

Virtus DC6

Air Quality Assessment Report

Virtus Holdco Ltd

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List of Acronyms

AQDRA	Air Quality and Dust Risk Assessment
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
CEMP	Construction Environmental Management Plan
CO	Carbon monoxide
Defra	Department of Environment, Food and Rural Affairs
EPUK	Environmental Protection UK
EU	European Union
GLA	Greater London Authority
HDV	Heavy Duty Vehicle
IAQM	Institute of Air Quality Management
LAQM	Local Air Quality Management
LBH	London Borough of Hillingdon
LPA	Local Planning Authority
NO	Nitric oxide
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
NPPF	National Planning Policy Framework
NRMM	Non Road Mobile Machinery
PC	Process Contribution
PEC	Predicted Environmental Concentration
PM _{2.5}	Particulate Matter with an aerodynamic diameter of less than 2.5 micrometre
PM ₁₀	Particulate Matter with an aerodynamic diameter of less than 10 micrometre
PPG	Planning Practice Guidance
SPG	Supplementary Planning Guidance
TG	Technical Guidance
µg	Micrograms
µg/m ³	Micrograms (of pollutant) per cubic metre (of air)

Executive Summary

AECOM has been commissioned to undertake an air quality assessment in relation to the proposed redevelopment of the DC6 site within Prologis Park, Hayes. The Application Site is located within the London Borough of Hillingdon (LBH) and is within the designated Air Quality Management Area (AQMA).

The proposed redevelopment of the Site envisages the provision of a data centre by refurbishing an existing warehouse building and constructing a new utilities gantry, office and other ancillary spaces. The three-tier gantry will be constructed to the immediate west of the existing building to accommodate power and cooling plant to serve the data centre. Diesel-powered generator sets (for the on-site stand-by production of electricity in the event of an emergency interruption of grid-supplied power) shall be located beyond (to the west of) the gantry area in a service yard. It is envisaged that 16 data centre standby rated generator sets will be required to support the operation of the Proposed Development.

A qualitative assessment of the potential impacts on local air quality from construction activities was undertaken according to the methodologies published by the Institute of Air Quality Management (IAQM) and the Mayor of London. This assessment found that the construction works associated with the Proposed Development would constitute a low-risk site overall for dust and particulate matter (PM₁₀) impacts. The potential for temporary local air quality impacts to arise from the operation of vehicles and non-road mobile machinery was also identified. However, through good site practice and the implementation of suitable mitigation measures (set out within this report), the impact of construction related emissions would be reduced, and excessive releases prevented. The residual impacts of construction phase activities on air quality would therefore be considered to be temporary, short-to-medium term, local and of negligible significance.

The assessment of the potential air quality impacts associated with the operational phase of the Proposed Development was undertaken using detailed air dispersion modelling in accordance with relevant government guidance. The significance of impacts was evaluated in accordance with the guidance published by Environmental Protection UK (EPUK) and the IAQM. Once operational, the Proposed Development will cause intermittent, short-duration emissions of diesel exhaust to atmosphere when the on-site stand-by generators are run. Therefore, the assessment considered the potential for changes in ambient concentrations of the air pollutants nitrogen dioxide (NO₂), PM₁₀ and fine particulate matter (PM_{2.5}) at selected existing sensitive receptor locations as a result of the operation of the Proposed Development. The changes to local air quality arising from the operation of the Proposed Development were found to range from negligible to moderate adverse at individual modelled receptor locations, but were overall considered to be negligible to slight adverse (not significant). It is highlighted that the Proposed Development does not provide for the introduction of any long-term sensitive receptors and consequently site suitability (in terms of air quality) was not considered.

It is acknowledged that the Greater London Authority currently aims for all planning applications to be accompanied by an air quality neutral assessment. However, it is highlighted that the Proposed Development does not fall into any of the predefined categories for which benchmarks are set. On this basis, and considering that operational phase road traffic movements associated with the Proposed Development are expected to be minimal (and certainly less than the extant use of the Site), this assessment was deferred in favour of an air quality damage cost calculation.

Overall, the Proposed Development was predicted to have a negligible to slight adverse impact on local air quality, which was not considered to be significant. The Applicant may be required to take measures to reduce emissions attributable to operation of the Proposed Development as far as reasonably practicable. On-site mitigations are generally considered preferable, where possible, however it is acknowledged that this may not always be possible and therefore that contributions towards off-site measures may be deemed appropriate. The Applicant should engage with the LBH to agree appropriate measures.

1. Introduction

Overview

- 1.1 This Air Quality Impact Assessment report has been prepared by AECOM on behalf of Virtus Holdco Ltd (hereafter referred to as the 'Applicant') to accompany a planning application for the redevelopment of the DC6 site within Prologis Park, Hayes, West Drayton UB7 9FN ('the Site').
- 1.2 The Site currently houses a warehouse building and is located within the London Borough of Hillingdon (LBH). LBH declared an Air Quality Management Area (AQMA) encompassing the southernmost two thirds of the Borough in 2003 on the basis that concentrations of the air pollutant nitrogen dioxide (NO₂) were in exceedance of the annual mean Air Quality Strategy (AQS) objective for this pollutant.
- 1.3 This assessment takes full account of current policy and technical guidance for the assessment of changes to the concentrations of air pollutants, specifically fugitive dust emissions, NO₂ and particulate matter (PM₁₀¹ and PM_{2.5}²).
- 1.4 The proposed redevelopment of the Site (hereafter referred to as the 'Proposed Development') envisages the provision of a data centre by refurbishing the existing warehouse and construction of a new utilities gantry, office and other ancillary spaces. The three-tier gantry will be constructed to the immediate west of the existing building to accommodate power and cooling plant to serve the data centre. Diesel-powered generator sets (for the on-site stand-by production of electricity in the event of an emergency interruption of grid-supplied power) shall be located beyond (to the west of) the gantry area in a service yard.
- 1.5 It is envisaged that 16 data centre standby rated generator sets will be required to support the operation of the Proposed Development. Aside from the necessary routine maintenance testing (typically requiring limited duration of operating each generator set), the generator sets installed shall not be used for any purpose other than providing emergency back-up power generation. No installed generators shall support Short-Term Operating Reserve (STOR) and/or triad management activities during the lifetime of the development. This represents a situation where there are no anticipated periods where the generator sets would be planned to be operated for any significant period of time.
- 1.6 Having on-site generator sets to provide back-up resiliency to supply the electrical loads for the data centre is considered an essential requirement due to the nature of its business (and its customer's businesses).
- 1.7 As the operation of the generator sets is considered undesirable, the Applicant has designed an incoming power system to the site to ensure that only the most major power interruption events would trigger the need for the generators to be used to support the buildings outside of maintenance activities.
- 1.8 A figure showing the Site location is included as Figure 1 within Appendix A.

Scope of the Assessment

- 1.9 This report presents the results of the assessment, the scope of which was as follows:
 - A review of background air quality and existing local air quality within the Borough and in particular in the vicinity of the Site;
 - A review of relevant legislation and air quality planning policy;
 - Review of sensitive locations in the vicinity of the Site and the selection of potentially sensitive receptors for inclusion in the assessment;
 - Qualitative assessment of likely impacts from dust and particulate matter emissions during the construction phase of the Proposed Development. This assessment has referenced the London Mayor's Supplementary Planning Guidance (SPG) on the Control of Dust and Emissions during Construction and Demolition (Ref 1) and guidance published by the Institute of Air Quality Management

¹ Particulate matter with aerodynamic diameter less than 10 µm.

² Particulate matter with aerodynamic diameter less than 2.5 µm.

(IAQM) (Ref 2). The findings of this assessment informed the selection of appropriate mitigation measures for activities to be undertaken during this phase of project implementation;

- Quantitative assessment of likely impacts on local air quality from emissions arising from the operation of the standby diesel generators (using the AERMOD dispersion model). Specifically, this has focused on predicting the changes in NO₂, PM₁₀ and PM_{2.5} concentrations at nearby, existing sensitive receptors. A comparison between the baseline and 'with development' scenarios has then been used to assess the impact of the Proposed Development on air quality in accordance with the Environmental Protection UK (EPUK) and IAQM Land-Use Planning & Development Control: Planning for Air Quality guidance (Ref 3);
 - Air Quality Damage Cost assessments to estimate the equivalent monetary 'damage cost' value of development-related emissions during the operational phase of the Proposed Development.
- 1.10 Once operational, the Proposed Development is not expected to generate significant amounts of road traffic (and indeed the quantum of traffic generation would be significantly lower than that associated with the Site's extant use). Therefore, an evaluation of impacts on local air quality from traffic related emissions associated with the operation of the Proposed Development was scoped out of this assessment.
- 1.11 Furthermore, while it is acknowledged that the Greater London Authority (GLA) currently aims for all planning applications to be accompanied by an air quality neutral assessment, it is highlighted that the Proposed Development does not fall into any of the predefined categories for which benchmarks are set. On this basis, and considering that operational phase road traffic movements associated with the Proposed Development are expected to be minimal, the air quality neutral assessment was scoped out in favour of an air quality damage cost calculation.

2. Legislation and Planning Policy Context

- 2.1 There are national, regional (i.e. London) and local policies for the control of air pollution, and local action plans for the management of local air quality in the LBH. The achievement of such policies and plans are matters that may be a material consideration for planning authorities, when making decisions for individual planning applications. In addition, there is regional air quality related guidance that has relevance to the Proposed Development and this assessment.

Legislation

- 2.2 The UK is no longer a member of the European Union (EU). Some types of EU legislation such as Regulations and Decisions, are directly applicable as law in an EU Member State. This meant that, as a Member State, these types of legislation applied automatically in the UK, under section 2(1) of the European Communities Act 1972 (c.68), without any further action required by the UK. These types of legislation are published by the Publications Office of the European Union on the EUR-Lex website. This legislation is now published on legislation.gov.uk as 'legislation originating from the EU'.
- 2.3 Other types of EU legislation, such as Directives, are indirectly applicable, which means they require a Member State to make domestic implementing legislation before becoming law in that State. In the UK this was often achieved by making Statutory Instruments rather than passing primary legislation. This implementing legislation has always been published on legislation.gov.uk.
- 2.4 EU legislation which applied directly or indirectly to the UK before 23:00 hours on 31st December 2020 has been retained in UK law as a form of domestic legislation known as 'retained EU legislation' under the control of the UK's Parliaments and Assemblies. This is set out in sections 2 and 3 of the European Union (Withdrawal) Act 2018 (c.16). Section 4 of the 2018 Act ensures that any remaining EU rights and obligations, including directly effective rights within EU treaties, continue to be recognised and available in domestic law after exit.

The Air Quality Standards Regulations (2010) and The Air Quality Standards (Amendment) Regulations (2016)

- 2.5 The Clean Air for Europe (CAFE) programme consolidated and replaced (with the exception of the 4th Daughter Directive) preceding directives with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (hereafter referred to as the 'EU Air Quality Framework Directive') (Ref 4). This directive is transcribed into UK legislation by the Air Quality Standards Regulations 2010 which came into force on 11th June 2010 (Ref 5). The 2010 Regulations were amended by the Air Quality Standards Regulations 2016 which came into force on 31st December 2016 (Ref 6). The limit values defined therein shown in Table 2.1, are legally-binding and are considered to apply everywhere (with the exception of the carriageway and central reservation of roads and any locations where the public do not have access).

Table 2.1 Key Air Quality Strategy Objectives

Pollutant	Objective (µg/m ³)	Averaging Period	Not to be Exceeded More Than
Nitrogen dioxide (NO ₂)	40	Annual	Not applicable
	200	1-hour	18 times per year (i.e. 99.79 th percentile)
Particulate matter (PM ₁₀)	40	Annual	Not applicable
	50	24-hour	35 times per year (i.e. 90.4 th percentile)
Particulate matter (PM _{2.5}) ¹	20	Annual	Not applicable

Note: The air quality objective for PM_{2.5} was amended to its 'Stage 2' value following the publication of 'The Environment (Miscellaneous Amendments) (EU Exit) Regulations 2020.

