents which have been published since the s.73 ES include:
- Revised Early Minor Alterations to the London Plan, October 2013;
 - Draft Revised Further Alterations to the London Plan, Draft July 2014;
 - IEMA Guidelines for Environmental Noise Assessment, 2014;
 - National Planning Practice Guidance, 2014;
 - Mayor of London, Sustainable Design and Construction Supplementary Planning Guidance, 2014; and
 - British Standard 8233 – Guidance on Sound Insulation and Noise Reduction for Buildings, 2014.

National Planning Policy

National Planning Policy Framework, 2012

- 9.2.2 The National Planning Policy Frameworkⁱ (NPPF) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF is a material consideration in planning decisions. With regard to noise the NPPF states that:

"The planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of noise pollution."

In support of this, paragraph 123 states that planning decisions should aim to:

"avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development;...and

identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason".

- 9.2.3 Annex 3 of the NPPF states that the document replaces Planning Policy Guidance 24 'Planning and Noise' (PPG24)ⁱⁱ but falls short of providing any specific technical guidance.
- 9.2.4 Web based guidance on the NPPF, the National Planning Practice Guidance, has been issued with regard to noiseⁱⁱⁱ although it does not explicitly state acceptable construction noise levels or indeed acceptable operational noise levels in the context of maintaining existing residential or commercial amenity. The National Planning Practice Guidance does outline the qualitative effects of noise exposure and what action should be taken (See 'Guidance' below).

Noise Policy Statement for England, 2012

- 9.2.5 The Noise Policy Statement for England (NPSE)^{iv} sets out the long term vision of Government noise policy as follows:

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

- 9.2.6 The policy aims, through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development, to:
- Avoid significant adverse impacts on health and quality of life;
 - Mitigate and minimise adverse impacts on health and quality of life; and
 - Where possible, contribute to the improvement of health and quality of life.

Regional Planning Policy

The London Plan: Spatial Development Strategy for Greater London, July 2011

- 9.2.7 The London Plan^v contains a number of policies pertaining to noise, not all of which are relevant to the Development. Policy 7.15 states:

"The transport, spatial and design policies of this plan would be implemented in order to reduce noise and support the objectives of the Mayor's Ambient Noise Strategy."

- 9.2.8 Additionally, the policy seeks to reduce noise by separating new noise sensitive development from major sources wherever practicable and containing emissions from noisy activities, and, where

appropriate, promoting well-managed designated tranquil locations and the protection of 'quiet areas'.

Revised Early Minor Alterations to the London Plan, 2013

- 9.2.9 The Revised Early Minor Alterations to the London Plan^{vi} makes no amendments or alterations to any noise policies stated within the London Plan.

Draft Revised Further Alterations to the London Plan, 2014

- 9.2.10 The Draft Revised Further Alteration to the London Plan proposes no change to Policy 5.3 'Sustainable Design and Construction' and Policy 7.7 Section D. Proposed changes to the wording of Policy 7.15 are detailed with an emphasis on the "management of noise". The revised wording is as follows:

- 9.2.11 Policy 7.15 'Reducing and Managing Noise, Improving and Enhancing the Acoustic Environment and Promoting Appropriate Soundscapes.'

"Strategic A *The transport, spatial and design policies of this plan will be implemented in order to reduce and manage noise to improve health and quality of life and support the objectives of the Mayor's Ambient Noise Strategy.*"

"Planning decisions B. *Development proposals should seek to manage noise by*

- a) *avoiding significant adverse noise impacts on health and quality of life as a result of new development;*
- b) *mitigating and minimising existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business;*
- c) *improving and enhancing the acoustic environment and promoting appropriate soundscapes (including identifying and protecting Quiet Areas and spaces of relative tranquillity);*
- d) *separating new noise sensitive development from major noise sources (such as road, rail, air transport and some types of industrial development) through the use of distance, screening or internal layout – in preference to sole reliance on sound insulation;*
- e) *where it is not possible to achieve separation of noise sensitive development and noise sources, without undue impact on other sustainable development objectives, then any potential adverse effects should be controlled and mitigated through the application of good acoustic design principles;*
- f) *having particular regard to the impact of aviation noise on noise sensitive development;*
- g) *promoting new technologies and improved practices to reduce noise at source, and on the transmission path from source to receiver.*

The Mayor's Ambient Noise Strategy, 2004

- 9.2.12 The Mayor's Ambient Noise Strategy^{vii} sets out 97 policies and 28 proposals for protecting and improving noise environments within London, with particular regard to roads, railways and aircraft. The Mayor also seeks to build a more sustainable City, which is more compact, thus requiring exemplary standards of acoustic design, including better sound insulation for new homes. In addition, the Strategy stipulates that any adverse noise impact from a proposed development must be minimised both within, and in the vicinity of, the development.

Local Planning Policy

Core Strategy and Development Management Policies Documents, 2012

- 9.2.13 Core Strategy^{viii} Policy CS13: Ensuring The Efficient Use of Natural Resources details that noise impact assessments are required for developments in-line with Barnet's Supplementary Planning Document (SPD) on Sustainable Design and Construction^{ix}.

Barnet's Local Plan Development Management Policies, 2012

- 9.2.14 Development Management^x Policy DM04: Environmental Considerations states:

"Proposals to locate development that is likely to generate unacceptable noise levels close to noise sensitive uses will not normally be permitted. Proposals to locate noise sensitive development in areas with existing high levels of noise will not normally be permitted. Mitigation of noise impacts through design, layout, and insulation will be expected where appropriate."

Local Plan Supplementary Planning Document Sustainable Design and Construction, 2013

- 9.2.15 Within the Local Plan SPD^{xi} it recognises that noise can be a significant nuisance in urban areas stating that; *"persistent and intermittent noises and vibrations, such as those made by traffic, building services plant, sound systems, construction activities or other people, can undermine quality of life for those who live, work and visit the borough"*.
- 9.2.16 Within Section 2.14 entitled Noise Quality it sets out the requirements to protect amenity. LBB has adopted the former Noise Exposure Categories of PPG24 when determining applications for residential developments. Further to this it lists a set of 'Noise Design Principles' such as location of development, internal layouts, exposure within buildings and appropriate noise insulation having regard to guidance within BS8233 'Guidance on sound insulation and noise reduction for building'.
- 9.2.17 The SPD details that noise from plant or machinery should be 5dB below the background noise level (L_{A90}) at 1 metre from the window of any room of a neighbouring property.

Guidance

IEMA Guidelines for Environmental Noise Assessment, 2014

- 9.2.18 The IEMA Guidelines for Environmental Noise Assessment^{xii} address the key principles of noise impact assessment and are applicable to all development proposals where noise effects may occur.
- 9.2.19 The guidance provides advice with regards to the collection of baseline noise data, prediction of noise levels and how noise should be assessed. The guidance recognises that the effect associated with a particular noise impact will be dependent on a number of factors including but not limited to the sensitivity of the receptor, frequency and duration of the noise source and time of day. However, it stops short of providing specific assessment criteria which developments should achieve but instead suggests that the methodology adopted should be selected on a site by site basis with reference to relevant national and local standards.

National Planning Practice Guidance – Noise, 2014

- 9.2.20 The National Planning Practice Guidance – Noise^{xiii} is web based guidance on the NPPF. It outlines qualitatively when noise could be a concern and states that:

"Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. When preparing local or

neighbourhood plans, or taking decisions about new development, there may also be opportunities to consider improvements to the acoustic environment.”

Mayor of London, Sustainable Design and Construction Supplementary Planning Guidance, 2014

- 9.2.21 The Mayor’s Supplementary Planning Guidance (SPG)^{xiv} entitled Sustainable Design Construction does not contain reference to the Mayor’s essential and preferred standards contained within the 2006 SPG. The 2014 SPG contains general references to noise within Section 4.4 Noise such as developments should reduce noise at source, contain noise sources and protect noise sensitive receptors through improved sound insulation. Other design consideration include increasing distance separation between source and sensitive receptor, design layout, administration measures and stepping back of building profile at higher levels.

[British Standard 5228 - Code of Practice for Noise and Vibration Control on Construction and Open Sites, Part 1: 2009+A1:2014 and Part 2: 2009](#)

- 9.2.22 BS 5228:2009^{xv} provides guidance on the assessment of noise and vibration effects during the redevelopment of a site, including procedures for estimating noise levels from construction activities and vibration attributable to vibratory rolling and piling activities. The guidance does not define acceptable limits. However, it does provide potential methods for assessing the significance of noise and vibration effects, which should be defined on a site-specific basis. BS 5228:2009+A1 2014 also provides guidance on minimising potential effects through the use of mitigation and the adoption of Best Practicable Means (BPM).

[British Standard 6472 – Guide to Evaluation of Human Exposure to Vibration in Buildings. Part 1: Vibration Sources Other Than Blasting, 2008](#)

- 9.2.23 BS 6472-Part 1^{xvi} provides guidance on the magnitude of vibration, expressed as a Vibration Dose Value (VDV) at which adverse comment might begin to arise and is referred to in BS5228-2:2009.

[British Standard 7385– Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Groundborne Vibration, 1993](#)

- 9.2.24 BS 7385-2^{xvii} provides guidance on the levels of vibration expressed as peak particle velocity (PPV) at which cosmetic damage is likely to occur within buildings.

[British Standard 8233 – Guidance on Sound Insulation and Noise Reduction for Buildings, 2014](#)

- 9.2.25 BS 8233:2014 ‘Guidance on sound insulation and noise reduction for building’^{xviii} provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building. The criteria relevant to the Development are presented in **Table 9.1**.

Table 9.1: BS8233:2014 Guideline Values

Activity	Location	Daytime 07:00 – 23:00	Period	Night-Time 23:00 – 07:00	Period
Residential Areas					
Resting	Living room	35 dB L _{Aeq,16h}		-	
Dining	Dining room/area	40 dB L _{Aeq,16h}		-	
Sleeping	Bedroom	35 dB L _{Aeq,16h}		30dB L _{Aeq,8h} ^[1]	

Note: [1] - Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or L_{Amax,F}, depending on the character and number of events per night. Sporadic noise events could require separate values.

9.2.26 With regard to external noise levels, BS 8233:2014 states:

“external areas that are used for amenity space, such as gardens and patios, it is desirable that the external noise level does not exceed 50 dB L_{Aeq,T}, with an upper guideline value of 55 dB L_{Aeq,T} which would be acceptable in noisier environments. However, it is also recognized that these guideline values are not achievable in all circumstances where development might be desirable”.

World Health Organisation – Guidelines for Community Noise, 1999

9.2.27 The World Health Organisation (WHO)^{xix} document provides guidance of a similar nature to BS 8233:2014, although it places more emphasis on the potential health effects associated with noise. Specifically, the document recommends internal and external noise levels that will provide an acoustic environment that is conducive to uninterrupted speech and sleep. Daytime noise limits aim to prevent the majority of the population being moderately or seriously annoyed by noise. Night-time noise limits are intended to ensure a good night’s sleep.

British Standard 4142 - – Method for Rating and Assessing Industrial and Commercial Sound, 2014

9.2.28 BS4142^{xx} has been updated since submission of the s.73 ES. It still provides a method for assessing the impact of industrial noise but includes changes to the assessment criteria.

9.2.29 The main changes to the replaced 1997 version are that it now encompasses commercial noise although there is no definition of what this includes; a 5dB reduction in the background and rating level where BS4142 is not applicable; increase in the night-time reference time from 5 minutes to 15 minutes and changes to determination of the rating noise level. Further to this, reference to “complaints likely/unlikely has been removed and replaced with the term “significant adverse impact” and “adverse impact”

Calculation of Road Traffic Noise (CRTN): 1988

9.2.30 The guidance provided within CRTN^{xxi} provides a method for the calculation of road traffic noise levels, taking into account factors such as distance between the road and receptor, road configuration, ground cover, screening, angle of view, reflection from façades and traffic flow, speed and composition. The noise parameter calculated is the L_{A10-18 hour} and is based on the 18 hour Annual Average Weekday Traffic (18hr-AAWT).