The Environment Act (2021)

- 2.6 The Environment Act 2021 (Ref 7) amends the Environment Act 1995. On 9th November 2021, the Act was approved after being first introduced to Parliament in January 2020 to address environmental protection and the delivery of the Government's 25-year environment plan following Brexit. It includes provisions to establish a post-Brexit set of statutory environmental principles and ensure environmental governance through an environmental watchdog, the Office for Environmental Protection (OEP).
- 2.7 Part IV of the Act requires the Government to produce a national AQS which contains standards, objectives and measures for improving ambient air quality. The AQS proposes that the Secretary of State publish a report reviewing the AQS every five years (as a minimum and with yearly updates to Parliament). The AQS also proposes that the government set two targets by October 2022: the first on the amount of PM_{2.5} in the ambient air (the figure and deadline for compliance remain unspecified) and a second long-term target set at least 15 years ahead to encourage stakeholder investment.

National Strategies

- 2.8 The UK National AQS was initially published in 2000, under the requirements of the Environment Act of 1995 (Ref 8). An AQS addendum was published in 2003 which tightened several of the objectives and introduced a new objective (Ref 9). A revised AQS was published in 2007 which set objectives for key pollutants as a tool to help Local Authorities manage local air quality improvements in general alignment with the EU Air Quality Framework Directive (Ref 10).
- 2.9 The 25 Year Environment Plan, published in January 2018, sets out the actions the UK Government will take to help the natural world regain and retain good health (Ref 11). This references several actions that are being taken to improve air quality, most notably the publication of the Clean Air Strategy (refer below) and tighter controls on Medium Combustion Plant. Focus also centres on the 'Future of Mobility', in the establishment of flexible regulatory framework to encourage new modes of transport, and the encouragement of opportunities to move toward zero emission transport. The 25 Year Environment Plan reinforces the demand for high environmental standards for all new builds. Resilient buildings and infrastructure will more readily adapt to a changing climate, and by extension have a lesser impact on local air quality.
- 2.10 In 2019, the UK Government released its much-anticipated Clean Air Strategy (Ref 12). The Strategy places greater emphasis on improving air quality in the UK than has been seen before and outlines how it aims to achieve this (including through the development of new enabling legislation). Air quality management focus in recent years has primarily related to one pollutant, NO₂, and its principal source in the UK, road traffic. However, the 2019 Strategy broadens the focus to other sources, including domestic emissions from wood burning stoves and from agriculture. This shift in emphasis is part of a goal to reduce the levels of PM_{2.5} in the air to below the World Health Organisation guideline level (annual mean 10 µg/m³) (Ref 13), which is presently lower than the current AQS objective / EU limit value of 20 µg/m³.

National Planning Policy

National Planning Policy Framework (2021)

- 2.11 The National Planning Policy Framework (NPPF) (Ref 14) was published on 27th March 2012, and updated on several occasions – the most recent of these being on 20th July 2021³, (Ref 15) and sets out the Government's environmental, economic and social planning policies for England and how these are expected to be applied. The NPPF sets out a presumption in favour of sustainable development which should be delivered with three main dimensions: economic; social and environmental (Paragraphs 8 and 15). The NPPF aims to enable local people and their councils to produce their own distinctive local and neighbourhood plans, which should be interpreted and applied in order to meet the needs and priorities of their communities.
- 2.12 Policies and objectives which are of particular relevance to local air quality are summarised below:
- Paragraph 105 of the NPPF states that:

³ The latest update to the NPPF did not affect air quality related content, other than paragraph numbering.

“The planning system should actively manage patterns of growth in support of these objectives. Significant development should be focused on locations which are or can be made sustainable, through limiting the need to travel and offering a genuine choice of transport modes. This can help to reduce congestion and emissions, and improve air quality and public health.”

- 2.13 Air quality is considered to be an important element of the natural environment. On conserving and enhancing the natural environment, Paragraph 174 states that:

“Planning policies and decisions should contribute to and enhance the natural and local environment by: ...e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality ...”

- 2.14 Air quality in the UK is managed through the LAQM regime using national objectives. The effect of a proposed development on the achievement of such policies and plans may be a material consideration by planning authorities when making decisions for individual planning applications. Paragraph 186 of the NPPF states that:

“Planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and Clean Air Zones, and the cumulative impacts from individual sites in local areas. Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. So far as possible these opportunities should be considered at the plan-making stage, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications. Planning decisions should ensure that any new development in Air Quality Management Areas and Clean Air Zones is consistent with the local air quality action plan.”

- 2.15 The different roles of a planning authority and a pollution control authority are addressed by the NPPF in paragraph 188:

“The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.”

National Planning Practice Guidance (2021)

- 2.16 The Planning Practice Guidance (PPG) was launched in March 2014 and was updated on 1st November 2019 with specific reference to air quality (Ref 16). The most recent update to the PPG was in June 2021, but this did not affect air quality related content. The PPG states that the planning system should consider the potential effect of new developments on air quality where relevant limits have been exceeded or are near the limit. Concerns also arise where the development is likely to adversely affect the implementation of air quality strategies and action plans and/or, in particular, lead to a breach of EU legislation (including that applicable to wildlife). In addition, air quality may also be considered to be material if the proposed development would be particularly sensitive to poor air quality in its vicinity.

- 2.17 When deciding whether air quality is relevant to a planning application the PPG states that the following criteria may be required to be taken into consideration by:

- *“the ‘baseline’ local air quality, including what would happen to air quality in the absence of the development;*
- *whether the proposed development could significantly change air quality during the construction and operational phases (and the consequences of this for public health and biodiversity); and*
- *whether occupiers or users of the development could experience poor living conditions or health due to poor air quality.”*

- 2.18 On how detailed an air quality assessment needs to be, the PPG states:

“Assessments should be proportionate to the nature and scale of the development proposed and the level of concern about air quality... Mitigation options where necessary will be locationally specific, will depend on the proposed development and should be proportionate to the likely impact. It is important therefore that local planning authorities work with applicants to consider appropriate mitigation so as to ensure the new development is appropriate for its location and unacceptable risks are prevented.”

Regional Planning Policy

The London Plan – Spatial Development Strategy for Greater London (2021)

2.19 The Mayor's London Plan (Ref 17) represents a spatial development strategy for Greater London. It is the overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital. It forms part of the development plan for Greater London. London boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

2.20 The policy Sustainable Infrastructure 1 (SI1) 'Improving Air Quality' states:

“A) Development plans, through relevant strategic, site specific and area-based policies should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B) To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1) development proposals should not:

- a. lead to further deterioration of existing poor air quality.*
- b. create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits.*
- c. create unacceptable risk of high levels of exposure to poor air quality.*

2) In order to meet the requirements in Part 1, as a minimum:

- a. Development proposals must be at least air quality neutral.*
- b. Development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retrofitted mitigation measures.*
- c. Major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1.*
- d. development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.*

C) Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this, a statement should be submitted demonstrating:

- a. How proposals have considered ways to maximise benefits to local air quality; and*
- b. What measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.*

D) In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission

Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

E) development proposals should ensure that where emissions need to be reduced, this is done on-site. Where it can be demonstrated that on-site provision is impractical or inappropriate, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.”

- 2.21 The London Plan also notes that whilst developments meeting Air Quality Neutral benchmarks is necessary to control the growth in London's regional emissions, this will not always suffice to prevent unacceptable local impacts, as these may be affected by other factors such as: the location of emission sources, the rate of emissions (as opposed to the annual quantum) and the layout of the development in relation to the surrounding area. Development related impacts such as concentrating emissions, increasing exposure or preventing dispersion in particular locations therefore need to be assessed and mitigated if required.

London Environment Strategy (2018)

- 2.22 The London Environment Strategy was published by the Mayor of London in May 2018 and sets out the Mayor's vision of London's environment to 2050 (Ref 19). The London Environment Strategy includes a number of policies and aspirations, with an accompanying implementation plan, setting out actions the Mayor is prioritising for the next five years to help implement the aims of this strategy.
- 2.23 Chapter 4 of this document relates to air quality. This chapter of the Strategy, which is positioned to supersede the 2010 Mayor's Air Quality Strategy, sets the ambitious target for London to have the best air quality of any major world city by 2050 and goes one step further than the previous strategy by requiring developments to be 'air quality positive'.

The Control of Dust and Emissions during Construction and Demolition SPG (2014)

- 2.24 In April 2014, the Mayor of London published a revised Sustainable Design and Construction SPG (Ref 1). This document provides guidance to councils, developers and consultants on implementation of relevant policies contained in the London Plan and the Mayor's Air Quality Strategy in order to reduce emissions of dust and nitrogen oxides from demolition and construction activities in London.
- 2.25 Chapter 4 of the SPG sets out the methodology to undertake a dust risk assessment, and Chapter 5 presents dust and emissions control measures to apply in order to control/reduce emissions from construction sites.

London Local Air Quality Management Policy Guidance (2019)

- 2.26 The London Local Air Quality Management (LLAQM) relates to Part IV of the 1995 Environment Act, and sets out the London authorities' local air quality management functions, together with the Mayor's responsibilities and statutory guidance from the Secretary of State for the Environment, Food and Rural Affairs. The Policy Guidance (Ref 20) and the accompanying Technical Guidance LLAQM.TG(19) (Ref 21) are the documents to which the boroughs must have regard.
- 2.27 The purpose of the LLAQM system is to put in place a framework that gives confidence to boroughs, the Mayor, and the Secretary of State that they are properly fulfilling their Part IV duties.

London Local Air Quality Management Technical Guidance (2019)

- 2.28 LLAQM.TG(19) (Ref 21) has been prepared by the GLA to support London boroughs in carrying out their duties under the Environment Act 1995 and connected regulations. It supersedes all previous LAQM guidance applicable to London boroughs. It is a statutory requirement for local authorities to regularly review and assess air quality in their area and take action to improve air quality when objectives set out in regulation cannot be met.

Local Planning Policy

London Borough of Hillingdon Local Plan

- 2.29 Part 1 of LBH's Local Plan, Strategic Policies, was adopted in November 2012 and provides the planning vision and strategy for the Borough (Ref 22). Policy EM8: Land, Water, Air and Noise has the greatest relevance to the assessment, as it requires that development should not cause deterioration in the local air quality levels and should ensure the protection of both existing and new sensitive receptors.
- 2.30 It also requires that all major development within the designated AQMA should demonstrate air quality neutrality (no worsening of impacts) where appropriate; actively contribute to the promotion of sustainable transport measures such as vehicle charging points and the increased provision for vehicles with cleaner transport fuels; deliver increased planting through soft landscaping and living walls and roofs; and provide a management plan for ensuring air quality impacts can be kept to a minimum.
- 2.31 Part 2 of the LBH Local Plan, Development Management Policies, was adopted on January 2020 and sets the overarching vision, strategic objectives and policies for development in Hillingdon (Ref 23). The Local Plan Part 2 identifies a number of spatial development issues across the Borough including accommodating population growth, achieving economic prosperity, tackling climate change, infrastructure provision, community cohesion, and creating and maintaining attractive and distinctive places.
- 2.32 Policy DMEI 1: Living Walls and Roofs and on-site Vegetation states that all development proposals are required to comply with the following:
- (a) *"All major development should incorporate living roofs and/or walls into the development. Suitable justification should be provided where living walls and roofs cannot be provided; and*
 - (b) *Major development in Air Quality Management Areas must provide onsite provision of living roofs and/or walls. A suitable offsite contribution may be required where onsite provision is not appropriate."*
- 2.33 Policy DMEI 14: Air Quality states:
- (a) *"Development proposals should demonstrate appropriate reductions in emissions to sustain compliance with and contribute towards meeting EU limit values and national air quality objectives for pollutants.*
 - (b) *Development proposals should, as a minimum:*
 - i) *Be at least "air quality neutral";*
 - ii) *Include sufficient mitigation to ensure there is no unacceptable risk from air pollution to sensitive receptors, both existing and new; and*
 - iii) *Actively contribute towards the improvement of air quality, especially within the Air Quality Management Area."*

LBH Air Quality Action Plan 2019-2024 (2019)

- 2.34 LBH's Air Quality Action Plan (AQAP) was published in 2019 (Ref 24). The plan sets out air quality actions to improve air quality and protect local residents, including:
- *"Promoting and delivering energy efficiency and energy supply retrofitting projects in workplaces and homes through EFL retrofit programmes such as RE:NEW and RE:FIT and through borough carbon offset funds;*
 - *Council procurement policies to promote use of cleaner vehicle technologies via contract tendering process;*
 - *Reducing emissions from council fleets;*
 - *Discouraging unnecessary idling by taxis and other vehicles;*
 - *Provision of infrastructure to support walking and cycling"*

Hillingdon Air Quality SPG

- 2.35 The LBH has published an Air Quality Development Plan aimed to developers which states its expectations regarding air quality in planning applications (Ref 25). The Air Quality SPG includes an indicative list of planning conditions or Section 106 obligations which could be applied to reduce impacts on air quality, and a list of design principles to adopt to minimize impact on air quality such as traffic reduction and low emission strategies, sustainable building design, heating and energy supply and reducing dust impacts.