Legislation and Policy Overview

9.2.31 Both national and local planning policy contains provisions to safeguard the amenity of existing and future sensitive receptors from potential adverse noise effects associated with new development. These policy provisions are complemented by the noise assessment mechanisms and standards contained within the suite of relevant British Standard Guidelines. Together, these documents

should ensure that appropriate safeguards are in place to protect sensitive receptors during both the construction and operation of proposed developments.

9.3 Relevant Phase 1A (North) RMA Details

9.3.1 This assessment considers the noise and vibration impacts of the Development as a whole (including the detailed design of Phase 1A (North)) based on updated traffic modelling and baseline monitoring. Modelling and assessment incorporates the detailed highway design and layout as defined by the Phase 1A (North) RMAs and assumes the low noise surface for the A406 (as described in the s.73 ES), details for Plots 53 and 54 and open space and an assumption regarding the A406 acoustic barrier as per the s.73 ES and as detailed in a design report provided by Buro Happold (dated November 2014). With regard to the A406 low noise surface, a road surface correction of minus 2.5dB is included within the noise modelling as an assumption. The location and height detail of the acoustic road side barrier is consistent with information provided by URS.

9.3.2 The RDSF defined Noise and Vibration Standards for the Development as follows:
“Long term daytime and night time noise levels at residential properties will be within Noise Exposure Categories B to D as described in Planning Policy Guidance 24 (1994, although formally withdrawn, still relevant in this context). Mitigation measures will be applied in line with the principles of the Noise Policy Statement for England at the detailed design stage to create acceptable noise conditions. Wherever potential noise levels are within Categories B, C or D mitigation measures will be applied at the detailed design stage to create acceptable noise conditions within buildings.

Internal noise levels within residential units will meet the ‘good’ standard in Table 5 of BS 8233 (BS 8233, 1999; Sound insulation and noise reduction for buildings. Code of Practice), or an equivalent contemporaneous standard, wherever practicable, and will meet the ‘reasonable’ standard throughout.

The new track works within the Railway Lands zone and adjacent to the Station Quarter zone will be designed to ensure vibration levels at adjacent sensitive receptors comply with the Vibration Dose Value standards given in BS 6472 (BS 6472 Guide to evaluation of human exposure to vibration in buildings; Part 1, vibration sources other than blasting, 2008).”

9.4 Assessment Methodology

9.4.1 This section presents the methodology used to assess the potential noise and vibration impacts the application of the standards and guidance (as detailed above) used, the types of data and analyses carried out and the derivation of the presented impact significance, or compliance criteria used in the assessments. Potential impacts are assessed for the construction and operational phase with the Development in place (referred to hereafter as ‘Do Something’) and without the Development in place (referred to hereafter as ‘Do Minimum’).

Scope of Assessment

9.4.2 The scope of this assessment is effectively the same as that of the s.73 ES albeit that updated baseline and assessment results are presented. The assessment has included the following tasks:

- Confirming that the potentially sensitive existing and future noise sensitive receptors on the Site and within the surrounding area as identified in the s.73 ES remain valid;
- Updating baseline noise and vibration conditions currently existing at the Site and at sensitive receptors in the surrounding area through direct measurements;

- Review and assessment of the s.73 ES to confirm that the potential noise and vibration levels generated during the demolition and construction works associated with the Development remain valid - a statement of conformity is provided.
- Impact of the Temporary Bus Station and Bus Stops, which will be required during the construction phase until the opening of the new permanent bus station (**Appendix 9.2**);
- Assessment of the potential noise impacts from forecast road traffic flows and composition during operation of the Development based on updated traffic data (**Appendix 9.3**);
- Assessment of the suitability of the Site (namely Brent Terrace Plots 53 and 54) for residential development in terms of the prevailing noise conditions having regard to the Acoustic Design report by Buro Happold (**Appendix 9.4**);
- Assessment of the suitability of the detailed design of the open spaces which form part of the Phase 1A (North) RMAs;
- Confirming that design aims for plant and services as identified in the s.73 ES remain valid for proposed new buildings at the Site – statement of conformity provided;
- Assessment of potential noise and vibration impacts from the new small-scale CHP on Plots 53 and 54 – statement of conformity.
- Assessment of potential noise and vibration from the new freight and waste handling facilities and trains serving them – statement of conformity;
- Assessment of the potential noise impact from sports usage of designated open spaces, namely Clitterhouse Park Playing Fields;
- Providing proposals for mitigation, where appropriate (i.e. over and above that identified in the s.73 ES); and
- Assessing the potential significance of residual noise and vibration effects.

Baseline Conditions

- 9.4.3 Since submission of the s.73 ES, further baseline noise monitoring has been undertaken at the Site by Waterman to supplement the noise data presented in the s.73 ES and to further inform the noise assessment. Further details are provided under 'Baseline Conditions'.

Construction

Noise & Vibration

- 9.4.4 In terms of construction noise and vibration effects the s.73 ES was based on typical plant associated with the key construction phases. There is no change to the assessment method of the construction phase to that detailed within the s.73 ES despite the replacement of BS5228-1:2009 with BS5288-1:2009+A1:2014. The assessment methodology of the s.73 ES therefore remains valid.
- 9.4.5 Construction traffic data remains unchanged from that presented in the Construction Impact Assessment (CIA) Addendum (**Appendix 2.2**) and as assumed in the s.73 ES and Consolidated Transport Report (**Appendix 7.2**). This is due to the Indicative Construction Programme (ICP) and the CIA as per the 2014 Permission remaining valid. A statement of conformity is therefore provided in this chapter stating why construction noise and vibration effects remain valid and no further assessment is provided.

Temporary Bus Station and Bus Stops

- 9.4.6 The potential impacts of the Temporary Bus Station and Bus Stops proposed as part of the construction phase at Plot 114 (bus station) and Plot 113 (bus stops) have been assessed by predicting the potential change in the prevailing noise level at the nearest sensitive receptors of Brent Park Road and Layfield Close respectively. CADNA-A noise modelling software has been used to predict operational noise levels using source noise data measured by Waterman at the existing bus station and operational information provided by URS together with layout designs detailed in drawings 1466 Rev 02 and 1470 Rev 02. The full methodology and assessment of the Temporary Bus Station and Bus Stops is provided in **Appendix 9.2**.
- 9.4.7 It should be noted that comparison of the predicted Temporary Bus Station and Bus Stops noise emissions have been made with the prevailing ambient noise levels measured in 2014. This approach is conservative as the Temporary Bus Station and Bus Stops operations are based on 2019 forecast operations when prevailing noise levels are slightly higher due to increases in road traffic noise on the surrounding road network.
- 9.4.8 In accordance with the requirements of Environmental Health of LBB, the potential impact during the night-time periods of 0500-0600 and 0600-0700 have been assessed with daytime assessment based on the maximum forecast hourly flow of 154 bus movements.
- 9.4.9 The assessment criteria used to assess the potential impact from the Temporary Bus Station and Bus Stops are presented as **Table 9.2**.

Table 9.2: Temporary Bus Station and Bus Stops Impact Criteria

Noise Change dB(A)	Perception of Change	Impact
0 to <3	Imperceptible	Negligible
3 to 5	Perceptible	Minor
>5 to <10	Increase in perception	Moderate
≥10	Subjectively perceived as doubling or halving of noise	Substantial

- 9.4.10 Potential impacts resultant from vibration have not been considered due to the off-set distance from source to receiver being greater than 10 metres, which means that significant impacts are unlikely. Impact from vibration generally occurs where there are irregularities in the road surface and where the vehicle passes relatively close to the receptor.

Operational Development Noise and Vibration

- 9.4.11 Operational traffic data used in the s.73 ES were based on the outputs of the BXC Transport Model (BXC – TM) and were assessed for the year of completion 2031.
- 9.4.12 The decision was made to update the traffic data from the Transport Model (BXC -TM) as previously used in the s.73 ES, which remains a robust tool to estimate the future transport impacts of the Development on both the highway network and the public transport network. As the Scheme has progressed into detailed design and technical approvals, a further transport model (the BXC- DDM) was developed in agreement with Transport for London (TfL), the Highways Agency (HA) and LBB principally for technical approvals for the highway authorities' functions. The opportunity has therefore arisen to use this new model to examine any impacts on the local roads within the study area of the A5 Corridor Study, the junction assessment report for the Phase 1A (North) Reserved Matters Transport Report and to provide traffic data from the BXC-DDM for the updated noise and air quality assessments for the ES Further Information Report.

9.4.13 The BXC - DDM has a significantly increased level of detail of both existing and forecast traffic movements on the local roads within the study area by means of a greater level of zonal disaggregation. This greater level of detail on local roads has been made possible by use of TfL's new North London Highway Assignment Model (NoLHAM) when preparing the BXC – DDM. A good level of agreement in the detailed design assessed by the BXC - DDM and the previous preliminary assessments of the BXC TM strategic model have been observed by URS (refer to **Chapter 7: Traffic and Transport** for further details). The BXC – DDM also includes the detailed highway design and layout as defined in these RMAs and therefore reports of the traffic flows with the Phase 1A (North) details in place.

Road Traffic Noise

9.4.14 Operational road traffic noise levels from the Development have been assessed by considering the increase in traffic flows and changes in composition and speed following the principles of the CRTN. Calculations have been undertaken for the year of completion of the whole Development (2031) only as per the s.73 ES. The change in noise level is determined by comparing the 'with' and 'without' Development scenarios. A separate assessment of the M1/A406 junction with the approved improvements in place has also been undertaken in accordance with Design Manual for Roads and Bridges (DMRB) methodology to satisfy the requirements of the Highways Agency. This assessment was undertaken at the specific request of the Highways Agency in relation to this area being designated as a First Priority Location by Defra (Department for the Environment and Rural Affairs) during the Round 1 Strategic Noise Mapping (in terms of the LA_{10,18hr} indicator) assessment and is included at **Appendix 9.6**.

9.4.15 Noise impacts arising from road traffic have been assessed in accordance with the significance criteria detailed in **Table 9.3**. These significance criteria are widely used by acoustic practitioners and are based on the subjective response of people to noise in that a change of 1dB(A) is only perceptible under laboratory condition, a change of 3dB(A) is generally accepted as the minimum noticeable change in environmental noise whereas a noise level change of 10dB(A) is generally perceived as a doubling or halving of the noise level.

9.4.16 Initial calculations were undertaken to identify those roads where a change in noise level of greater than 1dB would be expected. Where an increase in noise levels of greater than 1dB was predicted those links were modelled in detail using the software package CADNA-A. CADNA-A is an internationally recognised noise modelling software. It allows 3-dimensional models to be constructed of the site, including roads, rail and buildings. CADNA-A uses recognised algorithms within the field of acoustics to predict noise levels and subsequent contour plots.

9.4.17 The s.73 Scheme (with parameters of the 2014 Permission) along with the Phase 1A (North) RMAs were applied to the CADNA-A model to represent the latest available details of the Development.

9.4.18 Subsequently noise contour Plots were prepared for 'Do Minimum' and 'Do Something' scenarios for 2031. The model was prepared to allow a more accurate assessment of potential noise level changes resulting from changes in road traffic composition and changes to the infrastructure, including low noise surface for the A406 and the intervening landscape which form part of the Development. As previously mentioned, to take account of the low noise surface of the A406, a minus 2.5dB surface correction was included within the CADNA-A noise model. The location and height of the acoustic barrier was confirmed by information supplied by URS, but in summary was located on the southern roadside of Prince Charles Drive at a height of 2 metres above ground level. Further details of the acoustic barrier will be provided to LBB for approval under Planning Condition 29.10). For road links beyond the extents of the noise model but considered as part of the BXC –

DDM model, the potential noise impacts were ascertained using the basic noise level calculation procedures set out in CRTN in an Excel spreadsheet.

- 9.4.19 Where impacts are predicted to occur then the proximity of the road link to noise sensitive receptors (NSRs) was taken into account as well as its proximity to other roads which may dominate the noise climate in that area, thereby rendering the predicted impact as environmentally benign and therefore negligible.

Table 9.3: Road Traffic Noise Impact Criteria

Noise Change dB(A)	Perception of Change	Impact
0 to <3	Imperceptible	Negligible
3 to 5	Perceptible	Minor
>5 to <10	Increase in perception	Moderate
≥10	Subjectively perceived as doubling or halving of noise	Substantial

Residential Amenity

- 9.4.20 The assessment of the suitability of the Site for residential development in terms of the proposed Phase 1A (North) development Plots 53 and 54 and the Maximum Height Parameters (using illustrative building footprint) for the remainder of the Scheme where residential use is, has been undertaken. Illustrative building footprints were used as the maximum footprints would cause buildings to overlap and thus render the model inaccurate. The predicted 2031 prevailing noise levels have been compared with the standards set out in the 2014 Permission as well as LBBs SPD on Sustainable Design and Construction which adopts the Noise Exposure Categories (NEC) of the former PPG24 and makes reference to BS8233.
- 9.4.21 The NEC Categories which LBB refer to when determining residential amenity are presented as **Table 9.4** and **Table 9.5**.

Table 9.4: LBB Adopted Noise Exposure Categories for Residential Development

Noise Exposure Categories	Advice for New Dwellings
A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
B	Noise should be taken into account when determining planning applications, and where appropriate, conditions imposed to ensure an adequate level of protection.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Table 9.5: Noise Levels Corresponding to NECs for New Dwellings

Noise Levels ^[1] According to NECs dB LAeq,T				
Noise Exposure Category				
Noise Source	A	B	C	D
Road Traffic				

Noise Levels ^[1] According to NECs dB L _{Aeq,T}				
Noise Exposure Category				
Noise Source	A	B	C	D
0700-2300	<55	55-63	63-72	>72
2300-0700 ^[2]	<45	45-57	57-66	>66
Rail Traffic				
0700-2300	<55	55-66	63-74	>74
2300-0700 ^[2]	<45	45-59	59-66	>66
Air Traffic^[3]				
0700-2300	<57	57-66	66-72	>72
2300-0700 ^[2]	<48	48-57	57-66	>66
Mixed Source^[4]				
0700-2300	<55	55-63	63-72	>72
2300-0700 ^[2]	<45	45-57	57-66	>66

[1] Noise levels: the noise level(s) (L_{Aeq,T}) used when deciding the NEC of a site should be representative of typical conditions.

[2] Night-time noise levels (2300-0700): sites where individual noise events regularly exceed 82dB L_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C regardless of the L_{Aeq,8h} (except where the L_{Aeq,8h} already puts the site in NEC D).

[3] Aircraft noise: daytime values accord with the contour value adopted by the DoT which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2dBA higher than those of other sources because of ground reflection effects

[4] Mixed sources: this refers to any combination of road, rail, air and industrial noise sources. The “mixed source” values are based on the lowest numerical values of the single source limits in the table. The “mixed source” NECs should only be used where no individual noise source is dominant.

- 9.4.22 Noise modelling software has been used to predict the prevailing noise levels in 2031 for the day and night-time periods. This includes noise emissions from key roads and the Midland Main Line. Noise from key roads has been determined from traffic data provided by URS. Noise from the Midland Main Line remains unchanged from the s.73 ES therefore the CADNA-A noise model has been calibrated to the s.73 ES detailed noise emission from this source. In line with the s.73 ES noise from the proposed Waste Handling Facility and energy centres (not part of the Phase 1A (North) RMAs) which will serve the Development as a whole is not considered likely to constitute significant environmental effects on the basis that it is assumed that plant is designed to ensure noise emission from plant and buildings are no higher than 5dB below existing background (L_{A90}) noise levels at the nearest noise-sensitive buildings (as detailed within s.73 ES) and as such will not influence the ambient noise climate or constitute a likely significant environmental effect. This criteria is in line with the requirements of the Planning Conditions 29.5 attached to the 2014 Permission.
- 9.4.23 With regard to Plots 53 and 54, Planning Condition 29.1 has to be satisfied. This will also apply to the other residential elements of the Scheme as they are brought forward at RMA stage.
- 9.4.24 Planning Condition 29.1 states:

“Prior to, or coincident with the submission of any Reserved Matters Application for residential uses, the Acoustic Design Report shall be submitted to and approved by the LPA describing the design features that have been used to achieve good internal noise standards with reference to BS8233 as referred to in Paragraph 2.82 of the DSF. The report shall demonstrate that the following hierarchy

of noise mitigation measures has been considered so that the use of noise insulation, whilst necessary in some areas, is minimised:

- a) Site layout to locate non-noise-sensitive buildings adjacent to road/rail noise sources to provide screening to residential units;
- b) Residential block layout design to locate non-sensitive uses on noisy facades;
- c) The provision of 'quiet facades' to residential units where practicable;
- d) Architectural features such as balconies and to provide local screening to windows to sensitive rooms; and
- e) Resurfacing of roads with low noise surfaces, including the A406 running planes past the development;
- f) Opportunities for noise barriers adjacent to road and railway noise sources;
- g) Upgraded glazing and external building fabric to attenuate noise ingress, and where necessary, acoustic ventilation, passive wherever practicable (provided a positive flow of air, e.g. passive stack not trickle vents), to allow windows to remain closed where necessary.

The Details submitted in connection with the relevant Reserved Matters Application shall be in accordance with the Acoustic Design Report to be approved in accordance with this Condition."

- 9.4.25 In this respect, regard has been given to the advice contained within the Acoustic Design report by Buro Happold^{xxii} which specifically related to Plots 53 and 54 to ensure a consistent approach, included at **Appendix 9.4**.

Amenity of Open Spaces

- 9.4.26 The amenity of open spaces has been assessed against the WHO guideline value of 55dB $L_{Aeq,16h}$ for protecting the majority of the population from serious annoyance. Noise levels within open spaces have been predicted based on likely future noise levels in 2031. Regard has been given to the A406 acoustic barrier proposals and CADNA-A modelling of predicted noise levels included within the Buro Happold^{xxiii} report concerning Brent Riverside Park open space and the Brent Cross Cricklewood Living Bridge Design Development presentation by Chapman Taylor and MacGregor Smith^{xxiv}. The acoustic barrier configuration advised by URS which has been assumed to form part of the mitigation for the Phase 1A (North) RMAs, although not yet submitted for approval under Planning Condition 29.10, consists of a roadside barrier on the south side of the realigned Prince Charles Drive at a height of 2 metres above ground level. **Table 9.6** presents the assigned significance of the predicted noise level in relation to the WHO recommended criteria.

Table 9.6: Significance of Prevailing Noise Level in Open Spaces

Noise Level Change	Significance
≤ 55 dB $L_{Aeq,16h}$	Negligible
$> 55-60$ dB $L_{Aeq,16h}$	Minor
$> 60-65$ dB $L_{Aeq,16h}$	Moderate
$> 65-70$ dB $L_{Aeq,16h}$	Substantial
>70 dB $L_{Aeq,16h}$	Severe

- 9.4.27 For existing open spaces regard has also been given to the change in noise levels that will potentially arise as a result of the operation of the Development in order to provide an indication of the potential impacts associated with the Scheme. The significance of the impact resultant from the predicted change in noise levels within existing open spaces is as presented in **Table 9.7**.

Table 9.7: Significance of Change in Noise Level in Existing Open Spaces

Noise Level Change	Significance
No Change or Overall noise level $\leq 55\text{dB } L_{Aeq,16h}$	Negligible
+1 to 3dB change where final noise level $> 55\text{dB } L_{Aeq,16h}$	Minor
+3 to 5dB change where final noise level $> 55\text{dB } L_{Aeq,16h}$	Moderate
+5 to 10dB change where final noise level $> 55\text{dB } L_{Aeq,16h}$	Substantial
$>10\text{dB}$ change where final noise level $> 55\text{dB } L_{Aeq,16h}$	Severe

Fixed Mechanical Plant and Building Services

- 9.4.28 In accordance with the requirements of LBB and 2014 Permission, noise from plant or machinery should be 5dB below the background noise level (L_{A90}) at 1 metre from the window of any room of a neighbouring property. The significance of the potential noise impact where this noise criteria is not satisfied is presented as **Table 9.8**.

Table 9.8: Plant Noise Significance Criteria

Significance	Difference in Noise Level and Background Level (dB(A))
Negligible	≤ -5
Minor adverse	>-5 to 5
Moderate adverse	5 to 9
Substantial adverse	≥ 10

Combined Heat and Power Plant (CHP)

- 9.4.29 A small-scale CHP plant is proposed within Plots 53 and 54. Noise from plant or machinery should be 5dB below the background noise level (LA_{90}) at 1 metre from the window of any room of a neighbouring property so as to comply with the requirements of LBB. This is in-line with Planning Condition 29.5 of the 2014 Permission which states “*Where building services, plant or other external noise sources are to be installed, the total noise level of such items shall be at least 5dB(A) below the prevailing background LA_{90} noise level, measured at the nearest Noise Sensitive Premises., in accordance with BS4142 or successive guidance.*”
- 9.4.30 This is also applicable to CHPs which will form part of the site-wide Development.
- 9.4.31 The plant noise significance criteria presented as **Table 9.8** are therefore applicable to all CHPs, including the small-scale CHP proposed in Plot 53.

Waste Handling Facility

- 9.4.32 Plant and operations associated with the operation of the WHF should meet the requirements of BS 4142:2014 and LBB. This approach is consistent with the s.73 ES. The significance criteria for the assessment of noise from the WHF is presented as **Table 9.8**.

Noise from Proposed Uses

- 9.4.33 In the absence of guidelines for assessing the significance of noise generated by future non-residential uses of the development, the criteria provided in **Table 9.9** have been used which is based on the change in the prevailing noise level.

Table 9.9: Significance of Noise Level Change

Significance	Change in Noise Level dB(A)	Subjective Response
Negligible	<3	Imperceptible
Minor, adverse	3 to 5	Perceptible
Moderate, adverse	6 to 10	Up to a doubling of loudness
Substantial, adverse	>11	Over a doubling of loudness

Sport Pitch & Playing Fields

9.4.34 There is no recognised procedure to determine the noise impact from use of sports pitches and playing fields, as detailed within the Clitterhouse Playing Field Improvements Part 1. In this respect the selected assessment procedure for existing noise sensitive receptors is comparative and based on the change in the prevailing ambient noise level. Comparison has therefore been made with the measured prevailing noise levels as well as sample noise measurements taken for a similar sports facility. The significance of potential noise impacts on existing noise sensitive receptors has been assessed based upon the significance criteria presented as **Table 9.9**.

Vibration Assessment Criteria

9.4.35 The vibration assessment criteria remain unchanged from the s.73 ES; namely the probability of adverse comment based on the Vibration Dose Values detailed within BS6472^{xxv}. The levels at or below which the probability of 'adverse comment' is low are as follows:

- Daytime (0700-2300 hours):0.4 m/s^{1.75}; and
- Night-time (2300-0700 hours):0.13 m/s^{1.75}.

9.4.36 The term 'adverse comment' is used within BS 6472 to consider human response with respect to human annoyance and/or complaints about interference with activities. At vibration magnitudes below this 'adverse comment low' threshold, comments or complaints of vibration are rare. However, this does not imply that, depending on circumstances and expectations, annoyance and/or complaints are necessarily to be expected at higher magnitudes.