Hillingdon Planning Obligations SPG

- 2.36 A Planning Obligations SPG has also been published and aims to highlight guidance on planning obligations in Hillingdon for those in the submission and determination of planning applications (Ref 26). This document references the Air Quality SPG described above.

Other Relevant Policy and Guidance

Defra LAQM Technical Guidance 2016 (revised 2018)

- 2.37 The guidance published by the Department for Environment, Food and Rural Affairs (Defra) issued under Part IV of the Environment Act 1995 is designed to help local authorities with their LAQM duties (Ref 27). The guidance sets out the general approach to use and detailed technical guidance to guide local authorities through the Review and Assessment process for the all regions of the UK excluding London, and contains additional technical information than the shorter LLAQM.TG(19) document.

EPUK / IAQM Land Use Planning & Development Control (2017)

- 2.38 This guidance, jointly published by EPUK and IAQM (Ref 3) has been produced to ensure that air quality is adequately considered in the land use planning and development control processes by relevant officers within local authorities, developers, and consultants involved in the preparation of development proposals and planning applications. This document is best practice guidance and has no formal or legal status.

Air Quality Neutral Planning Support Update (2014)

- 2.39 Guidance was published on behalf of the GLA to support the process of undertaking air quality neutral assessments for developments within Greater London. The Air Quality Neutral Planning Support document was published in March 2013 and updated in April 2014 (Ref 28).

London Councils Air Quality and Planning Guidance (2007)

- 2.40 The London Councils have published guidance for undertaking air quality assessments in the London boroughs, the majority of which have declared AQMAs (Ref 29). The guidance sets out suggested methods for undertaking such assessments, including approaches to assist in determining the impacts of development proposals on air quality. The guidance identifies two primary factors that should be considered within air quality assessments for developments:
- Site suitability: relating to the appropriateness of the proposed development within existing local air quality conditions and constraints; and
 - Impact of the development: relating to the likely change in pollutant concentrations (within the context of the AQS objectives) attributable to the implementation of the proposed development, including during both the construction and operational phases.

3. Methodology

Introduction

- 3.1 There is currently no statutory guidance on the methodology for air quality impact assessments. However, several non-statutory bodies have published their own guidance relating to the assessment of air quality within the planning context.
- 3.2 The key air quality impacts associated with the Proposed Development are:
- Fugitive emissions of dust and particulate matter from construction phase activities;
 - Traffic related emissions associated with the construction phase of the Proposed Development; and
 - Emissions from diesel generator exhausts associated with the operational phase of the Proposed Development.
- 3.3 The following sections provide details of the approach taken to assess the change in air quality as a result of the Proposed Development as well as how the significance of any change has been evaluated. Receptors potentially sensitive to changes in air quality have been identified through review of mapping and aerial photography of the area surrounding the Site.
- 3.4 The assessment of air quality has been based on the design drawings and other information relating to the Proposed Development, several of which are submitted in support of the Planning Application and which are sought for approval.

Description of Pollutants Assessed

Construction Phase Fugitive Emissions of Particulate Matter

- 3.5 Fugitive emissions (i.e. emissions which are not associated with a single fixed release point) of airborne particulate matter are readily produced through the action of abrasive forces on materials and therefore a wide range of construction activities have the potential to generate this type of emission, including:
- Demolition – any activities associated with the removal of existing structures on site;
 - Earthworks, including the handling, working and storage of materials;
 - Construction activities; and
 - The transfer of dust-making materials from the Site onto the local road network (track-out).
- 3.6 Particulate matter in the air is made up of particles of a variety of sizes, and the concept of a 'size fraction' is used to describe particulates with sizes in a defined range. These definitions are based on the collection efficiency of specific sampling methods and each of the size fractions is especially associated with different types of impacts. In this assessment the term 'dust' is used to mean particulate matter in the size fraction 1 µm – 75 µm in diameter, as defined in BS 6069:1994 (Ref 30). The size fraction called 'PM₁₀' is composed of material with an aerodynamic diameter of less than 10 µm in diameter and overlaps with the size fraction for dust.
- 3.7 AQS objectives for PM₁₀ have been set for the protection of human health and the term PM₁₀ is only used in this assessment when referring to the potential impact of emissions of particulate matter from demolition and construction activities on human health. The short term, 24-hour mean objective for airborne concentrations of PM₁₀ is the appropriate AQS objective for assessing the potential impact on health of short-term fugitive emissions from demolition and construction sites.
- 3.8 Dust impacts are considered in terms of the change in airborne concentration and the change in the rate of deposition of dust onto surfaces. The IAQM adopts a broad definition of dust that includes the potential for changes in airborne concentration, changes in deposition rates and the risk to human health and public amenity, when considering the significance of effects from emissions of fugitive particulate matter (PM). In this assessment, specific reference is made to the impacts associated with specific size fractions (dust, PM₁₀), before considering the overall effect on receptors using an approach that is consistent with the IAQM's guidance (Ref 2).

- 3.9 The nature of the impact varies between different types of receptor. In general, receptors associated with higher baseline dust deposition rates are less sensitive to impacts, such as farms, light and heavy industry or outdoor storage facilities. In comparison some hi-technology industries or food processing plants operate under clean air conditions and increased airborne particulate matter concentrations may have an increased economic cost associated with the extraction of more material by plant air filtration units.

Construction Phase Non-Road Mobile Machinery (NRMM)

- 3.10 Emissions from NRMM will have the potential to increase NO₂ and PM₁₀ concentrations locally when in use on-site during the construction phase of the Proposed Development. This source is considered temporary, and localised. Experience of assessing the exhaust emissions from on-site plant (NRMM) and site traffic suggests that these are unlikely to have a significant impact on local air quality, and in the vast majority of cases they will not need to be quantitatively assessed (Ref 2).
- 3.11 The Mayor of London, through “The Control of Dust and Emissions during Construction and Demolition – SPG”, has put in place a strategy to address emissions from NRMM in the London area (Ref 1). In order to reduce emissions from NRMM, this equipment will need to meet set emission standards. Issued on 1st September 2015, NRMM of net power between 37 kW and 560 kW used in London has been required to meet emission standards, based upon engine emissions standards set in EU Directive 97/68/EC (Ref 31) and its subsequent amendments (Ref 32). From 1st September 2020, NRMM used on any site within Greater London has been required to meet Stage IIIB of the Directive as a minimum.
- 3.12 Local Planning Authorities are responsible for the application and enforcement of this policy through the planning process, and developers, as part of their Air Quality Dust Risk Assessment, are required to provide a written statement of their commitment and ability to meet the NRMM standards as well as provide details of the NRMM to be used on the site for addition to the NRMM Register.
- 3.13 With regard to the Proposed Development, emissions from NRMM will be limited, temporary and localised and will be controlled via the adoption of the NRMM emission standards. For this reason, construction phase NRMM emissions have not been modelled, and are not considered further in this assessment.

Operational Phase Emissions from Stand-by Diesel Generators

- 3.14 When operating, diesel engines emit various air pollutants, including oxides of nitrogen (NO_x) (a generic term for the mono-nitrogen oxides NO and NO₂) and PM, among others.
- 3.15 NO_x emissions are produced at high temperatures inside the combustion chamber, where excess oxygen reacts with nitrogen to form NO_x, mainly in the form of nitric oxide (NO), which is then converted to NO₂ in the atmosphere. The presence of NO₂ in the atmosphere is associated with adverse effects on human health.
- 3.16 PM comprises soot, condensed unburnt hydrocarbons (such as fuel or lubricating oil), and any other condensed or solid particles, such as wear particles (Ref 33). The majority of PM produced by diesel engines is fine (<1µm in diameter) (Ref 34).

Sensitive Receptors

Construction Phase

- 3.17 As described in the IAQM Guidance on the Assessment of Dust from Demolition and Construction (Ref 2), a receptor sensitive to dust is defined as:

“a location that may be affected by dust emissions during demolition and construction. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors are habitats that might be sensitive to dust.

When assessing the impact of dust emissions generated during demolition and construction works, receptors are defined as the nearest potentially sensitive receptor to the boundary of the site in each direction. These receptors have the potential to experience impacts of greater magnitude due to emissions of particulate matter generated by the works, when compared with other more distant receptors, or less sensitive receptors. Moreover, receptors located within

50m of routes to be used by demolition and construction vehicles might be impacted by dust originating from the trackout of material onto the road, and as such have been considered in this assessment."

- 3.18 There are a number of receptors that are sensitive to dust in the immediate vicinity of the Site (and less so alongside routes which may be used by construction-related traffic). These include the existing residential areas to the east and south of the Site.
- 3.19 The guidance from the Mayor of London (Ref 1) and the IAQM (Ref 2) provide criteria for determining the sensitivity of the area to dust soiling effects and the sensitivity of people to experiencing adverse health effects as a result of exposure to PM₁₀. In terms of sensitivity of the receptors referred to above, the residential properties located in close proximity to the Proposed Development are considered to be highly sensitive to both dust soiling impacts and human health effects. All other potential receptors (commercial and offices) in the study area are considered to have a medium level of sensitivity.
- 3.20 The identification of potential ecologically sensitive receptors has been undertaken in line with current guidance (Ref 1). There are no ecological receptors within 50 m of the Site boundary or within 50 m of a road used by construction vehicles on the public highway or up to 500 m from the Site entrance. Therefore, the risk of dust impacts at designated ecological receptor sites is not considered further in this assessment.

Operational Phase Sensitive Receptors

- 3.21 The impacts on ambient pollutant concentrations at sensitive receptors due to the operation of the Proposed Development will be influenced by a number of factors. These include background / baseline pollution levels and the additional contribution to these levels that the Proposed Development will add through the operation of the stand-by generators. Receptors have been selected to represent locations where people are likely to be present as the assessment is most concerned with human health. It is highlighted that the Proposed Development will not introduce any long-term sensitive receptors and consequently site suitability (in terms of air quality) is not considered in this assessment.
- 3.22 The national AQS objective values for pollutants have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such the sensitivity of receptors was accounted for in the definition of the AQS objective values and therefore all receptors that represent exposure of the public are of equal sensitivity as any member of the public could be present at those locations.
- 3.23 Receptors to be considered against annual mean AQS objectives include members of public present in areas affected by regular exposure. This includes building facades of residential properties, schools, hospitals, care homes, etc. Receptors to be considered against short-term AQS objectives include members of the public present in areas where the annual mean objective applies, but also areas with less regular exposure, such as any outdoor locations where the public might reasonably be expected to spend one hour or longer.
- 3.24 Each discrete existing receptor selected for inclusion to the modelling assessment represents the maximum level of exposure that could be experienced by other receptors in their vicinity and is therefore considered sufficiently representative of them.
- 3.25 Further details of modelled receptors are provided in paragraph 3.57.