Assumption and Limitations

Construction

9.4.37 At this stage in the design process specific detail on the plant and machinery to be used with each phase of demolition and construction is not known. As such, demolition and construction noise levels are based on generic plant detail contained within BS5228-1:2009+A1:2014 and as detailed in Appendix F of s.73. In this respect, a medium to high degree of confidence is assigned to the predicted demolition and construction impact significance detailed within the s.73 ES.

Operation

9.4.38 With regards to the completed and operational Development, calculations have been based upon current national and local guidance and traffic data from the BXC - DDM. One limitation with the traffic data provide by URS is that on some road links the forecast traffic speed was less than 20kph, which is below the predictive accuracy of CRTN. This has been subsequently addressed where this has been found to skew the noise impact results.

9.4.39 Provided that the recommendations contained within this report are adhered to, it is considered that a medium to high confidence in predicted significance levels can be assigned to the likely completed and operational Development impacts.

9.5 Consultation

9.5.1 Opinion was sought from Environmental Health of LBB on the use of the baseline noise data which formed the basis for the s.73 ES noise impact assessment, for the Phase 1A (North) RMA elements. It was agreed by Environmental Health of LBB that given the s.73 ES 2007 data was augmented with 2013 baseline survey it was still applicable to the assessment. Further to this however, Environmental Health of LBB agreed to additional noise measurements conducted in 2014 by Waterman to further inform the noise impacts of the sports pitches at Clitterhouse Playing Fields.

9.5.2 In its informal scoping review, LBB noted that the IEMA Guidelines for Noise Impact Assessment (October 2014) should be applied to the Further Information Report. With the exception of Plant Noise (BS4142) the assessment follows the IEMA Guidelines as assessments are predominantly based on change in noise levels. IEMA provides several approaches to determining and presenting noise effects resultant from a scheme. On balance the Further Information Report is in line with the approaches presented within the IEMA Guidelines, although the term 'Minor' effect has been used rather than 'Slight'. This difference in semantics does not alter the results.

9.5.3 Further comments were then received from Capita and LBB in their EIA Scoping Opinion (dated December 2014). Further details of the scoping comments and Waterman's response in respect of Noise and Vibration issues are provided in **Table 4.1** of this Report.

9.6 Baseline Conditions

Noise and Vibration Sensitive Receptors

9.6.1 The sensitive areas of the Site and surrounds taken into consideration in the assessment of noise and vibration impacts from the demolition, construction and operational phases of the Scheme are presented as **Table 9.10** and in **Figure 9.1**. These are the same as those detailed within Table 9.6 of s.73 ES.

9.6.2 The sensitive areas; namely residential areas, are predominantly outwith but directly adjacent to the Site, however some areas are surrounded by the application boundaries.

Table 9.10: Noise Sensitive Areas

Ref (Figure 9.1)	Description	Approximate Distance from Site Boundary
A	Brent Park Road (south)	20m north
B	Brent Park Road (north)	20m north
C	Edgware Road	20m west
D	Claremont Road (south)	5m east
E	Claremont Road (north)	10m east
F	Cricklewood Lane	5m south
G	Plot 61	adjacent
H	Cotswold Gardens	10-15m south
I	Grampian Gardens	10-15m south

Ref (Figure 9.1)	Description	Approximate Distance from Site Boundary
J	Hamilton Road (south)	45-50m east
K	Hamilton Road (north)	10-15m east
L	Hendon Way	5m east
M	Sturgess Avenue	25m northwest
N	Layfield Close	10m west
O	Clitterhouse Road	10m central location
P	Clitterhouse Crescent	10-30m central location
Q	Brent Terrace	5m central location
R	Marble Drive	10m central location
S	Prayle Grove	10-20m central location
T	Railway Terraces Cricklewood Conservation Area	Adjacent

9.6.3 Phase 1A (North) is planned to be completed in 2021 with full scheme completion in 2031. Given the build out of the whole of the Scheme is approximately 15 years, there is also the potential for noise and vibration impacts from the construction phase as well as the operational phase to impact on future residential and sensitive receptors. This is dictated by the phasing of the works but is likely to include residents and noise sensitive receptors (NSRs) of Brent Cross West, Market Quarter, Eastern Lands, Station Quarter, Brent Terrace, and Cricklewood Lane. The degree of the impact will be dependent on distance from the works or noise source and the absolute noise level. These receptors are not identified on **Figure 9.1**.

Baseline Noise Monitoring

9.6.4 It was agreed with LBB Environmental Health that the baseline noise survey detailed within the s.73 ES undertaken in 2007 and updated in 2013 could be used as a basis for the purposes of this assessment. For completeness a summary of the s.73 ES noise survey data is presented as **Table 9.11**.

Table 9.11: Summary of s.73 ES Baseline Survey Results

Location	Noise Levels dB (rounded to nearest whole dB)				
	Daytime		Night-Time [1]		
	LAeq	LA90	LAeq	LA90	LAmx
1. Brent Park Road West	57-61	54-58	52	46	63-64
2. Brent Park Road East	54-61	52-59	49	46	54-68
3. Edgware Road	69	59-61	61	43	75-89
4. Railway Terraces Cricklewood Conservation Area North	48-51	45-46	39	35	54-61
5. Railway Terraces Cricklewood Conservation Area South	51-55	43-46	40	33	58-80
6. Claremont Road	65-68	52-56	42	38	54-79
7. Clitterhouse Crescent	53-59	51-57	38	36	55-65
8. Prayle Grove South	48-52	46-51	40	39	54-66

Location	Noise Levels dB (rounded to nearest whole dB)				
	Daytime		Night-Time [1]		
	LAeq	LA90	LAeq	LA90	LAmx
9. Prayle Grove North	54-56	51-54	44	39	55-68
10. Hendon Way	70	64-65	60	50	72-81
11. Railway noise site [2]	65	46	60	40	73-82

Note: [1] Night-time LAeq and LA90 values are the lowest measured noise levels. [2] For site 11 LAeq is the logarithmic average for the 16 or 8 hour period.

- 9.6.5 Additional baseline noise surveys have been undertaken by Waterman in 2014 to further inform the updated impact assessment including the Phase 1(A) North RMA elements. **Table 9.12** presents a summary of the 2014 baseline results with full details within **Appendix 9.1**. **Figure 9.1** presents the s.73 ES noise monitoring locations and the 2014 baseline noise monitoring locations.

Table 9.12: Summary of 2014 Baseline Survey

Location (Figure 9.1)	Noise Levels dB (rounded to nearest whole dB)				
	Daytime		Night-Time ^[1]		
	LAeq	LA90	LAeq	LA90	LAmx
12.Layfield Close ^[2]	58	45	42	38	47-93
13.Dallas Road ^[3]	67	63	64		
14.Grampian Gardens	58	56	n/a	n/a	n/a
15.Prayle Grove	56	55	n/a	n/a	n/a
16.Claremont Road	66	56	n/a	n/a	n/a
17.Whitefield Avenue	60	58	No Data	No Data	No Data
18.Claremont Road	69	57	No Data	No Data	No Data
19. A406 ^[2]	72	71	69	63	73-83
20.Plot 53 Brent Terrace	57	47	37	35	42-67

Note:[1] Night-time LAeq and LA90 values are the lowest measured noise levels unless stated otherwise. [2] LAeq is the logarithmic average for the 16 or 8 hour period [3] LAeq value derived from CRTN shortened measurement procedure and subsequent TRL calculations. No Data – noise measurements not taken within the night-time period as not required for subsequent assessment.

- 9.6.6 The short-term attended noise measurements at Grampian Gardens, Prayle Grove and Claremont Road were to allow a more detailed assessment of the proposed sporting facilities at Clitterhouse Playing Fields to be undertaken. The noise monitoring locations are representative of the residential areas which overlook this area.
- 9.6.7 The short-term attended noise measurements at Plot 53, Brent Terrace, were to provide supplementary information on the prevailing day and night-time noise levels to inform the suitability of Plots 53 and 54 for residential development.
- 9.6.8 The noise monitoring conducted adjacent to the A406, Whitefield Road and Claremont Road was undertaken to inform discussions with residents from the Whitefield Estate regarding relocation to residential Plots 53 and 54 and Brent Terrace.

9.6.9 The CRTN short-term noise survey conducted within the vicinity of NSRs on Dallas Road, within the vicinity of the M1, was to provide additional baseline data for NSRs within the vicinity of the Staple Corner junction upgrade (see **Table 9.11**).

Baseline Vibration Monitoring

9.6.10 Additional vibration monitoring had not been requested by Environmental Health of LBB. Vibration measurements undertaken as part of the s.73 ES are still considered valid for the assessment of vibration impacts from Rail and Freight, as these are not affected by the Phase 1A (North) RMA elements, and therefore remain unchanged.

9.7 Assessment and Mitigation

Demolition & Construction

Potential Impacts

9.7.1 The Indicative Construction Programme (ICP) and the Construction Impact Assessment Addendum which accompanied the s.73 Application (BXC21) which formed the basis of the s.73 ES remain unchanged (taking into account Planning Condition 4.2 of the 2014 Permission). Therefore the construction activities provided within the s.73 ES Chapter remain applicable. Further commentary on the validity of the s.73 ES in respect of construction noise and vibration is provided below under each heading presented in the s.73 ES.

Construction Noise Impacts

9.7.2 The s.73 ES assessed construction noise and vibration impacts based on assumed plant (Annex F) and assumed total power levels for various construction activities as defined in Table 9.5 of the s.73 ES. A summary of expected significant construction noise impacts was identified in Table 9.6 of the ES for the NSRs (A – S and 4). Commentary was then provided in respect of Road Works, Bridge Works, Buildings Demolition, Foundations and Superstructure, Railway Works and Impacts on NSRs within the Development.

9.7.3 The adverse impacts upon NSRs were identified as significant impacts in areas where the works are expected to be within critical distances of receptors (as detailed in Table 9.5 of the s.73 ES). The details now provided by the Phase 1A (North) RMAs do not significantly alter the distance at which the various construction works occur in relation to the selected NSRs, in this respect the significance of effects detailed within s.73 ES remain valid. This is also applicable to Construction Vibration and Construction Traffic which also remain unchanged from the s.73 ES.

Temporary Bus Station and Bus Stops

9.7.4 The potential impact from operation of the Temporary Bus Station and Bus Stops has been assessed by predicting the potential change in the prevailing noise level. The results are presented as **Table 9.13** and are based on a 20 seconds average bus idling time at bus stops as forecast by URS. Results for a longer bus idling time of 60 seconds are also presented as an indication of worst-case scenario. Full details of the assessment results are presented in **Appendix 9.2**.

Table 9.13: Noise Impact From Temporary Bus Station and Bus Stops

Period	Buses/Hour	Predicted Façade Noise Levels dB L _{Aeq,1h} (Idling Time At Bus Stops)	Significance
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		20 seconds	60 seconds	
Brent Park Road				
0500-0600	44	42 - 44	44 – 46	Negligible
0600-0700	108	43 - 46	45 - 47	Negligible
0700-2300	154	44 - 46	49 - 51	Negligible
Layfield Close				
0500-0600	44	38 - 41	42 – 44	Negligible
0600-0700	108	42 - 43	45 – 48	Negligible
0700-2300	154	44 - 45	46 - 49	Negligible

9.7.5 **Figures 9.2 and 9.3** present the predicted façade noise levels for the night-time period 0600-0700 and daytime period respectively at the above receptor locations for the operation of the temporary bus station and bus stops (a period of around four years).

9.7.6 In consideration of the proposed operations, no significant vibration impacts are likely at the nearest sensitive receptors due to the operations at the temporary bus station and bus stops.

Mitigation

Construction

9.7.7 As part of the mitigation for demolition and construction operations, a draft Code of Construction Practice (CoCP) was provided in s.73 Application as an Appendix to the Revised Development Specification Framework (RDSF) and is due to be updated and finalised as a pre-commencement Planning Condition in 2015 alongside Construction Environmental Management Plans (CEMP).

9.7.8 Taking into account the detailed design of Phase 1A (North) RMAs the mitigation measures presented within the s.73 ES remain valid.

Temporary Bus Station and Bus Stops

9.7.9 It should be noted that provision of a 2.5 metre high acoustic screen at Plot 113 is inherent to the scheme design to reduce noise emissions from the temporary bus stops to the nearest noise sensitive receptors on Layfield Close.

9.7.10 It should be noted that increase in bus idling times upon which the noise assessment is based, namely 20 and 60 seconds, will increase noise emissions from this operation.

9.7.11 No mitigation is proposed on account of the acoustic screen being inherent mitigation included within the detailed design of the temporary bus stops at Plot 113.

Residual Impacts

Construction

- 9.7.12 Given there are no material changes to the proposed construction methods and operations to that presented within the s.73 ES, and that the assessment methodology and predicted impacts remains unchanged, the residual construction impacts of the s.73 ES remain valid in respect of noise and vibration.

Temporary Bus Station and Bus Stops

- 9.7.13 The residual impacts with the inherent scheme design mitigation in place are predicted to be **negligible**.

Operational

Potential Impacts

Railway Noise and Vibration and Rail Freight Facility

- 9.7.14 The Phase 1A (North) RMA elements have no impact on railway operations, both passenger and freight. In this respect there are no changes to the s.73 ES noise and vibration impacts. The noise and vibration impacts stated within the s. 73 ES therefore remain appropriate. It should be noted that noise from the railway line as per the s.73 ES is included within the CADNA-A noise model.
- 9.7.15 The EHO at LBB mentioned during consultation that concerns have previously been raised with regard to noise from the trains on the Brent Curve to the southwest of the Site. A review of this feature has deemed that due to their distance from Phase 1A (North) features and that the railway noise was not detected in the background noise monitoring, it is not considered appropriate to further assess rail noise within this Report, therefore it remains as reported in the s.73 ES. It will instead be assessed in further detail for the RMAs for future sub-phases which either lie in close proximity to the railway line or which have proposed works to the railway.

Road Traffic Noise

- 9.7.16 The change in road traffic noise levels which will arise with and without the Scheme in 2031 have been predicted. Predicted noise levels are presented in full as **Appendix 9.3** and operational traffic data are provided in **Appendix 9.5**. Predicted noise levels are also presented graphically in:
- **Figure 9.4:** 2031 Noise Difference Contour Plot (Do Something minus Do Minimum);
 - **Figure 9.4a:** 2031 Noise Difference Contour Plot (revised road link to 20mph);
 - **Figure 9.5:** 2031 Do Minimum Daytime Noise Contour Plot (1.5m agl);
 - **Figure 9.6:** 2031 Do Something Daytime Noise Contour Plot (1.5m agl);
 - **Figure 9.6a:** 2031 Do Something Daytime Noise Contour Plot (revised road link to 20 mph) (1.5m agl);
 - **Figure 9.7:** 2031 Do Something Daytime Noise Contour Plot (4, agl); and.
 - **Figure 9.8:** Predicted Noise Levels Clitterhouse Playing Fields.
- 9.7.17 Similarly to the s.73 ES Figures, the noise levels are presented as $L_{Aeq,16h}$ daytime (0700-2300 hours) free-field noise contours in 3dB increments. The contours do not take into account all local factors that may affect noise levels, but they are considered sufficiently accurate to indicate both the

changes in noise levels expected from the s.73 Scheme and the likely levels that will impact on the noise-sensitive elements of the s.73 Scheme.

- 9.7.18 In-line with s.73 ES, the A406 North Circular Road bisects the Site and several junction improvements are included. It is a very noisy road, and in view of the Noise Policy Statement for England and the London Noise Strategy it is considered appropriate for the Scheme to facilitate resurfacing the road with a low noise surface. The resurfacing of the A406 with a 'low noise surface' road which is part of the Development, is identified as part of a hierarchy of noise mitigation measures in Planning Condition 29.1 of the 2014 Permission. The effect of resurfacing the A406 road with a 'low noise' surface between the railway overpass and Hendon Way, is assumed to reduce noise emissions by 2.5dB. This is included within the 'Do Something' noise modelling.
- 9.7.19 With reference to **Appendix 9.3** and **Figures 9.4, 9.4, 9.5 9.6, 9.6 and 9.7** it can be seen that for the majority of the modelled road links a change in noise levels of less than 1dB is predicted. Such a change in noise levels will give rise to at worst **negligible** impacts. Additional Figures have also been presented; namely **Figures 9.4 and 9.6** to graphically illustrate how the predicted noise impacts at dwellings on Brent Park Road are affected by an M1/A406 road junction road link with forecast speeds (2kph) considerably below the predictive accuracy of CRTN (20kph). The additional Figures (**Figures 9.4 and 9.6**) illustrate how the predicted impact is reduced if the speed on the roundabout road link is increased to 20mph (32 kph).
- 9.7.20 A summary of those links which are exposed to a change in noise levels in excess of 3dB determined from CRTN basic noise level excel calculations is presented as **Table 9.14**. It should be noted that several links either have low flows (below 1,000) or low speeds (below 20kph). Under such a scenario CRTN advises that predicted noise levels should be treated with caution as this may overestimate the likely benefit or adverse effect. Those links which are subject to low flows/speeds are noted within **Table 9.14** as are those links where in one scenario flows are less than 1,000 per 18-hour period which is under the predictive accuracy of CRTN.

Table 9.14 : Summary of Impacts for Roads with ≥ 3 dB Noise Level Change (Basic Noise Level Calculations)

Road Link	Link ID	Predicted Change in Noise Level dB	Significance
Oaklands Road (between Olive Road and Cricklewood Broadway) ^[1]	L6689366892	+3.6	Minor Adverse ^[3]
Roman Road (access to Industrial Estate off A5)	L6692366922	+8	Moderate Adverse ^{[2] [3]}
Gladstone Park Gardens (between A5 and Mount Road)	L6652766525	+3.1	Minor Adverse
Gladstone Park Gardens (between Mount Road and Parkside)	L6652566500	+4.3	Minor Adverse
Oxgate Gardens (between A5 and Conway Road)	L6693466932	-9.9	Moderate Beneficial ^[4]
Oxgate Gardens (between Conway Road and Coles Green Road)	L6693266931	-3.5	Minor Beneficial
Tadworth Road		+3.3	Minor Adverse
The Dore roundabout ^[1]	L7885578131	-4.5	Minor Beneficial
Link between Haley Road and A41 slip	L7012370343	-23.2	Substantial Beneficial ^[2]

Road Link	Link ID	Predicted Change in Noise Level dB	Significance
A41 southbound slip off Brent Cross Gardens	L7034470343	-15.3	Substantial Beneficial ^[2]
Fordwynch Road (between Skard Road and Cricklewood Lane) ^[1]	L1482570720	-5.5	Moderate Beneficial
Tadworth Road	L6696566508	+3.3	Minor Adverse
Waterloo Road	L6696666965	+3.3	Minor Adverse
A5 southbound of Geron Way roundabout links	L7075270328	+3.2	Minor Adverse
Geron Way roundabout link from A5 southbound	L7075170750	+4.0	Minor Adverse ^[2] ^[3]
Geron Way	L7094670750	+7.1	Moderate Adverse ^[2]
Link off Geron Way roundabout	L7094570750	+5.9	Moderate Adverse ^[2]
Link off Geron Way	L7094770946	+8.1	Moderate Adverse ^[3]

Note: [1] Outside Cadna-A noise model area. [2] Traffic speed below 20kph, outside predictive accuracy of CRTN. [3] Flow in DM scenario below 1000 AAWT-18h. [4] Flow in DS scenario below 1000 AAWT-18h.

- 9.7.21 A beneficial change in noise level is predicted along a number of links namely the A41 and Haley Slip Road (-23.2dB) and the A41 southbound slip off Brent Cross Gardens (-15.3dB) as a result of a change in the forecast traffic speed. A change in noise levels of this magnitude will give rise to **substantial beneficial** impacts. These results however, should be treated with caution as the traffic speeds provided in the traffic data are below the predictive accuracy of CRTN.
- 9.7.22 The moderate beneficial impact predicted at Oxgate Gardens between the A5 and Conway Road is unlikely to be realised due to the noise climate at this location being dominated by road traffic noise from the A5. At Fordwych Road the moderate beneficial impact should however be realised but may be reduced due to the contribution from rail noise and to a less extent A5 road traffic noise, which are likely to contribute significantly at this location.
- 9.7.23 An increase in road traffic noise levels of greater than 5dB but less than 10dB will give rise to **moderate adverse** impacts. Those roads where increases in road traffic resulting from the Development which will have the potential to give rise to moderate adverse impacts are summarised below:
- Roman Road;
 - Geron Way;
 - Link off Geron Way Roundabout; and
 - Link off Geron Way.
- 9.7.24 From a review of the traffic data provided by URS (**Appendix 9.5**) it is considered that the largest change in noise levels have arisen as a result of changes in traffic speeds along these links from above to below 20kph, rather than an increase in traffic flows. Further to this, the noise climate at the nearest NSRs to Roman Road, namely Gladstone Park Gardens, are dominated by road traffic noise from the A5. This predicted noise impact on Roman Road, notwithstanding the flow and speed parameters being under the predictive accuracy of CRTN, is unlikely to be realised at the nearest NSRs. With regard to predicted adverse impacts on the various Geron Way road links which are

located within a light industrial area, there are no residential receptors in the immediate vicinity that will be affected.

- 9.7.25 The introduction of new roads such as within the Eastern Lands and Market Quarter will have an influence on the overall change in noise levels at these locations as new noise sources are being introduced.
- 9.7.26 The closest dwellings to the proposed highways improvements are those located on Brent Park Road which are located approximately 45 to 200 metres from the M1/A406 road junction. Further interrogation of the noise model indicates that the dwellings on Brent Park Road are predicted to be exposed to environmental noise levels ranging from 72 to 66dB $L_{Aeq,16h}$ in 2031 Do Minimum scenario, not taking account of barrier attenuation afforded by intervening fencing. With the Development (Do Something) this is predicted to range from 79 to 68dB $L_{Aeq,16h}$. On further investigation of the CADNA-A noise model, the elevated noise level in the 'With Development' scenario is dominated by a roundabout link (link ID L7105371054) where the predicted traffic speed provided by URS is 2.5 kph, which is considerably below the predictive accuracy of CRTN (20kph). Disregarding this link the predicted noise level will reduce from 79 to 71dB $L_{Aeq,16h}$ and therefore comparable with the 2031 Do Minimum scenario. Taking account of this the predicted impact on properties on Brent Park Road be **negligible**. As previously stated, the CADNA-A noise model does not take account of barrier attenuation afforded by the intervening *in situ* fencing as topographic information of this was not available as it falls outside the 2014 Permission boundary. On this basis, although the predicted change in noise level is accurate, the absolute noise level at the NSR (Brent Park Road) is likely to be lower than predicted with the in situ fences and barriers. It should be noted that barrier attenuation is afforded by the new build adjacent to the M1/A406 junction which is predicted to reduce noise level at some of the properties on Brent Park Road by up to 4dB.
- 9.7.27 The predicted increase in noise levels on the A5/A406 junction are due to some of the Development road links having forecast speeds well below 20 kph. The predicted increases however are not considered important given there are no existing or proposed future residential receptors within the vicinity of this junction.
- 9.7.28 **Table 9.15** presents the predicted change in noise at existing receptors based on the results of **Figure 9.4** which includes a revised speed to 32kph (20mph) from the forecast speed of 2kph for one of the road links on the M1/A406 junction. The locations presented are the same as those presented in Table 9.2 of the s.73 ES.