Methodology for Determining Potential Construction Phase Air Quality Impacts

Construction Dust Emissions

- 3.26 Construction phase activities associated with the Proposed Development have the potential to generate dust emissions that could result in dust soiling and/or air quality impacts at nearby sensitive receptors. The main impacts that may occur due to demolition and construction phase activities are:
- Dust deposition, resulting in the soiling of surfaces;

- Visible dust plumes, which are evidence of dust emissions; and
 - Elevated PM₁₀ concentrations as a result of dust-generating activities on site.
- 3.27 A qualitative Air Quality and Dust Risk Assessment (AQDRA) has been undertaken in accordance with the guidance published by the IAQM (Ref 2) and Mayor of London (Ref 1) and considers potential sources of emissions on the basis of the main activity groupings (demolition, earthworks, construction and trackout).
- 3.28 The potential for dust emissions has been assessed for each activity that is likely to take place. The guidance has been used to assess the risk and significance of any impacts and to identify appropriate and proportionate mitigation measures to be adopted to reduce any potential impacts.
- 3.29 The first step of the assessment is to assess the risk of dust impacts. This is undertaken separately for each of the four activities (demolition, earthworks, construction and trackout) and takes account of:
- The scale and nature of the works, which determines the potential dust emission magnitude; and
 - The sensitivity of the area, which is dependent on the number of sensitive receptors within certain distance bands of the site (illustrated in Figure 2 within Appendix A) and whether assessing nuisance or human health impacts.
- 3.30 The IAQM guidance assigns sensitivities to receptors with respect to dust soiling and human health effects, as set out in Table 3.1 and Table 3.2.

Table 3.1 Receptor Sensitivity Descriptors with Respect to Dust Soiling

Sensitivity	Descriptor
High	Locations where users can reasonably expect enjoyment of a high level of amenity; or Appearance, aesthetics or value of property would be diminished by soiling; and People / property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land e.g. residential dwellings, museums, medium/long-term car parks, car showrooms.
Medium	Locations where users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or Appearance, aesthetics or value of property could be diminished by soiling; or People or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land e.g. parks and places of work
Low	Enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land e.g. playing fields, farmland (unless commercially sensitive horticultural), footpaths, short term car parks and roads

Table 3.2 Receptor Sensitivity Descriptors with Respect to Human Health Impacts

Sensitivity	Descriptor
High	Locations where members of the public are exposed over a time period relevant to the 24-hour objective for PM ₁₀ (a relevant location would be where individuals may be exposed for 8 hours or more in a day) e.g. residential dwellings, hospitals, schools, residential care homes.
Medium	Locations where the people exposed are workers, and exposure is over a time period relevant to the 24-hour objective for PM ₁₀ (a relevant location would be where individuals may be exposed for 8 hours or more in a day) e.g. office and shop workers, generally excludes workers occupationally exposed to PM ₁₀ , as protection is covered by Health and Safety at Work legislation.
Low	Locations where human exposure is transient, e.g. public footpaths, playing fields, parks and shopping streets.

- 3.31 These factors are combined to give an estimate of the risk of dust impacts occurring. Risks are described in terms of there being a low, medium or high risk of dust impact for each of the four separate potential

activities. Where there are low, medium or high risks of an impact, then site specific mitigation will be required, proportionate to the level of risk. Based on the threshold criteria and professional judgment, one or more of the groups of activities may be assigned a 'negligible' risk.

- 3.32 Site-specific mitigation for each of the four activity categories is then determined based on the risk of dust impacts identified. Professional judgment is employed to examine the residual dust impacts assuming mitigation is undertaken to determine significance.

Construction Vehicle Emissions

- 3.33 The IAQM guidance on the assessment of dust from construction sets out how to undertake a construction phase air quality assessment (Ref 2). This in turn describes that criteria for determining whether it is necessary to undertake a detailed assessment of construction traffic related air quality impacts can be based on the EPUK / IAQM guidance (Ref 3), which are:

“Large, long-term construction sites that would generate large HGV flows (>200 per day) over a period of a year or more.”

- 3.34 At the time of compiling this assessment report, detailed construction traffic movement information was not available. However, it is considered highly unlikely that a development of the site and nature proposed would generate a quantum of construction related traffic above this threshold, and would furthermore not expected to be sustained at a 'peak' level for more than a year. Therefore, construction phase road traffic emissions are not considered further in this assessment.

Methodology for Determining Potential Operational Phase Air Quality Impacts

Introduction

- 3.35 This section describes the approach taken for the assessment of emissions associated with the operation of the proposed diesel-powered stand-by generator sets. All the generators envisaged for the Proposed Development shall be fit-for-purpose vendor-supplied units, having the following (or similar/equivalent) characteristics:
- Prime mover: V-16, four-stroke water-cooled diesel, low fuel consumption;
 - Set arrangement: Containerised with close couple radiator; and
 - Standby rating: 2.4 MWe at 1,500 revolutions per minute, 400 volts, 50 Hertz.
- 3.36 Each generator set shall be provided with its own dedicated exhaust flue stack. It was noted that the project designs envisage the co-mingling of diesel engine exhaust with clean air passed through the generator set cooling system, with the combined stream discharged vertically through the flue outlet.
- 3.37 The point sources of emissions have been modelled using AERMOD. AERMOD is a new generation air quality modelling system, developed by the United States Environmental Protection Agency (US EPA) in collaboration with the American Meteorological Society. It is a straight-line, steady-state Gaussian plume model that can model the dispersion of pollutants over rural and urban areas, flat and complex terrain. AERMOD considers surface and elevated releases, and multiple sources including point, area and volume sources to determine ground level pollutant concentrations at specified receptor points.
- 3.38 AERMOD incorporates improved algorithms for convective and stable boundary layers for computing vertical profiles of wind, turbulence and temperature, and for the treatment of all types of terrain. AERMOD possesses the ability to construct vertical profiles of required meteorological variables, allowing improved modelling of the dispersion of pollutants, particularly vertical dispersion.
- 3.39 The AERMOD View software package, published by Lakes Environmental was used in conjunction with the latest currently-approved US EPA regulatory version of AERMOD at the time of starting the assessment (version 21112).

AERMOD Model Inputs

Emission Source Parameters

3.40 The key emission source parameters that have been used as inputs to the dispersion model are summarised in Table 3.3.

3.41 Each of the generator sets discharges flue gases to atmosphere via a dedicated flue stack (i.e. one flue for each of the 16 generator sets).

Table 3.3 Details of Modelled Emission Sources (per Generator)

Sources	Operating Condition	Stack Height (m)	Building Height (m)	Stack Int. Diam. (m)	Flue Gas Exit Temp. (°C)	Exit Velocity (m/s)	Volumetric Flow Rate (Am ³ /s)	NO _x Emission Rate (g/s)
All Generators	100% Load	14.45	14.5	3.27	493	6.82	57.3	4.19
All Generators	'Hybrid' Load [100% / 75% load]	14.45	14.5	3.27	497	6.59	55.4	3.16
All Generators	10% Load	14.45	14.5	3.27	356	5.42	45.5	1.62

Note: 'Hybrid' Load was defined by pro-rating certain key parameters by 1/3 of an hour @100% load and 2/3 of an hour @75% load. This was done to represent the operating mode where the generator runs at maximum load for approximately 20 minutes from starting, then stabilising at 75% load for the balance of the hour.

Modelling Scenarios

3.42 Three modes of operation for the generator sets have been evaluated to account for the local air quality impacts from emissions during the operation. The details of each (and corresponding model setup parameters used) are presented in Table 3.4.

3.43 As described in the table, operation of the stand-by generators for testing and/or maintenance purposes will be done individually (i.e. no concurrent operations). When considering impacts arising from these activities, the dispersion model was set up to include all sources operating throughout the year, but with the contribution at each modelled receptor segregated out per source (i.e. per generator). This therefore allowed for the the likely impacts from each generator being tested to be evaluated.

3.44 Considering that the stand-by generators could operate at any time under emergency conditions, a hypergeometric distribution assessment was undertaken. This is a discrete probability distribution which in this case was used to determine the probability that, from a set of mutually exclusive randomly selected hourly values from a full year's dataset (8,760 hours), there will be 19 1-hour mean NO₂ concentrations which will exceed the threshold concentration of 200 µg/m³ considering the number of hours of operation of the sources. The assessment criterion considered the probability of the short-term air quality standard being exceeded being greater than 5% (a 1 in 20-year event).

Table 3.4 Modelled Scenario Information

Mode of Operation	Description of Operation	Modelling Notes / Representation
Routine off-load testing / maintenance	Each generator being tested individually on a monthly basis, being run at 10% load for 20 minutes.	– The intermittent, short-duration contributions (20 minutes monthly) to long-term mean NO₂ and PM concentrations from this mode of operation have been accounted for through modelling the generators at 10% load. – Impacts on short-term mean NO₂ concentrations were modelled on a conservative assumption of the generators operating at the 'hybrid' (75-100%) load.
Routine mains failure testing	Each generator being tested individually twice per year under load. Envisaged 20 minutes at 100% load followed by 40 minutes at 75% load.	– The intermittent, short-duration contributions (120 minutes monthly) to long-term mean NO₂ and PM concentrations from this mode of operation have been accounted for through modelling the generators at 'hybrid' (75-100%) load. – Impacts on short-term mean NO₂ concentrations were also modelled with the generators operating at the 'hybrid' (75-100%) load.
Emergency operation (estimate)	All generators operating concurrently, initially for 20 minutes at 100% load followed by 220 minutes at 75% load. Could occur at any time.	– Infrequent contributions to long-term mean NO₂ and PM concentrations from this mode of operation have been accounted for through by modelling all generators operating for 240 minutes annually on a conservative assumption of being at 100% load. – Impacts on short-term mean NO₂ concentrations were also modelled with the generators operating at 100% load.

Note: 'Hybrid' Load was defined by pro-rating certain key parameters by 1/3 of an hour @100% load and 2/3 of an hour @75% load.

Building Downwash Effects

- 3.45 The dispersion of pollutants from modelled sources (particularly industrial point sources) may be affected by aerodynamic wakes generated by winds flowing around and over nearby buildings. Building wakes generally decrease the distance downwind at which pollutant plumes emitted from stacks come into contact with the ground. This may result in higher ground level pollutant concentrations closer to the emission source.
- 3.46 AERMOD includes the PRIME building wake algorithm and the Building Profile Input Program (BPIP) for entering the location and dimension of buildings where building wakes may influence dispersion characteristics. The location and dimensions of the main buildings and structures at the site have been included in the model, based on site layout plans, elevation drawings and publicly available aerial imagery. An illustrative depiction of the buildings inputted to the model is provided in Figure 3 (within Appendix A) with further technical details presented in Appendix B.

Meteorological Data

- 3.47 Hourly sequential data from London Heathrow Airport meteorological station for the years 2015 to 2019 inclusive were used in this study. The station is approximately 3 km to the south of the Site and is considered to be broadly representative of meteorological conditions experienced at the site.
- 3.48 A visual representation of the meteorological data used in the assessment is shown in the wind roses presented in Appendix C. The wind roses demonstrate that the wind is predominantly from the south west.

Terrain

- 3.49 The site and surrounding area are relatively flat with little significant change in terrain height. As such, the effects of terrain of the dispersion of emissions have not been considered in the modelling.

Surface Roughness

- 3.50 A surface roughness of 1 m was used to represent the surface roughness of the land surrounding the site and fits the description of the landscape between the emission points and the closest sensitive receptors.

Specialised Model Treatments

- 3.51 Emissions have been modelled such that they are not subject to dry and wet deposition or depleted through chemical reactions. The assumption of continuity of mass is likely to result in an overestimation of impacts at receptors (i.e. environmentally conservative).