Table 9.15: Predicted 2031 Change in Noise Level

Location	Predicted Increase In Noise Level ($L_{Aeq,16hour}$) dB	Significance
Brent Terrace (south of railway bridge)	Reduction in noise levels on western facades range from zero to 8 dB. Reduction in noise levels on eastern facades range from 1 to 8dB.	Negligible to Moderate Beneficial on western facades. Minor to Moderate Beneficial on eastern facades. Note this does not include noise contribution from local residential roads where forecast flow is less than 1,000 and therefore below CRTN predictive accuracy. In this respect predicted benefits may be reduced.

Location	Predicted Increase In Noise Level (L _{Aeq,16hour}) dB	Significance
Brent Terrace (north of railway bridge)	<p>Reduction in noise levels on west facades range from 3 to 10 dB. Reduction is due to attenuation afforded by new buildings adjacent to railway line.</p> <p>Reduction in noise levels on eastern facades range from 2 to 9dB.</p>	<p>Negligible to Substantial Beneficial on western facades.</p> <p>Negligible to Moderate Beneficial on eastern facades.</p> <p>Note this does not include noise contribution from local residential roads where forecast flow is less than 1,000 and therefore below CRTN predictive accuracy. In this respect predicted benefits may be reduced.</p>
Claremont Road	<p>Predominantly eastern facades are predicted to have a slight decrease in noise levels ranging from 1 to 4dB. At some locations slight increases of less than 1dB are predicted.</p>	<p>Predominantly Minor Beneficial with some Minor Adverse.</p>
Clitterhouse Playing Fields	<p>When no contribution from sports pitches, reduction in noise levels of up to 8dB at central locations with predominantly less than 3dB change adjacent to road links.</p>	<p>Negligible, Minor Adverse/Beneficial up to Moderate Beneficial.</p> <p>Note: This is when there is no contribution from use of sports pitches.</p>
Clitterhouse Crescent	<p>Reduction in noise levels ranging from 6dB to greater than 10dB. Predicted reduction due to reduction in noise contribution from A406 afforded by screening from intervening Development buildings.</p>	<p>Moderate to Substantial Beneficial.</p>
Cotswold Gardens	<p>Reduction in noise levels ranging from 4 to 8dB.</p>	<p>Minor to Moderate Beneficial.</p> <p>Note: Does not include noise contribution from Sports Pitches at Clitterhouse Playing Fields or local residential roads where flow is less than 1000/18 hour period.</p>
The Vale	<p>Reduction in noise level ranging from 2 to 4dB.</p>	<p>Negligible to Minor Beneficial</p>
Brent Park Road	<p>Reduction in noise level ranging from zero to 4dB. Higher reduction due to screening attenuation afforded by Development building to north of M1/A406 junction.</p>	<p>Negligible to Minor Beneficial.</p>

Location	Predicted Increase In Noise Level (L _{Aeq,16hour}) dB	Significance
Edgware Road	Predominantly changes of less than +/-1dB. Near A5/A406 junction some increases up to 4dB but no dwelling within vicinity.	Negligible with some limited Minor Adverse.
Hendon Way	Predominantly changes of less than +/-1dB with some increases of less than 2dB predicted at one location near Grampian Gardens.	Negligible

9.7.29 In summary, the predicted impacts resultant from changes in road traffic noise as a result of the Development are predominantly **negligible**. Some beneficial impacts ranging from minor to substantial are predicted due to screening afforded by the Development buildings. Some **minor adverse** impacts are also predicted, however where impacts of moderate adverse impact have been identified these should be treated with caution as generally they are a result of forecast changes in traffic speed to below the predictive accuracy of CRTN. This is likely to overestimate the benefit or adverse effect.

9.7.30 As previously stated the predicted reduction in noise levels in the Do Something scenario are mainly due to attenuation afforded by the new building structures which provide significant barrier attenuation to road traffic noise from the A406 and rail noise and to a lesser extent road traffic noise from the A5.

9.7.31 As previously mentioned, an additional noise assessment has been conducted of the M1/A406 junction at the request of the Highways Agency who are the responsible authority for the M1. This is to allow a more detailed noise assessment of this area which has been designated as a First Priority Area due to the prevailing noise levels dominated by road traffic noise. The assessment was required by the Highways Agency for the Highways Technical Approvals as part of its highway authority functions, but for completeness is included as part of the ES at **Appendix 9.6**.

Road Traffic Vibration

9.7.32 Peak levels of vibration arising from road traffic vehicles should not be any greater than can presently arise from existing heavy duty vehicle and bus movements on the existing roads. The distance from HGV and bus movements to receptors is such (greater than 10 metres) that vibration is not considered to give rise to adverse effects and is therefore not considered further.

Residential Amenity Plots 53 and 54

9.7.33 The s.73 ES identified that residents at proposed properties at Brent Terrace (North of Railway Bridge) will have an estimated Noise Exposure Category of D possible on closest Spine Road facades depending on building set back. Impacts were identified from road traffic on the new Spine Road and rail noise. Mitigation was therefore identified as being necessary for these properties.

9.7.34 A baseline noise survey undertaken in 2014 during the day and night-time periods indicate that both Plots 53 and 54 just fall within LBB's NEC B due to the measured prevailing daytime noise level (**Table 9.15**). In accordance with advice contained within LBB's SPD on Sustainable Design and Construction, the sites are suitable for residential development provided design measures are in place to ensure an adequate level of protection; namely achieving BS8233 internal ambient noise criteria (refer to **Table 9.1**).

9.7.35 Provided the mitigation measures detailed within Buro Happold Acoustic Design report (**Appendix 9.4**) are implemented, the acoustic design of the buildings will achieve appropriate standards so as to ensure an acceptable living environment is achieved within all dwellings at Plots 53 and 54.

Residential Amenity (outside Phase 1A (North))

9.7.36 The residential amenity of areas identified within **Figure 2.1** have been assessed against the predicted 2031 with Development noise levels (**Figure 9.7**). For consistency with s.73 ES, comparison has been made with the predicted noise levels at equivalent first floor level (4 metres above ground level) based on illustrative building footprints with maximum parameter heights. In this respect, the building footprints may be subject to change but are within the outline planning parameters.

9.7.37 An indication of the night-time noise levels has been determined by reducing the predicted daytime noise levels by 5dB. This is in-line with the findings of the s.73 ES which detailed that the differential in the daytime and night-time measured noise levels range from 4 to 6dB.

9.7.38 **Figure 9.8** presents the indicative night-time noise levels based on the 5dB reduction approach for the with Development Scenario 4 metres above ground level.

9.7.39 The noise levels illustrated within **Figures 9.7** and **9.8** have been used to estimate the likely LBB NEC category that the future residential amenity areas will fall within, the result of which are presented within **Table 9.16**. It should be noted that the results are comparable to those detailed within the s.73 ES.

Table 9.16: LBB Noise Exposure Categories for Residential Development Sites, End State

Development (Figure 2.2)	Zone	Estimated Noise Exposure Category	Comment
Brent Cross East (plot 113)	C		Road traffic noise Stadium Road, mitigation required.
Brent Cross West	D		Road traffic noise A406 junction, mitigation required.
Market Quarter	D A406 B/C Claremont Park Road		Road traffic noise A406 within northern area and road traffic noise from Claremont Park Road within southern area, mitigation required.
Eastern Lands	C/D A406 C/D A41 B Marble Drive		Road traffic noise A406 within northern area, A41 eastern area and Marble Drive road southern area away from A41, mitigation required.
Station Quarter	D A406 B/C High Street B/C Claremont Park Road		Road traffic A406 and rail noise within northern area and rail noise and road traffic noise southern area. Mitigation required.
Brent Terrace	D Rail B/C Brent Terrace		Rail noise for facades facing the railway line and sidings. Facades facing Brent Terrace road benefit from acoustic screening afforded by buildings. Road traffic noise Brent Terrace Road.
Cricklewood Lane	C		Road traffic noise Cricklewood Lane and rail noise at rear and to the east.

- 9.7.40 Facades of future residential buildings which face major roads (A406) and the railway are likely to fall within NEC C and D therefore mitigation is required. Façades facing into the Development are likely to benefit from screening afforded by the building structure itself and therefore the requirement for mitigation is likely to be reduced.
- 9.7.41 Although when a site falls into NEC D guidance provided in the LBB SPD indicates that “*planning permission should normally be refused*”, mitigation options are available to ensure that the required BS8233 required IANLs are achieved. Further to this, development of land which falls within NEC D within London is common place due to the mitigation solutions available to ensure suitable residential amenity is provided.
- 9.7.42 As outlined in the s.73 ES and in line with the relevant planning conditions attached to the 2014 Permission, an Acoustic Design Report will be submitted to and approved by LBB at each reserved matters stage and prior to the construction of residential buildings. This will ensure that appropriate noise conditions are satisfied.

Open Spaces

- 9.7.43 The predicted 2031 noise levels within the open spaces which form part of the Development are presented within **Table 9.17**. Where relevant, noise levels for both with and without the Development are presented.

Table 9.17 : Predicted 2031 Noise Levels Within Open Spaces

Open Space (Figure 2.1)	Do Minimum Noise Levels	Do Something Noise Levels	Significance of Impact
Clitterhouse Playing Fields	>55 – 63	<55 – 63 [1]	Negligible - Moderate Adverse
Claremont Park	N/A	<55-60	Minor Adverse
Central Brent Riverside Park	N/A	60-65	Moderate Adverse
Living Bridge	N/A	55-65	Minor to Moderate Adverse

Note: [1] Sports facilities present in Do Something scenario.

- 9.7.44 It should be noted that when Clitterhouse Playing Fields are not in use then noise levels within the central area of Clitterhouse Playing Fields will fall below 55dB L_{Aeq}, i.e. a negligible impact. When the sports pitches are in use then noise levels within the immediate vicinity of the sports pitches is likely to range from 60 to 65dB L_{Aeq} reducing to less than 55dB to 60dB within adjacent residential gardens. This therefore will range from a **negligible** to **moderate adverse** impact, depending on the nature of the usage.
- 9.7.45 Noise levels in Claremont Park are predicted to range from less than 55 to 60dB L_{Aeq}. The new buildings of the Market Quarter and Station Quarter once delivered will provide screening to road traffic noise from the A406 and with the latter, noise from the railway line. The main noise influence on this open space is from the new Claremont Park Road. Areas within Claremont Park will however benefit from localised screening afforded by structures such as fences which form part of the consented Scheme.
- 9.7.46 As identified in the s.73 ES the area around the realigned River Brent within the Central Brent Riverside Park will be exposed to high level of noise from the A406, as it is currently. To improve the amenity in this space a noise barrier will be provided as part of the Development (Phase 1A (North)) as detailed in the Buro Happold report ‘*Brent Cross and Cricklewood Regeneration Planning*

Condition 29.1 – noise barrier at the A406 (included at **Appendix 9.4**). As previously stated, although the A406 acoustic barrier will be delivered as part of the Phase 1A (North) it is subject to approval as a Planning Condition 29.10 and the final design of the barrier is yet to be confirmed.

- 9.7.47 The predicted noise levels within the Central Brent Riverside Park of 60 to 65dB L_{Aeq} are mitigated noise level due to the 2 metre roadside barrier adjacent to Prince Charles Drive. The barrier, which is located between the A406 and Prince Charles Drive (as confirmed by URS) reduces road traffic noise levels from the A406 (Buro Happold report Noise Barrier at the A406, November 2014). The difference in topography between the A406 and Prince Charles Drive also provides additional screening of noise from the A406 so that the minimum effective barrier is 2 metres increasing up to approximately 5 metres, based on cross sections provided by URS. Although the noise levels are above the WHO criteria of 55dB L_{Aeq} , the predicted noise level with inherent scheme mitigation are reasonable for its urban setting directly adjacent to major roads and as presented within **Table 9.17** are considered to be of moderate adverse significance.
- 9.7.48 The noise levels on the Living Bridge^{xxvi} are predicted to range from 55 to 65dB L_{Aeq} due to the barrier attenuation afforded by the sides of the bridge (parapet) and bridge structure itself as defined by the Phase 1A (North) RMAs. Again, although these level are above the WHO criteria of 55dB L_{Aeq} and are considered to be of minor to moderate adverse significance given its location over a major road the noise levels are considered reasonable given its urban setting.
- 9.7.49 Predicted impacts of minor to moderate in an urban setting are however considered reasonable. To put into context, a noise level of 65dB L_{Aeq} is the upper range of normal conversation which typically ranges from 55 to 65dB L_{Aeq} .

Fixed Plant & Building Services Noise

- 9.7.50 Items of fixed plant and that associated with building services installed as part of the Development will have the potential to generate noise. To ensure any potential effects are minimised and to meet LBB requirements the design aim of the proposed Development is to ensure that the level of noise from the plant should be 5dB below the existing background noise levels outside the nearest noise-sensitive property at any time, or 10dB under existing background noise levels if the plant noise is tonal or intermittent enough to attract attention.
- 9.7.51 It is likely that some plant will be located at both roof and ground floor levels. Roof plant is likely to include a number of air handling units, chillers, condensers and the boiler flue termination whilst the ground floor plant area is likely to include boilers, along with pumps additional chillers and other ancillary plant.
- 9.7.52 At this stage in the design process, plant specification is sufficiently flexible to ensure that suitably quiet, non-tonal plant can be procured and / or mitigation options such as screening (e.g. acoustic louvres, duct silencers, plenum treatment etc) can be investigated as necessary to ensure that guideline noise criteria are met.
- 9.7.53 The use of appropriate fixed mechanical plant, suitable locations and mitigation measures, and compliance with existing Planning Conditions (notably 29.1 and 29.5) will protect the local amenity and result in the Development having an insignificant effect on the ambient noise climate. Where plant is located within the building structure, the potential effects of fixed plant noise may be significantly mitigated by the external building envelope.
- 9.7.54 Achieving the design aims will ensure that a good standard of noise is achieved with regard to static plant and equipment within and around the Development. Such, measures will be inherent in the scheme design and as such noise effects associated with fixed mechanical plant and building services are considered to be **negligible**.

Combined Heat & Power (CHP)

- 9.7.55 Subsequent to issue of the s.73 ES, a feasibility study has concluded that use of refuse derived fuel (RDF) is no longer a feasible option at the current time and that an alternative fuel source will need to be taken forward when the energy centres are designed in detail. Although this is a change from the s.73 ES it is not possible at this stage to undertake a noise assessment of the CHP as there is not enough detail on the plant to allow noise predictions to be undertaken.
- 9.7.56 As noted within the s.73 ES, the CHP location is adjacent to the M1/406 junction where ambient noise sources are 'high' and where there are no sensitive receptors.
- 9.7.57 Provided the recommended noise criteria are satisfied the results of the s.73 ES are still valid.
- 9.7.58 A small CHP plant is proposed within Plots 53 and 54 and shown in **Figure 2.26**. Although this is not specifically addressed within the Acoustic Design report by Buro Happold, provided it satisfies the fixed plant noise criteria of LBB under the conditions of the 2014 Permission, this should have **negligible** impact on existing and future receptors.

Waste Handling Facility

- 9.7.59 The Waste Handling Facility (WHF) assessment is deemed to remain valid as reported in the s.73 ES. There have been no further studies or design on the WHF since the s.73 application and therefore the noise and vibration assessment remain valid as per the former ES, whilst the sensitive receptors are also considered to remain unchanged. The sub-phasing change for Plots 53 and 54 results in residents occupying these Plots earlier than expected, however this is not expected to change the outcome of the previous assessment as the existing WHF will remain operational whilst the Plots are constructed and occupied and the new WHF will only become operational when the existing site ceases to operate. The baseline noise measurements at Plot 53 indicate that noise emissions from the existing WHF facility will not significantly affect Plots 53 and 54 (providing the noise emissions from the WHF remain similar to the existing), therefore the impacts reported in the s.73 ES are considered to remain valid.

Small Scale Wind Turbines

- 9.7.60 The assessment of small scale wind turbines included in the s.73 ES is considered to remain valid as none are proposed within the Phase 1A (North) RMAs.

Noise from Proposed Future Uses

- 9.7.61 There are a number of proposed uses associated with the completed, occupied Development which may generate noise, namely:
- Retail uses (A1, A2, A3, A4 and A5);
 - Leisure (D2); and
 - Office (B1), Warehouse and Distribution (B8).
- 9.7.62 The exact nature of the future non-residential uses are not yet known because this is dependent on occupiers being secured. However, consideration will need to be given to noise prior to occupation and operation to ensure that the amenity of surrounding uses is protected.
- 9.7.63 Noise break-out from the proposed buildings including in later phases and sub-phases, which may include A3, A4 and A5 (bars/cafes/restaurants) will be negligible because the façade insulation provided by the new construction will be more than adequate to attenuate internally generated noise to below the existing ambient noise levels in the vicinity of the Site. Standard controls, which could

be secured through planning conditions relating to opening hours and use of outside space, will also minimise the potential noise effects on sensitive receptors.

- 9.7.64 For any of the proposed on-Site uses, existing noise conditions relating to acoustic design which form part of the 2014 Permission could be used to control the potential for noise emanating from within the Development, in order to prevent annoyance or disturbance to neighbouring premises on or off the Site.
- 9.7.65 However, in the absence of mitigation it is considered that the uses of the Development will have the potential to give rise to at worst **minor adverse** impacts on the closest existing and proposed NSRs to the use. For those existing and proposed sensitive receptors further removed from the Development **negligible** impacts are predicted.

Sports & Playing Fields

- 9.7.66 Planned improvements to the Clitterhouse Playing Fields may result in potential noise impacts to the surrounding residential areas from use of the football, Multi-Use Games Areas (MUGA) and sports pitches. The usage is daytime only with evening use when natural light allows, as the sports areas are not floodlight.
- 9.7.67 Noise levels at the surrounding residential areas have been predicted based on source noise measurements taken by Waterman during a football match on a MUGA similar to the proposed and the use of CADNA-A noise modelling software together with general arrangement drawing 1065-08-001 Rev D of Clitterhouse Playing Fields provided by MacGregor Smith.
- 9.7.68 The source noise measurements were taken at both the centre line and behind the goal area. Measurements behind the goal area were higher and have therefore been used to calibrate the noise model for each sports pitch area. The key noise sources were noted to be players calling and shouting to each other and impact noise associated with the ball hitting the boundary fence. The average source noise measurements are presented in **Table 9.18**.

Table 9.18: Measured Noise Levels of Football Match on MUGA

Description	Noise Level dB LAeq,90-minute	Maximum Noise Level dB LAF, max
Centre Line (average)	66	94
Behind Goal (average)	69	92

- 9.7.69 **Figure 9.8** illustrates the predicted noise contour plot resultant from usage of all the sports pitches concurrently. Predicted noise levels at the nearest dwellings on Cotswold Gardens and Prayle Grove range from less than 55dB LAeq up to 60dB and 58dB LAeq respectively. This is slightly above the measured 'quiet day' noise levels of 58 and 56dB LAeq respectively for these residential area and is therefore likely to result in temporary increases in the prevailing ambient noise levels of **minor adverse** significance (3-5dB increase) when sports pitches are in use. It should be noted that the predicted noise levels do not include any attenuation that may be afforded by garden fences of sufficient mass and construction or boundary fencing to the MUGA.
- 9.7.70 The predicted noise levels at dwellings on Claremont Road are less than 55dB LAeq due to distance attenuation effects. No increase in the prevailing ambient noise level is predicted at these dwellings during usage of Clitterhouse Playing Fields due to distance attenuation combined with the relatively high prevailing noise levels due to road traffic noise on Claremont Road. The impact is therefore **negligible** for properties on Claremont Road.
- 9.7.71 The LAmax values are likely to range from 66 to 72dB LAmax within 10 and 20m of the sports pitches. This is within the range already experienced by dwellings at this locality during the daytime period.

- 9.7.72 The potential impact on future potential NSRs is considered to be **negligible** due to the distance separation between these two uses. The noise level from usage of Clitterhouse Playing Fields, which is already existing and in use, will be considerably below the WHO criteria of 55dB L_{Aeq} which will protect the majority of the population from serious annoyance.

Mitigation

Railway Noise & Vibration and Rail Freight Facility

- 9.7.73 In respect of the Brent Terrace Zone, the s.73 ES states “*the railway stabling area may give rise to significant impacts in the proposed adjacent housing development in the Brent Terrace Zone. The perimeter fencing will be of a suitable noise barrier design to provide some noise screening to lower floor and to existing Brent Terrace housing beyond*”. No new or different mitigation has therefore been identified from the s.73 ES and this matter will be addressed at the detailed design of the railway stabling area.
- 9.7.74 Mitigation measures in relation to the rail freight terminal and other also remain valid.

Road Traffic Noise

- 9.7.75 Given the predicted impacts from changes in road traffic noise levels range predominantly from negligible to minor adverse no mitigation is proposed. There are therefore no further mitigation measures identified as being necessary from those set out in the s.73 ES.

Road Traffic Vibration

- 9.7.76 Vibration resultant from road traffic vehicles is predicted to be negligible due to stand-off distances between source and receptors. Mitigation is therefore not proposed.

Residential Amenity Plots 53 and 54

- 9.7.77 With regard to Plots 53 and 54 required mitigation and design standards is as detailed with the Buro Happold report entitled ‘Planning Condition 29.1 Acoustic Design Report 031758’ (**Appendix 9.4**). This will ensure an appropriate level of amenity is provided at this location.

Residential Amenity (Outside of Phase 1A (North))

- 9.7.78 The LBB NECs for residential areas which do not form part of the Phase 1(A) North RMA essentially remain unchanged from that contained within the s.73 ES which details mitigation that will be required to provide an appropriate level of amenity. As stated previously, detailed mitigation will be developed at the reserved matters for each Phase/Sub-Phase as it is brought forward. Given the high predicted noise levels however, for facades facing the A406 and A41 this is likely to encompass mechanical ventilation and high performance glazing. For facades facing new roads such as Claremont Park Road and Marble Drive, passive attenuating ventilation should be possible in combination with high performance glazing.

Open Spaces

- 9.7.79 Mitigation is inherent in the Phase 1A (North) RMAs and associated planning conditions for Central Brent Riverside Park in the form of a 2 metre road-side acoustic barrier on the southern side of Prince Charles Drive. This will reduce noise levels to between 60 to 65dB L_{Aeq,16h} which is of moderate adverse impact and considered reasonable for the urban setting next to major roads. No additional mitigation is proposed.

9.7.80 Mitigation is inherent in the Phase 1A (North) RMAs for the Living Bridge as detailed within presentation entitled 'Living Bridge Design Development' reducing noise levels to between 55-65db $L_{Aeq,16h}$ compared with A406 roadside noise level of 75dB L_{Aeq} and above. No additional mitigation is proposed.

Fixed Plant & Building Services Noise

9.7.81 **Table 9.19** presents the noise limits at existing NSRs based on measured prevailing noise levels to satisfy the requirements of LBB (façade noise level to be 5dB below the prevailing background noise level). The recommended noise limits are based on the lowest measured background noise level, with a minimum values of 35dB L_{Aeq} and a maximum of 45dB L_{Aeq} . Where the noise in question has an acoustic character, then the recommended noise limit is lowered by 5dB.