Oxides of Nitrogen to NO₂ Conversion

- 3.52 Emissions of NO_x from the project sources will mainly consist of nitric oxide (NO) at the point of release. NO is subsequently oxidised to form NO₂ following release from the flue stacks, with the proportion of NO₂ in the exhaust plume increasing with distance from the point of release. NO is a relatively innocuous substance, but it is of interest as a precursor to NO₂ through chemical reactions in the atmosphere.
- 3.53 Conversion of NO to NO₂ can be significant at downwind distances of up to 10 km from the project emission sources, in the case of large sources. However, the chemistry of this conversion is complex and subject to many influences (such as the primary NO_x-NO₂ ratio of the emission at source, locations of receptors in relation to the source, and the background concentrations of NO, NO₂ and ozone (O₃), and to a lesser extent background hydrocarbons); it is consequently difficult to accurately predict the rate of conversion of NO to NO₂.
- 3.54 The Environment Agency (EA), in its generic combustion source related guidance document (Ref 35), recommends applying the following conversion ratios to provide what it describes as a “worst-case scenario”:
- Long-term NO_x to NO₂ conversion: 70%
 - Short-term NO_x to NO₂ conversion: 35%
- 3.55 It concedes however, that more case-specific conversion ratios may be used, provided that adequate justification is given. In a focused study relating specifically to evaluating short-term NO₂ impacts from diesel generators (Ref 36), the EA found that due to the very high NO_x emissions of diesel generator engines and the very high resulting process contributions (PCs), the amount of conversion is likely to be limited by the amount of available O₃ in the background. The study incorporated several tests and sensitivity analyses (including using actual background pollutant concentrations from the neighbouring

suburb of Harlington), which concluded that a short-term conversion ratio of 15% was reasonable within approximately 500 m of the source. This conversion ratio was considered more likely to underestimate the impacts beyond 500 m from the source; however it highlighted that it is within 500 m that potential exceedances would be more likely to occur. A 15% conversion ratio was therefore adopted for the study for modelling of hourly mean NO₂ concentrations⁴.

Predicting the Number of Days in which the PM₁₀ 24-hour Mean Objective is Exceeded

- 3.56 In order to assess model results against the AQS 24-hour mean objective for PM₁₀, LAQM.TG(16) (Ref 27) sets out the method by which the number of days in which the PM₁₀ 24-hour objective is exceeded can be obtained based on a relationship with the predicted PM₁₀ annual mean concentration (C):

$$\text{No. of Exceedances} = 0.0014 * C^3 + \frac{206}{C} - 18.5$$

Note: When applying this calculation, if an annual mean PM₁₀ concentration is below 32 µg/m³, then the 24-hour mean AQS objective is unlikely to be exceeded.

Modelled Receptors

- 3.57 A total of 97 discrete cartesian receptors were defined and were selected based on being representative of locations where people could be exposed to air pollutants arising from the operation of the Proposed Development across relevant time periods defined by the AQS objectives. Figure 4 within Appendix A illustrates the locations of each of the discrete modelled receptor locations. All receptor points were all modelled at a height of 1.5m above ground level.

Baseline Air Quality

- 3.58 Further discussion on background and baseline ambient air quality is presented more broadly in Section 4, however for the specific purposes of defining baseline air pollutant concentrations at each of the modelled discrete sensitive receptor locations, the London Atmospheric Emission Inventory (LAEI) 2019 (Ref 37) was used. The LAEI provides modelled pollutant concentrations (including those of relevance to this assessment – NO₂, PM₁₀ and PM_{2.5}) on a 20 m regular cartesian gridded resolution.
- 3.59 For each modelled discrete sensitive receptor, the corresponding LAEI pollutant concentration for that location was used to represent the baseline pollutant concentration. Therefore, each of the modelled receptors has a different assumed baseline pollutant concentration to one another.
- 3.60 The baseline pollutant concentrations adopted for each of the modelled receptor locations can be seen in the tabulated results of the dispersion modelling assessment, presented in Appendix F.
- 3.61 As is customary in the absence of detailed data to support the derivation of short-term background pollutant concentrations (and in alignment with guidance published by the UK Environment Agency (Ref 38) indicative short-term background concentrations have been derived by doubling the known long-term background concentrations).

Modelling Outputs

- 3.62 The following terminology has been used in this report when assessing the modelled impacts on local air quality:
- Process Contribution (PC): The ground level concentration predicted by the model from emissions contributed by the Proposed Development's activities (i.e. operation of the stand-by generators) alone; and
 - Predicted Environmental Concentration (PEC): PC plus the baseline pollutant concentration identified at each modelled receptor location.

⁴ A sensitivity analysis was undertaken to consider the effects of applying this approach compared to the generic assumption of 35% NO_x:NO₂ conversion ratio. This analysis found that implementing the 35% conversion ratio would not lead to predicted exceedances of the short-term NO₂ AQS objective at any of the modelled receptor locations.

Modelling Assumptions

3.63 The following assumptions have been considered in the dispersion modelling assessment:

- XY coordinates of emission sources, modelled building vertices, etc. are based on best approximation / interpretation from design drawings and publicly-available mapping, projected in ArcMap GIS software;
- Emission source data was derived from a manufacturer specification datasheet for a make / model of generator that could be used for the Proposed Development (though it is noted that the final selection of generator set had not been made at the time of compiling this assessment). Refer to Appendix D for a copy of the manufacturer's datasheet used as a source of information for this assessment;
- The majority of PM produced by diesel engines is fine ($<1\mu\text{m}$ in diameter) (Ref 34). Therefore, this assessment has assumed that all PM emissions from the generators (specified on the manufacturer's datasheet simply as "particulate matter") shall represent $\text{PM}_{2.5}$ emissions;
- The design for the flues for each generator set envisages a large, rectangular vent duct (which, as described in paragraph 3.36, will discharge co-mingled of diesel engine exhaust and clean air from the generator set cooling system). The AERMOD modelling software cannot account for non-circular point sources of emissions, so each flue was modelled as a circular source with the flue cross-sectional area being the same as if it were a rectangular section);
- Receptors representative of the location of maximum exposure to air pollutants within an area have been selected to provide a conservative assessment;
- The modelled NO_2 concentrations used in the assessment of impacts from generator operation for testing and/or maintenance are based on the 99.79th percentile of 1-hour mean concentrations, which is the statistic form of the allowable exceedances, as per the AQS objective for this pollutant. However, the assessment of impacts from emergency operation of the generators used the 100th percentile of 1-hour mean NO_2 concentrations as inputs to the hypergeometric analysis;
- The Environment Agency's recommends (for permitting rather than planning purposes) multiplying the calculated probability output from a hypergeometric analysis by a factor of 2.5 where the statistical method assumes independent and random operational hours and sources may include continuous operation of more than an hour. Notwithstanding that this is a recommended for permitting, it was adopted for the current study to provide a conservative assessment.

Air Quality Neutral Assessment

3.64 The air quality neutral assessment is intended to address the risk of a number of developments across the Greater London area contributing very small amounts of additional pollutants to air quality. The GLA's Air Quality Neutral Planning Support document (Ref 28) provides specialist consultants with a methodology to undertake an 'air quality neutral' assessment, as well as emission benchmarks for buildings and transport, against which the predicted values for proposed development can be compared.

3.65 While it is acknowledged that the GLA currently aims for all planning applications to be accompanied by an air quality neutral assessment, it is highlighted that the Proposed Development does not fall into any of the predefined categories for which benchmarks are set. On this basis, and considering that operational phase road traffic movements associated with the Proposed Development are expected to be minimal (and certainly less than the extant use of the Site), this assessment has been deferred in favour of an air quality damage cost calculation (refer to the following section).

Air Quality Damage Cost Calculation

3.66 The LBH requires that air quality damage cost calculations are undertaken for proposed developments, in order to provide an indication of the value of mitigation measures to be applied. The assessment has used guidance published by Defra (Ref 39).

Significance Criteria

Construction Phase

- 3.67 The construction phase assessment does not use a magnitude of change approach, but rather a risk-based approach as described further below. The primary aim of the AQDRA is to identify the appropriate site-specific mitigation measures that must be adopted to ensure there will be no significant impact on local amenity or public health.
- 3.68 The significance of impact of dust and PM₁₀ in relation to the type of impacts is described in Table 3.5. The scale of the risk of adverse impacts occurring due to each type of construction activity, with mitigation in place, is described using the terms high, medium and low risk. The basis for the choice of description is set out for each activity, comprising demolition, earthworks, construction and track-out, and is consistent with the IAQM's guidance (Ref 2).

Table 3.5 Descriptors Applied to the Predicted Adverse Impacts of Fugitive Emissions of Particulate Matter

Significance of Impact at Single Receptor	Description
Substantial	A significant impact that is likely to be a material consideration in its own right.
Moderate	A significant impact that may be a material consideration in combination with other significant impacts but is unlikely to be a material consideration in its own right.
Slight	An impact that is not significant but that may be of local concern.
Negligible	An impact that is not significant change.

Operational Phase

- 3.69 Air quality impacts are considered to be significant if a development leads to significant impacts at existing sensitive receptors or if air quality objectives / EU limit values are predicted to be exceeded at sensitive receptors. The EPUK / IAQM guidance on land-use planning and development control (Ref 3) suggests that a two-stage approach be adopted to determine whether or not a proposed development has a significant impact on local air quality. Firstly, qualitative descriptions are applied to the predicted impacts on local air quality at individual receptors, which is then supplemented by professional judgment about the overall significance of the identified impacts.
- 3.70 In order to assess the potential impacts of a proposed development on local air quality, a description of the impact is given based on the magnitude of change as a percentage of a relevant Air Quality Assessment Level (AQAL). Account must also be taken of predicted pollutant concentrations and their relationship to the air quality objective for the pollutant of concern. Table 3.6 summarises the impact descriptors for annual mean NO₂ and PM₁₀ concentrations, whilst Table 3.7 presents the equivalent descriptors for annual mean PM_{2.5} concentrations. The impact descriptors may be adverse or beneficial depending upon whether concentrations are predicted to increase or decrease.

Table 3.6 Air Quality Impact Descriptors for Annual Mean NO₂ and PM₁₀ Concentrations

Annual mean concentration at receptor in assessment year		Change in concentration relative to AQAL ^a				
		0%	1%	2% – 5%	6% – 10%	>10%
As % of AQAL	NO ₂ / PM ₁₀ (µg/m ³) ^b	<0.2 µg/m ³	0.2 – <0.6 µg/m ³	0.6 – <2.2 µg/m ³	2.2 – ≤4.0 µg/m ³	>4.0 µg/m ³
≤75%	≤30.2	Negligible	Negligible	Negligible	Slight	Moderate
76% - 94%	30.2 – 37.8	Negligible	Negligible	Slight	Moderate	Moderate
95% - 102%	37.8 – 41.0	Negligible	Slight	Moderate	Moderate	Substantial
103% - 109%	41.0 – 43.8	Negligible	Moderate	Moderate	Substantial	Substantial
≥110%	≥43.8	Negligible	Moderate	Substantial	Substantial	Substantial

Notes:

a. The percentage change in pollutant concentration is calculated and rounded to the nearest whole number to make it clearer which column the impacts fall within. Changes of less than 0.5% are rounded down to zero and therefore described as negligible.

b. Concentrations quoted were obtained from IAQM.

Table 3.7 Air Quality Impact Descriptors for Annual Mean PM_{2.5} Concentrations

Annual mean concentration at receptor in assessment year		Change in concentration relative to AQAL ^a				
		0%	1%	2% – 5%	6% – 10%	>10%
As % of AQAL	PM _{2.5} (µg/m ³)	<0.2 µg/m ³	0.2 – <0.4 µg/m ³	0.4 – <1.2 µg/m ³	1.2 – ≤2.0 µg/m ³	>2.0 µg/m ³
≤75%	≤15	Negligible	Negligible	Negligible	Slight	Moderate
76% - 94%	15 – 18.8	Negligible	Negligible	Slight	Moderate	Moderate
95% - 102%	18.8 – 20.4	Negligible	Slight	Moderate	Moderate	Substantial
103% - 109%	20.4 – 21.8	Negligible	Moderate	Moderate	Substantial	Substantial
≥110%	≥21.8	Negligible	Moderate	Substantial	Substantial	Substantial

Notes:

a. The percentage change in pollutant concentration is calculated and rounded to the nearest whole number to make it clearer which column the impacts fall within. Changes of less than 0.5% are rounded down to zero and therefore described as negligible.

- 3.71 The descriptors presented in the tables above are ascribed to impacts at individual sensitive receptor locations, however they are not, of themselves, a clear and unambiguous guide to reaching a conclusion on significance. The guidance makes it clear that the assessment of significance of the overall impact should be based on professional judgment. Whilst it may be that there are 'slight', 'moderate' or 'substantial' impacts at one or more receptors, the overall impact may not necessarily therefore be judged as being significant in some circumstances. A 'moderate' or 'substantial' impact may not have a significant impact if it is confined to a very small area.
- 3.72 Where a single development can be judged in isolation, it is likely that a 'moderate' or 'substantial' impact will give rise to a significant impact and a 'negligible' or 'slight' impact will not have a significant impact, but such judgments are always more likely to be valid at the two extremes of impact severity.

Overall Assessment of Significance

- 3.73 The significance of the reported likely impacts is then considered for the Proposed Development in overall terms. The potential for the Proposed Development to contribute to or interfere with the successful

implementation of policies and strategies for the management of local air quality are considered if relevant, but the principal focus is in determining the significance of any change to the likelihood of future achievement of the air quality objective values.

- 3.74 The achievement of local authority goals for local air quality management is directly linked to the achievement of the air quality objectives and, as such, this assessment focuses on the likelihood of future achievement of the air quality objectives as a result of the Proposed Development.

4. Baseline

- 4.1 The Proposed Development is located within the administrative boundary of the LBH. In 2003, LBH declared an AQMA encompassing the southernmost two thirds of the Borough on the basis that concentrations of NO₂ were in exceedance of the annual mean national ambient air quality objective for this pollutant. In the immediate vicinity of the Site, the main source of pollution is considered to be related to emissions from road traffic, although there are additionally contributions from local energy generation, industry and other (non-road) transportation sources.
- 4.2 To assess the significance of any new development proposal (in terms of air quality), it is necessary to identify and understand the baseline air quality conditions in and around the study area. This provides a reference against which any potential changes in air quality can be assessed.
- 4.3 To identify the existing air quality conditions, a review of publicly available information has been undertaken, including the latest local authority air quality reports, monitoring data, and background concentration maps. This section presents the results of the review.

Local Air Quality Management

- 4.4 LBH's first AQAP was published and adopted in 2004, which set out measures to improve air quality in the AQMA. An updated AQAP, Hillingdon's AQAP 2019-2024 (Ref 24) reinforced that road transport emissions are the major source of air pollution in the Borough, and set out updated measures for reducing these.
- 4.5 The LBH's most recently published LAQM Annual Status Report (ASR) (Ref 40) presents information for 2020, indicating that there has been a reduction in annual mean NO₂ concentration at most sites across borough compared to the previous assessment year, though it is highlighted that this is likely to have been influenced by the COVID-19 pandemic and associated impacts on travel.

Air Quality Focus Areas

- 4.6 The Mayor of London has designated 183 Air Quality Focus Areas (AQFAs) in the latest published database (LAEI 2016 Air Quality Focus Areas) (Ref 41). These are locations that not only exceed the EU annual mean limit value for NO₂ but are also locations with high human exposure. The AQAFs were defined to address concerns raised by boroughs within the LAQM review process and forecasted air pollution trends. The Objective 4.1 of the London Environment Strategy (Ref 19) states:

"... It requires reducing exposure, particularly at priority locations like the Air Quality Focus Areas, including by raising awareness of the impacts of pollution and when air quality is particularly poor."

- 4.7 The Site lies outside of any designated AQAF, with the nearest of these being the West Drayton/Yiewsley and M4 Focus Areas (Highways England responsible for AQ monitoring and management scheme). These are approximately 1.5 km west and 0.6 km south of the Site respectively.

Local Air Quality Monitoring

- 4.8 The LBH monitors air quality at 12 automatic monitoring sites (as at the end of 2020, which represents the most recent published data). The closest of these to the Site is located the "London Hillingdon" ("HIL") site at Sipson Road, West Drayton approximately 1.4 km south of the Site. This station records concentrations of NO₂ and PM₁₀.
- 4.9 The LBH also monitors annual mean concentrations of NO₂ using passive diffusion tubes at several sites within their administrative area (44 sites in 2020 – the latest year for which data is available). The nearest monitoring site is "HILL21", Mulberry Crescent, West Drayton (a background site), located approximately 850m west of the Site.
- 4.10 The locations of these and other nearby LBH air quality measurement locations in relation to the Site are illustrated in Figure 5 within Appendix A.

- 4.11 The most recent monitoring data (from 2016 – 2020) for NO₂ annual mean concentrations from the nearest LBH measurement sites (albeit noting that some are located several kilometres away from the Site) are summarised in Table 4.1.

Table 4.1 LBH Measured Annual Mean NO₂ Concentrations (2016 – 2020)

Site ID	Type	Distance from Site (km)	Annual Mean NO ₂ Concentration (µg/m ³)				
			2016	2017	2018	2019	2020
Automatic Monitoring Sites							
HIL	Urban background	1.4	51.2	53	46	45	28
HRL	Airport	1.8	34	32	30	31	20
Diffusion Tube Monitoring Sites							
HILL21	Background	0.85	29.6	34.7	34.9	32.3	23.4
HILL28	Roadside	1.3	32.3	35.7	31.7	31.7	23.0
HILL01	Roadside	1.4	34.3	45.3	42.0	38.6	25.6
HILL20	Background	1.5	35.9	37.9	36.6	36.6	31.6
HILL18	Roadside	1.5	40.9	49.0	38.5	37.4	29.9
HILL27	Roadside	1.7	30.8	33.8	32.5	33.2	24.5
HILL26	Roadside	1.9	42.1	51.5	42.0	40.0	28.2
HILL07	Roadside	1.9	34.7	43.3	37.7	36.9	28.1

Note: Figures shown in bold font indicate that the measured annual mean concentration exceeded the corresponding AQS objective.

- 4.12 The measured data generally appear to indicate a reducing trend in annual mean NO₂ concentrations at most of monitoring sites presented.

Defra's Background Pollutant Concentration Mapping

- 4.13 A large number of small sources of air pollutants exist, which individually may not be significant, but collectively, over a large area, need to be considered in the modelling process. Pollutant emissions from these sources contribute to background air quality, which when added to modelled emissions allow the total ambient pollutant concentration to be predicted.
- 4.14 Defra has produced maps of background pollutant concentrations covering the whole of the UK for use by local authorities and consultants in the completion of LAQM reports and air quality assessments where local background monitoring data are unavailable or inappropriate for use. The maps provide background pollutant concentrations for each 1 km x 1 km grid square within the UK for all years between 2015 and 2030 (Ref 36).
- 4.15 Defra background map concentrations for NO₂, PM₁₀, and PM_{2.5} for the years 2019 – 2021 for the two grid squares nearest the Site are presented in Table 4.2. These indicate that background pollutant concentrations in the vicinity of the Site are below the respective annual mean AQS objectives / limit values.

Table 4.2 Defra Annual Mean Background Mapped Concentrations

Defra OS Grid	2019 Concentration (µg/m ³)			2020 Concentration (µg/m ³)			2021 Concentration (µg/m ³)		
	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}	NO ₂	PM ₁₀	PM _{2.5}
508500_179500	26.5	17.0	11.5	25.0	16.6	11.2	24.5	16.4	11.0
507500_179500	26.2	17.5	12.0	25.2	17.1	11.7	24.3	16.9	11.6

- 4.16 Defra mapped background pollutant concentrations have not however been used in the dispersion modelling element of this assessment – rather LAEI 2019 concentrations have been used (refer to the following section).

LAEI Background Pollutant Concentration Mapping

- 4.17 The GLA's work on the LAEI (Ref 37) has enabled the prediction of annual average pollutant concentrations at a high resolution across Greater London (the 32 London boroughs and the City of London), as well as areas outside Greater London up to the M25 motorway. Ground level concentrations of key pollutants including NO₂, PM₁₀ and PM_{2.5} are estimated using an atmospheric dispersion model and are output at a spatial resolution of 20 m x 20 m. This resolution is considerably finer than that of the data contained within the UK-wide Defra background maps.
- 4.18 The latest available data in the LAEI is based on an assessment base year of 2019.
- 4.19 As discussed in paragraph 3.59 above, the 2019 LAEI modelled pollutant concentrations have been used in the dispersion modelling assessment to provide representative long-term baseline pollutant concentrations specific to each discrete modelled sensitive receptor location. The range of LAEI pollutant concentrations adopted to represent baseline conditions at the modelled sensitive receptor locations are presented in Table 4.3.

Table 4.3 Range of LAEI 2019 Pollutant Concentrations at Modelled Sensitive Receptor Locations

Parameter	NO ₂ Concentration (µg/m ³)	PM ₁₀ Concentration (µg/m ³)	PM _{2.5} Concentration (µg/m ³)
AQS Objective	40	40	20
Minimum Range	25.3	15.1	10.0
Maximum Range	33.6	17.4	10.7

- 4.20 The baseline pollutant concentrations adopted for each of the modelled sensitive receptor locations can be seen in the tabulated results of the dispersion modelling assessment, presented in Appendix F.

Baseline Dust Climate

- 4.21 A background level of dust exists in all urban and rural locations in the UK. Dust can be generated on a local scale from vehicle movements and from the action of wind on exposed soils and surfaces. Dust levels can be affected by long range transport of dust from distant sources into the local vicinity.
- 4.22 This baseline rate of soiling is considered normal to those experiencing it and varies dependent on prevailing climatic conditions. The tolerance of individuals to deposited dust is therefore shaped by their experience of baseline conditions.
- 4.23 Existing local sources of particulate matter includes wind-blown dust from exhaust emissions from road vehicles, brake and tyre wear from road vehicles and the long-range transport of material from outside the study area.

5. Construction Phase Assessment

- 5.1 Construction works associated with the Proposed Development will be reduced from that of a comparable complete new-build, as the existing building on site will be refurbished to provide a data hall for the facility. Earthworks and civils requirements will also be relatively small, and will primarily relate to the provision of a utilities gantry area to the immediate west of the existing building on site.
- 5.2 Detailed information relating to the construction phase activities is not currently available, so indicative information and reasonable assumptions have been used to undertake this qualitative assessment in relation to dust impacts from this phase of the Proposed Development.
- 5.3 As there are human receptors within 200 m of the Site, an assessment is required as set out in the guidance published by the Mayor of London (Ref 1) and IAQM (Ref 2). Based on these documents, the potential impacts are considered at the identified receptors using a risk-based approach.
- 5.4 The early phases of the works will involve limited site preparation works and minor demolition. Excavations, earthworks, and temporary stockpiling of potentially dusty materials are also likely to be limited. These activities are likely to represent primary sources of dust during the early phases of construction works.
- 5.5 During the phase of construction works when new building elements are erected, the principal sources of dust are likely to be cutting and grinding of materials, and the movement of construction related road vehicles. Dust emissions from construction give rise to elevated dust deposition and PM₁₀ concentrations, however these effects are generally short-lived episodes over a few hours or days. The movement of construction vehicles may give rise to trackout of materials, generating dust emissions, though in the case of the Proposed Development, the majority of surfaces on the site are likely to be hardsurfaced, limiting the potential for track-out.
- 5.6 Once the majority of buildings and infrastructure have been completed, there would typically be fewer and less significant sources of dust on site.
- 5.7 Appendix E comprises and presents the Air Quality and Dust Risk Assessment (AQDRA). As described above, information relating to the likely magnitude of dust impacts and the sensitivity of the receptors and surrounding area have been combined to determine the risk of dust impacts (refer to Table 5.1). These risk levels were used to determine the appropriate level of mitigation required at the Site.

Table 5.1 Summary Table of Dust Risk to Define Mitigation

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	Low Risk	Low Risk	Low Risk	Negligible
Human Health	Negligible	Negligible	Negligible	Negligible

- 5.8 Overall, the AQDRA conservatively identified the Site as having a 'low risk' of causing dust impacts, as shown in the table above. Mitigation measures proportionate to this level of risk are presented in Section 7.

6. Operational Phase Assessment

Results of Dispersion Modelling Assessment

- 6.1 As indicated in Table 3.4, the three modes of operation of the stand-by generators (i.e. routine off-load testing/maintenance, routine mains failure testing and emergency operation) all have a somewhat interconnected impact on long- and short-term air pollutant concentrations. The results below are therefore set out under sub-headings related to each of the pollutants and applicable averaging periods.
- 6.2 The full results tables from the modelling are included as Appendix F. Note that the results from the most conservative year of the five modelled (i.e. the one which predicts the highest results) are presented in the appendix and discussed below.