Table 9.19 : Provisional Plant Noise Limits

Location (Figure 9.1)	Daytime		Night-Time	
	$LA_{90}^{(1)}$	Limit L_{Aeq}	$LA_{90}^{(1)}$	Limit L_{Aeq}
1. Brent Park Road West	54	45	46	41
2. Brent Park Road East	52	45	46	41
3. Edgware Road	59	45	43	38
4. Railway Terraces Cricklewood Conservation Area North	45	40	35	35
5. Railway Terraces Cricklewood Conservation Area South	43	38	33	35
6. Claremont Road	52	45	38	35
7. Clitterhouse Crescent	51	45	36	35
8. Prayle Grove South	46	41	39	35
9. Prayle Grove North	51	45	39	35
10. Hendon Way	64	45	50	45
11. Railway noise site	42	37	35	35
12. Layfield Close	46	41	38	35
20. Plot 53, 54	44	39	35	35

Note: Lowest measured LA_{90} (free-field).

9.7.82 Mitigation for building services and fixed plant is likely to include the following measures:

- procurement of 'quiet' non-tonal plant;
- locate plant and air vents away from sensitive receptors;
- acoustic enclosures;
- in-duct attenuators;
- acoustic louvres; and
- isolation of plant from building structures.

9.7.83 These mitigation measures will achieve the proposed noise limits set out in **Table 9.7** and the residual effects of building services plant associated with the Development will be **negligible**.

Combined Heat & Power (CHP)

- 9.7.84 The mitigation is unchanged from the s.73 ES in that CHP will be designed to ensure that noise emission from plant and building is no higher than 5dB below existing background (L_{A90}) noise levels at the nearest noise-sensitive buildings (in line with existing Planning Condition 29.5). Tonal or obtrusive character will be designed out where practicable.

Waste Handling Facility

- 9.7.85 The mitigation is unchanged from the s.73 ES in that WHF will be designed to ensure that noise emission from plant and building is no higher than 5dB below existing background (L_{A90}) noise levels at the nearest noise-sensitive buildings (in line with existing Planning Condition 29.5). Tonal or obtrusive character will be designed out where practicable.

Noise from Proposed Future Uses

- 9.7.86 The assessment results show that the land uses within the Development will give rise at worst to minor adverse effects on existing NSRs and future NSRs. The use of adequate façade design and standard controls, which will be delivered through the 2014 Permission, will further reduce the potential noise effects on sensitive receptors.

Sports Pitches and Playing Fields

- 9.7.87 During usage of sports pitches temporary increases in the prevailing noise levels is predicted. These temporary impacts will range from **negligible** to **minor adverse** significance, and that usage is temporary and daytime only, no mitigation is proposed.

Residual Impacts

Railway Noise & Vibration and Rail Freight Facility

- 9.7.88 The Phase 1A (North) RMA elements have no impact on railway operations, both passenger and freight. In this respect there is no change to the s.73 ES noise and vibration impacts. The noise and vibration impacts stated within the s. 73 ES therefore remain valid.

Road Traffic Noise

- 9.7.89 The residual impacts range remain consistent with those reported under Potential Impacts, i.e. from **negligible** to **minor adverse/beneficial** with some **substantial beneficial** (due to screening afforded by Development buildings).

Road Traffic Vibration

- 9.7.90 Given vibration impacts from road traffic vehicles are predicted to be negligible, residual impacts are also negligible.

Residential Amenity Plots 53 and 54 and Other than Phase 1A (North)

- 9.7.91 Provided a suitable ventilation and glazing strategy is adopted together with strategic design layout, then appropriate residential amenity could be provided with **negligible** impacts on residents.

Open Spaces

- 9.7.92 The residual impact in the open spaces within the Development will range from **negligible** to **moderate adverse**. These impacts have been assessed against the WHO guideline value of 55dB

$L_{Aeq,16hT}$. **Moderate adverse** impacts in respect of the significance criteria are considered acceptable given the urban setting of the Site (based on professional judgement) and the extent of infrastructure within and around the Development.

Fixed Plant & Building Services Noise

- 9.7.93 Provided noise emissions from plant and building services satisfy the noise criteria of LBB (as detailed in Planning Condition 29.5) and those presented as Table 9.7, **negligible** residual impacts are predicted.

Combined Heat & Power (CHP)

The residual impacts remain unchanged from the s.73 ES, negligible. This is on the assumption that intrinsic design measures of the CHP allow the noise criteria required by LBB (as detailed in Planning Condition 29.5) and those presented as **Table 9.7** to be satisfied.

Waste Handling Facility

- 9.7.94 The residual impacts remain unchanged from the s.73 ES, i.e. negligible. This is on the assumption that intrinsic design measures of the WHF allow the noise criteria of LBB (as detailed in Planning Condition 29.5) and those presented as **Table 9.7** to be satisfied.

Noise from Proposed Future Uses

- 9.7.95 Through the use of appropriate façade design and noise control measures, residual impacts will be **negligible**.

Sports Pitches & Playing Fields

- 9.7.96 The residual impacts of use of the new sports pitches and facilities at Clitterhouse Playing Fields will range from **negligible to minor adverse** significance. These impacts however will be short-lived temporary and daytime only, therefore no mitigation is proposed.

9.8 Summary

- 9.8.1 For the reasons set out in this Chapter construction noise and vibration potential impacts, mitigation and residual impacts reported in the s.73 ES remain valid. On this basis the results of the construction phase are not summarised below.
- 9.8.2 Potential impacts, mitigation measures and residual impacts associated with the operation of the Development with Phase 1A (North) in place are presented in **Table 9.20**.
- 9.8.3 Potential impacts from the railway and rail freight facility remain unchanged from the s.73 ES as they are not affected by the Phase 1A (North) RMA elements and therefore remain valid, i.e. no significant residual impact.

Table 9.20: Potential Impacts, Mitigation Measures and Residual Impacts

	Potential Impacts	Mitigation Measures	Residual Impacts
Construction			
Temporary Bus Station and Bus Stops - Noise	Negligible but mitigation inherent in scheme design at Plot 113.	No additional mitigation measures.	Negligible.
Vibration	Negligible	No mitigation recommended	Negligible
Operation			
Road Traffic Noise	Negligible to Minor Adverse/Beneficial with some Substantial Beneficial (due to screening afforded by Development buildings).	No further mitigation proposed (road re-surfacing inherent in Scheme design)	Negligible to Minor Adverse Minor to Substantial Beneficial (due to screening afforded by Development buildings).
Road Traffic Vibration	Negligible	No mitigation recommended	Negligible
Residential Amenity Plots 53 and 54	Proposed residential areas falls within LBB's NECs B.	Design mitigation measures as detailed within Buro Happold Acoustic Design report (Appendix 9.4).	Negligible
Residential Amenity (other Development Plots)	Proposed residential areas fall with LBB's NECs ranging from B/C to D.	Appropriate ventilation and glazing strategy to be developed in line with existing Planning Conditions.	Negligible
Open Spaces	Negligible to Moderate Adverse	Mitigation is inherent in Scheme design; namely 2m acoustic barrier southern side of Prince Charles Drive and construction and design of Living Bridge. (Planning condition 29.1)	Negligible to Moderate Adverse
Fixed Plant & Building Services	Negligible [assumed mitigation inherent in design]	Plant designed so that noise emissions satisfy criteria of LBB (5dB below prevailing background noise level 1m outside window of nearest Sensitive Receptor). (Planning condition 29.5)	Negligible

	Potential Impacts	Mitigation Measures	Residual Impacts
Combined Heat & Power (CHP)	Negligible [assumed mitigation inherent in design]	Plant designed so that noise emissions satisfy criteria of LBB (5dB below prevailing background noise level 1m outside window of nearest Sensitive Receptor). (Planning condition 29.5)	Negligible
Waste Handling Facility	Negligible [assumed mitigation inherent in design]	Plant designed so that noise emissions satisfy criteria of LBB (5dB below prevailing background noise level 1m outside window of nearest Sensitive Receptor). (Planning condition 29.5)	Negligible
Proposed Future Uses	Negligible to Minor Adverse	It is assumed that mitigation is inherent in the proposed future use design to ensure amenity is safeguarded (to be implemented through existing planning conditions under 2014 Permission).	Negligible
Sports Pitches & Playing Fields	Negligible to Minor Adverse	None proposed, considering limited sport pitch hours of operation and duration.	Negligible to Minor Adverse

References

- ⁱ Communities and Local Government. (2012) 'The Planning Policy Planning Framework'. HMSO.
- ⁱⁱ DoE (1994). Planning Policy Guidance 'Planning and Noise'. HMSO.
- ⁱⁱⁱ Department for Communities and Local Government, 2014. Noise. Available from:<http://planningguidance.planningportal.gov.uk/blog/guidance/noise/>
- ^{iv} Defra (2010) –' Noise Policy Statement for England'. Defra
- ^v GLA (2011) 'The Spatial Development Strategy for Greater London (The London Plan)
- ^{vi} Greater London Authority (2013): The London Plan Spatial Development Strategy for Greater London Revised Early Minor Alterations, GLA, London.
- ^{vii} GLA (2004) 'The Mayors Ambient Noise Strategy'
- ^{viii} London Borough of Barnet. (2012) Barnet's Local Plan (Core Strategy) Development Plan Document. LBB.
- ^{ix} London Borough of Barnet. (2013). Local Plan Supplementary Planning Document. Sustainable Design and Construction. LBB.
- ^x London Borough of Barnet. (2012) Barnet's Local Plan. Development Management Policies. LBB.
- ^{xi} London Borough of Barnet. (2013) Local Plan Supplementary Planning Document. Sustainable Design and Construction. LBB.
- ^{xii} IEMA, 2014, Guidelines for Environmental Noise Impact Assessment, IEMA
- ^{xiii} Department for Communities and Local Government, 2014. Noise. Available from:<http://planningguidance.planningportal.gov.uk/blog/guidance/noise/>
- ^{xiv} GLA. (2014). Mayor of London. Supplementary Planning Guidance – Sustainable Design and Construction. GLA.
- ^{xv} British Standard Institute 2009 and 2014, British Standard 5228:Part 1- Code of practice for noise and vibration control on construction and open sites, part 1:Noise, part 2: Vibration and addendum +A1:2014.
- ^{xvi} British Standards Institute. (2008). BS 6472 Guide to evaluation of human exposure to vibration in buildings. Part 1: Vibration sources other than blasting.
- ^{xvii} British Standards Institute. (1993). BS 7385– Evaluation and Measurement for Vibration in Buildings – Part 2: Guide to Damage Levels from Groundborne Vibration, 1993
- ^{xviii} British Standards Institute, 'BS 8233:2014 Guidance on sound insulation and noise reduction for buildings', 2014.
- ^{xix} World Health Organisation (WHO): 'Guidelines for Community Noise'. 1999
- ^{xx} British Standard Institute (2014) BS4142 'Method of rating and assessing industrial and commercial sound'. BSI.
- ^{xxi} DoT. (1988) Calculation of Road Traffic Noise. HMSO.
- ^{xxii} Buro Happold. (2014) Planning Condition 29.1 Acoustic Design Report 031758.
- ^{xxiii} Buro Happold. (2014) Brent Cross and Cricklewood Regeneration Planning Condition 29.1 – noise barrier at the A406 031758.
- ^{xxiv} Chapman Taylor, MacGregor Smith. (8th October 2014) Brent Cross Cricklewood Living Bridge Design Development.
- ^{xxv} British Standards Institute. (2008). BS6472: Guide to evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting. BSI
- ^{xxvi} Chapman Taylor, MacGregor Smith. (8th October 2014). Brent Cross Cricklewood Living Bridge Design Development.