Annual Mean Nitrogen Dioxide

- 6.3 The modelling took account of cumulative contributions to annual mean NO₂ concentrations from all three modes of operation.
- 6.4 The model predicted that the Proposed Development would not cause any exceedance of the annual mean AQS objective for NO₂ at any of the modelled receptor locations. The highest predicted environmental concentration (PEC) “without development” (simply the baseline LAEI 2019 concentration) is 33.6 µg/m³ at receptor R69 (dwelling on Mildred Avenue). The highest PEC “with development” is also 33.6 µg/m³ (also at receptor R69) i.e. the Proposed Development does not result in an appreciable change in annual mean NO₂ concentrations at this receptor location.
- 6.5 Based on the EPUK / IAQM criteria, the predicted impacts due to the Proposed Development were described as “negligible” at all 97 modelled sensitive receptor locations. The greatest predicted process contribution (PC) as a result of emissions from the Proposed Development is 0.3 µg/m³ which occurs at receptors R0 and R1 (both being dwellings on Denbigh Drive).
- 6.6 According to the London Councils’ APEC, all of the existing modelled receptors are likely to be “APEC Level A” for annual mean NO₂ concentrations (i.e. no air quality grounds for refusal; however, mitigation of any emissions should be considered).

Hourly Mean Nitrogen Dioxide

- 6.7 The modelling took account of cumulative contributions to annual mean NO₂ concentrations from all three modes of operation, however the results are sub-categorised into those associated with ‘routine operations’ and ‘emergency operations’ due to the different assessment methodologies.

Routine Operations

- 6.8 The model predicts that the Proposed Development would not cause any exceedance of the 1-hour mean AQS objective for NO₂ at any of the modelled receptor locations. The highest PEC “without development” (simply representing twice the long-term baseline concentration) is 67.2 µg/m³, at receptor R69 (dwelling on Mildred Avenue). The highest PEC “with development” is 105.4 µg/m³, at receptor R0 (dwelling on Denbigh Drive). The PECs represent the 99.79th percentile of 1-hour mean predicted NO₂ concentrations.
- 6.9 The greatest predicted PC as a result of emissions from the Proposed Development is 51.1 µg/m³ which occurs at receptor R0 (dwelling on Denbigh Drive). Based on the EPUK / IAQM criteria, the predicted impacts due to the Proposed Development were described as “negligible” at 87% of the modelled sensitive receptor locations (i.e. at 84 of the 97 locations). “Slight adverse” impacts were predicted at 8 receptor locations and “moderate adverse” impacts predicted at 5 receptor locations.

Emergency Operations

- 6.10 For short-term impacts associated with emergency operation, the assessment focused on 1-hour mean concentrations of NO₂ (100th percentile) and the probability of emergency operations causing an exceedance of the applicable short-term AQS objective (19 hours or more of hourly mean NO₂ concentrations of 200 µg/m³ or more).

- 6.11 Given that emergency operation of the generators is only anticipated to occur for 4 hours per year, the short-term AQS objective will not be exceeded directly as a result of the Proposed Development. Hypergeometric distribution analysis of the predicted short-term NO₂ concentrations at the most highly-impacted sensitive receptor locations (R0-R4; R6-R9; R95-R97) revealed that the generators could operate for up to 64 hours before the probability of the short-term AQS objective being exceeded surpasses 5% (a 1 in 20 year event)⁵.

Annual Mean PM₁₀

- 6.12 The modelling took account of cumulative contributions to annual mean PM₁₀ concentrations from all three modes of operation.
- 6.13 The model predicted that the Proposed Development would not cause any exceedance of the annual mean AQS objective for PM₁₀ at any of the modelled receptor locations. The highest PEC “without development” (simply the baseline LAEI 2019 concentration) is 17.4 µg/m³ at receptor R74 (dwelling on Mulberry Crescent). The highest PEC “with development” is 33.6 µg/m³ (also at receptor R74) i.e. the Proposed Development does not result in an appreciable change in annual mean PM₁₀ concentrations at this receptor location.
- 6.14 All predicted PCs as a result of emissions from the Proposed Development are less than 0.1 µg/m³. Based on the EPUK / IAQM criteria, the predicted impacts due to the Proposed Development were described as “negligible” at all 97 modelled sensitive receptor locations.
- 6.15 According to the London Councils’ APEC, all of the existing modelled receptors are likely to be “APEC Level A” for annual mean PM₁₀ concentrations (i.e. no air quality grounds for refusal; however, mitigation of any emissions should be considered).

Daily Mean PM₁₀

- 6.16 The model predicted that the Proposed Development would not cause exceedances of the 24-hour mean AQS objective for PM₁₀ above the total of 35 allowed per year at any of the modelled receptor locations.
- 6.17 The predicted number of days with PM₁₀ concentrations exceeding the 24-hour mean AQS objective “without development” (based simply on the baseline LAEI 2019 long-term concentration) is 1 day at receptors R45 (Busy Bees Nursery at Heathrow), R69 (dwelling on Mildred Avenue) and R74 (dwelling on Mulberry Crescent). There is no change predicted to the number of days with PM₁₀ concentrations exceeding the 24-hour mean AQS objective “with development”. PCs as a result of emissions from the Proposed Development are predicted to be “negligible” at all 97 modelled sensitive receptor locations.
- 6.18 According to the London Councils’ APEC, all of the existing modelled receptors are likely to be “APEC Level A” for 24-hour mean PM₁₀ concentrations (i.e. no air quality grounds for refusal; however, mitigation of any emissions should be considered).

Annual Mean PM_{2.5}

- 6.19 The modelling took account of cumulative contributions to annual mean PM_{2.5} concentrations from all three modes of operation.
- 6.20 The model predicted that the Proposed Development would not cause any exceedance of the annual mean AQS objective for PM_{2.5} at any of the modelled receptor locations.
- 6.21 The highest PEC “without development” (simply the baseline LAEI 2019 concentration) is 10.7 µg/m³ at receptor R69 (dwelling on Mildred Avenue). The highest PEC “with development” is also 10.7 µg/m³ (also at receptor R69) i.e. the Proposed Development does not result in an appreciable change in annual mean PM_{2.5} concentrations at this receptor location.

⁵ Additionally, a sensitivity test was undertaken assuming a NO_x to NO₂ conversion rate of 35%. The results of this sensitivity test revealed that up to 39 hours of emergency operation are likely to occur before the probability of the short-term AQS objective being exceeded surpasses 5% (a 1 in 20 year event). This figure is still well above the maximum expected number of hours that the generators would operate under emergency conditions and therefore the assessment finding is considered robust.

- 6.22 All predicted PCs as a result of emissions from the Proposed Development are less than $0.1 \mu\text{g}/\text{m}^3$. Based on the EPUK / IAQM criteria, the predicted impacts due to the Proposed Development were described as “negligible” at all 97 modelled sensitive receptor locations.

Damage Cost Assessment

- 6.23 LBH requires that an environmental damage cost calculation be carried out to estimate the equivalent monetary ‘damage cost’ value of development-related emissions.
- 6.24 These calculations have used information from the same manufacturer specification datasheet for a make / model of generator that could be used for the Proposed Development as was used for inputs to the dispersion modelling (Appendix D). This emission information was used in conjunction with the latest damage cost guidance and tools (Ref 39) to consider NO_x and $\text{PM}_{2.5}$ emissions associated with the first five years of operation of the Proposed Development.
- 6.25 The assessment considered a start year and price base year of 2022 and used the national average NO_x and $\text{PM}_{2.5}$ damage cost values from the Defra toolkit.
- 6.26 The key emissions-related input parameters used for the calculation are presented in Table 6.1, while the results of the assessment are presented in Table 6.2.

Table 6.1 Input Data for Calculation of Development-Related Emissions

Generator Operating Mode	Duration of Operation (minutes)	Frequency per Year	NO_x Emission Rate (g/hour)	$\text{PM}_{2.5}$ Emission Rate (g/hour)
Off load testing	20	12	5,814	25
Mains failure test (initial period - maximum load)	20	2	15,096	265
Mains failure test (stable period - normal load)	40	2	9,527	246
Estimated emergency operation (initial period – maximum load)	20	1	15,096	265
Estimated emergency operation (subsequent stable operation)	220	1	9,527	246

Notes:

- Duration and frequency per year are based on best assumptions and experience.
- NO_x and $\text{PM}_{2.5}$ emission rates are taken from the Caterpillar EM4791 generator set specification datasheet and represent ‘per generator’ emissions under various load conditions matched to the operating modes. All PM emissions have been assumed to be $\text{PM}_{2.5}$.
- “Off-load” = 10% load; “normal/stable load” = 75% load; “maximum load” = 100% load.

Table 6.2 Damage Cost Estimate of Development-Related Emissions

Parameter	Result	Notes
5-Year NO_x Emissions	6.879 tonnes	5-year emissions total for 16 generator sets
5-Year $\text{PM}_{2.5}$ Emissions	0.128 tonnes	5-year emissions total for 16 generator sets
5-Year Damage Cost NO_x	£51,864	5-year damage cost (central present value) for 16 generator sets
5-Year Damage Cost $\text{PM}_{2.5}$	£11,059	5-year damage cost (central present value) for 16 generator sets
TOTAL 5-Year Damage Cost	£62,923	-

- 6.27 The total 5-year environmental damage cost has been calculated to be £62,923 at the central present value. LBH advises that this figure should be used to guide the Applicant’s investment/expenditure on commensurate measures to mitigate the likely impacts on local air quality, as far as reasonably practicable.
- 6.28 The selection of measures to be adopted to mitigate air quality impacts of the development shall be subject to further discussion and agreement between the Applicant and LBH.

7. Mitigation

- 7.1 This air quality assessment report has presented the findings of both the construction phase assessment (Section 5) and operational phase assessment (Section 6) for the Proposed Development. Recommended mitigation measures for each phase of the development are presented in the following sections.

Construction Phase

- 7.2 There are a range of mitigation measures which can be followed to reduce the likely nuisance and human-health impacts of the dust and PM₁₀, which if effectively implemented should reduce impacts to a negligible level. These mitigation measures should be incorporated within an overall Construction Environmental Management Plan (CEMP) or equivalent.
- 7.3 The measures set out below relate to 'Low risk sites' (as specified in the guidance published by the Mayor of London (Ref 1) and the IAQM (Ref 2)) which should be implemented during the construction work (demolition, earthworks, construction; and track-out). Note that where a measure may not be considered mandatory, but its adoption would be considered desirable to mitigate impacts, it has been denoted with an asterisk (*). Recommended measures from the guidance that would not apply to the Proposed Development (either due to the nature of the Site or the works) have been excluded.

General Requirements:

Site Management

- Develop and implement an Air Quality and Dust Management Plan (AQDMP), which may include measures to control other emissions, approved by the Local Planning Authority;*
- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. The complaints log should be made available to the local authority when asked; and
- Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book.

Monitoring

- Carry out regular site inspections to monitor compliance with the AQDMP, record inspection results, and make an inspection log available to the local authority when asked;
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions; and
- Agree dust deposition, dust flux, or real-time PM₁₀ continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site.

Preparing and Maintaining the Site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site;
- Avoid site runoff of water or mud;
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.

Operating Vehicle / Machinery and Sustainable Travel

- Ensure all on-road vehicles comply with the requirements of the London Low Emission Zone;
- Ensure that non-road plant and vehicles are well maintained and comply with the prevailing London NRMM standards. Should any emissions of dark smoke occur (except during start-up) then the relevant machinery will be stopped immediately and any problem rectified before being used;

- Ensure all vehicles switch off engines when stationary - no idling vehicles should be permitted;
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable and safe to do so;
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials; and
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing)*.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems;
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
- Use enclosed chutes and conveyors and covered skips;
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate; and
- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.*

Waste management

- Avoid bonfires and burning of waste materials.

Measures Specific to Demolition:

- Ensure effective water suppression is used during any deconstruction operations;
- Avoid blasting techniques, using appropriate manual or mechanical alternatives; and
- Bag and remove any biological debris or damp down such material.

Measures Specific to Construction:

- Avoid scabbling (roughening of concrete surfaces) if possible*;
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;*
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- For smaller supplies of fine powder materials ensure bags are sealed after use and stored to prevent dust.

Measures Specific to Track-out:

- Ensure vehicles entering and leaving the Site are covered to prevent escape of materials during transport.

Air Quality and Dust Management Plan (AQDMP)

7.4 It is desirable that an AQDMP should be produced and submitted prior to construction works commencing on-site. An AQDMP should give specific instructions on how to manage impacts from dust and air pollutant emissions on the development site. It should cover all phases of the construction process and take account of all contractors and sub-contractors. If produced, an AQDMP should be prepared in accordance with the Mayor of London's guidance (Ref 1) and include:

- Project programme;
- Construction Logistics Plan;

- Commitment to NRMM Standard from the development;
- Construction monitoring method statement; and
- Non-Road Mobile Machinery Policy.

Operational Phase

- 7.5 The dispersion modelling assessment predicted that local air quality impacts at identified sensitive receptor locations would be mostly insignificant, significant impacts were predicted at a small number of receptor locations nearest the Site. Furthermore, the air quality damage cost calculation indicates that the Applicant should consider investment in measures to mitigate impacts from the Proposed Development on local air quality.
- 7.6 Consequently, the Applicant will need to identify and implement measures to mitigate impacts on, and/or improve, local air quality as far as reasonably practicable. On-site mitigations are generally considered preferable, where possible, however it is acknowledged that this may not always be possible and therefore that contributions towards off-site measures may be deemed appropriate. The Applicant should engage with the LBH to agree appropriate measures.
- 7.7 From an operational perspective, it is recommended that the generator sets be operated for the minimum feasible duration during testing / maintenance.

8. Conclusions

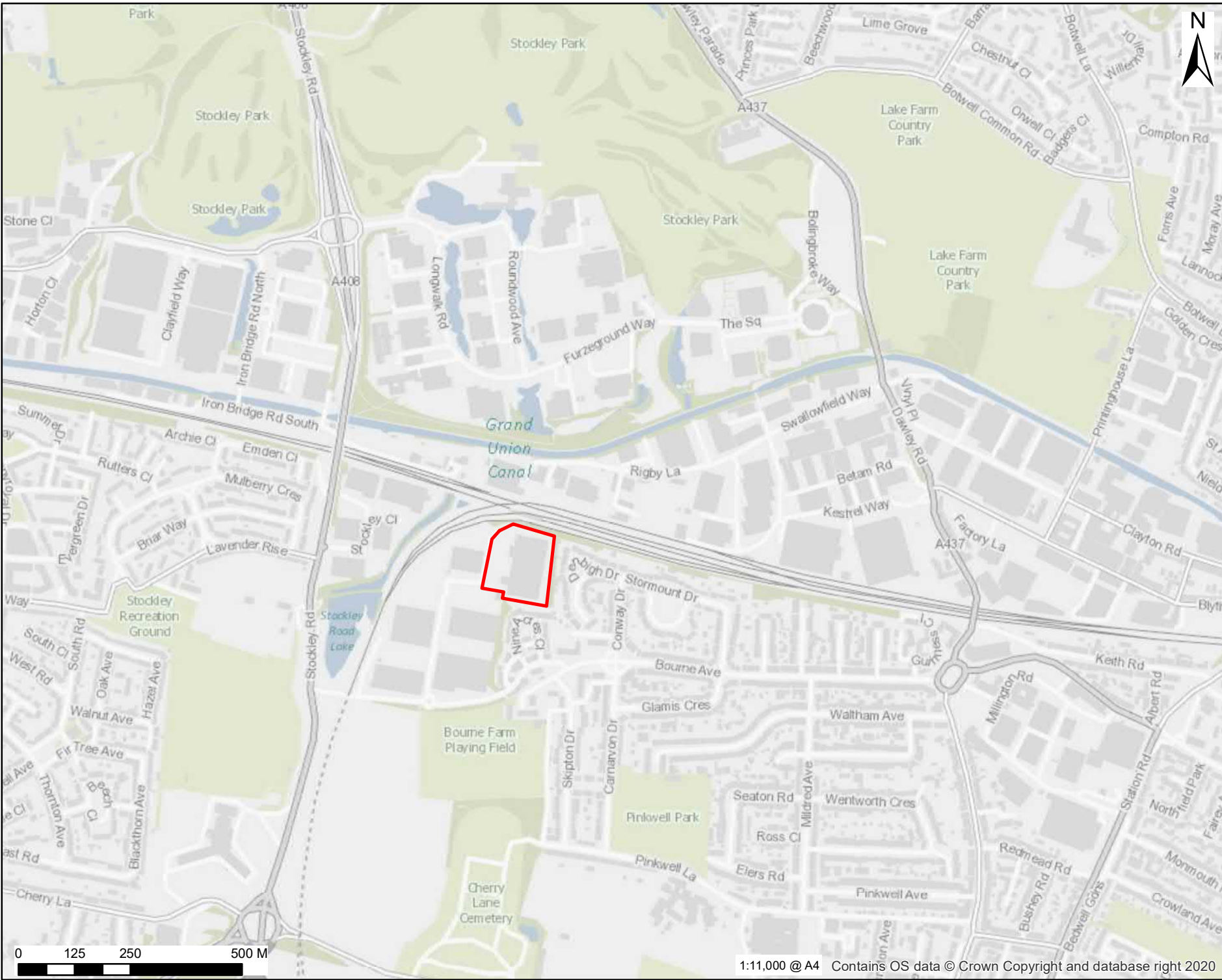
- 8.1 An air quality assessment has been undertaken in order to assess the potential local air quality impacts associated with the Proposed Development of a data centre at the DC6 site within Prologis Park.
- 8.2 LBH declared an AQMA encompassing the southernmost two thirds of the Borough in 2003 on the basis that exceedances of the national annual mean AQS objective for NO₂. The Proposed Development is situated within the AQMA.
- 8.3 The results of the construction phase assessment indicate that, in the absence of mitigation, impacts associated with this phase of the Proposed Development can be described as posing a low-level risk of dust soiling and negligible risk for human health impacts. There are a range of mitigation measures which have been recommended to be adopted and implemented. Provided that all of these measures are effectively implemented, all impacts are likely to be reduced to negligible levels.
- 8.4 The impact of the operation of the Proposed Development on local air quality has been assessed at several existing sensitive receptor locations. The key findings are:
- Impacts from the Proposed Development on annual mean NO₂ concentrations are predicted to be negligible and not significant;
 - Impacts from the Proposed Development on 1-hour mean NO₂ concentrations are predicted to be negligible when considering emergency operation of the generator sets, and overall slight adverse when considering routine operations (testing / maintenance), though it is noted that moderate adverse impacts are predicted at a small number of individual receptors immediately adjacent to the Site. Overall these impacts are considered not significant;
 - Impacts from the Proposed Development on annual mean and daily mean PM₁₀ concentrations are predicted to be negligible and not significant;
 - Impacts from the Proposed Development on annual mean PM_{2.5} concentrations are predicted to be negligible and not significant; and
 - The operation of the Proposed Development is not expected to cause any of the AQS objectives to be exceeded at the modelled sensitive receptor locations.
- 8.5 Overall, the Proposed Development is predicted to have a negligible to slight-adverse impact on local air quality, which is not considered to be significant.

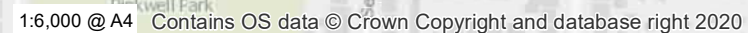
9. References

1. Mayor of London (2014), The Control of Dust and Emissions during Construction and Demolition – Supplementary Planning Guide, July 2014.
2. Institute of Air Quality Management (2014), Guidance on the assessment of dust from demolition and construction.
3. Institute of Air Quality Management (IAQM) and Environmental Protection United Kingdom (EPUK) (2017), Guidance on land-use planning and development control: Planning for air quality 2017.
4. 2008/50/EC, (2008), The Ambient Air Quality and Cleaner Air for Europe Directive.
5. The Air Quality Standards Regulations (2010), Statutory Instrument No. 1001. The Stationery Office.
6. The Air Quality Standards (Amendment) Regulations (2016), Statutory Instrument No. 1184. The Stationery Office.
7. H.M. Government (2021), Environment Act 2021.
8. Defra (2000), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.
9. Defra (2003), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Addendum.
10. Defra (2007), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (Volume 1).
11. H.M. Government (2019), A Green Future: Our 25 Year Plan to Improve the Environment
12. Defra (2019), The Clean Air Strategy.
13. World Health Organization (WHO) (2005), Air Quality Guidelines Global Update 2005.
14. Department for Communities and Local Government (2012), National Planning Policy Framework, the National Archives.
15. Ministry of Housing, Communities and Local Government (2021), National Planning Policy Framework.
16. Ministry of Housing, Communities and Local Government (2019); Planning Practice Guidance (PPG), <https://www.gov.uk/guidance/air-quality--3>.
17. Greater London Authority (2021), The London Plan – Spatial Development Strategy for London, March 2021.
18. Mayor of London (2021), London Plan Guidance – Air Quality Positive [pre-consultation draft], March 2021.
19. Greater London Authority (2018), Mayor of London – London Environment Strategy, May 2018.
20. Mayor of London (2019), London Local Air Quality Management (LLAQM) Policy Guidance 2019 (LLAQM.PG(19)), 2019
21. Mayor of London (2019), London Local Air Quality Management (LLAQM) Technical Guidance 2019 (LLAQM.TG(19)), 2019
22. LBH (2012), London Borough of Hillingdon Local Plan Part 1: Strategic Policies.
23. LBH (2018), London Borough of Hillingdon Local Plan 2.
24. LBH (2019), London Borough of Hillingdon Air Quality Action Plan. Available at: <https://modgov.hillingdon.gov.uk/documents/s45069/Air%20Quality%20Action%20Plan%202019-2024.pdf>.
25. LBH (2002), Air Quality Supplementary Planning Guidance to the Hillingdon Unitary Development Plan.
26. LBH (2014), Supplementary Planning Document Planning Obligations.
27. Defra (2021), Local Air Quality Management, Technical Guidance, LAQM.TG(16).
28. Air Quality Consultants (2014), Air Quality Neutral Planning Support Update: GLA 80371.
29. London Councils (2007), Air Quality and Planning Guidance.
30. BSI (1994); BSI, BS 6069 (Part 2) (1994), Characterization of Air Quality.
31. Council of European Communities (1997), Directive on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery, 97/68/EC.
32. EU 2016/1628 (2016), Regulation on requirements relating to gaseous and particulate pollutant emission limits and type-approval for internal combustion engines for non-road mobile machinery, amending Regulations (EU) No 1024/2012 and (EU) No 167/2013, and amending and repealing Directive 97/68/EC.
33. Ricardo Energy & Environment (2016), London STOR and triad management study - Assessing the air quality impacts of standby generators.
34. ECOpoint Inc (2002), Diesel Net Technology Guide: Diesel Exhaust Particle Size. Available at: [Diesel Exhaust Particle Size \(dieselnet.com\)](http://dieselnet.com).
35. Environment Agency (n.d.), "Conversion Ratios for NO_x and NO₂," EA - Air Quality Modelling and Assessment Unit.. [Online]. Available:

- http://webarchive.nationalarchives.gov.uk/20140328232919/http://www.environment-agency.gov.uk/static/documents/Conversion_ratios_for_NOx_and_NO2_.pdf.
36. Environment Agency (2016), "Diesel generator short-term NO₂ impact assessment," EA - Air Quality Modelling & Assessment Unit.
 37. Greater London Authority (2021), London Atmospheric Emissions Inventory (LAEI) 2019. Available at: <https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2019>.
 38. Environment Agency (2021), Air emissions risk assessment for your environmental permit. Available at: <https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit>.
 39. Defra (2021), Air quality appraisal: damage cost guidance. Available at: <https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance>.
 40. LBH (2021), Air Quality Annual Status Report 2020. May 2021.
 41. Greater London Authority (2019), London Atmospheric Emissions Inventory (LAEI) 2016 Air Quality Focus Areas. Available at: <https://data.london.gov.uk/dataset/london-atmospheric-emissions-inventory--laei--2016-air-quality-focus-areas>.
 42. Defra (2020), DEFRA LAQM Tools Urban Background Maps, UK-AIR. Available at: <http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html>.

Appendix A Figures





Virtus DC6

Virtus Holdco Ltd

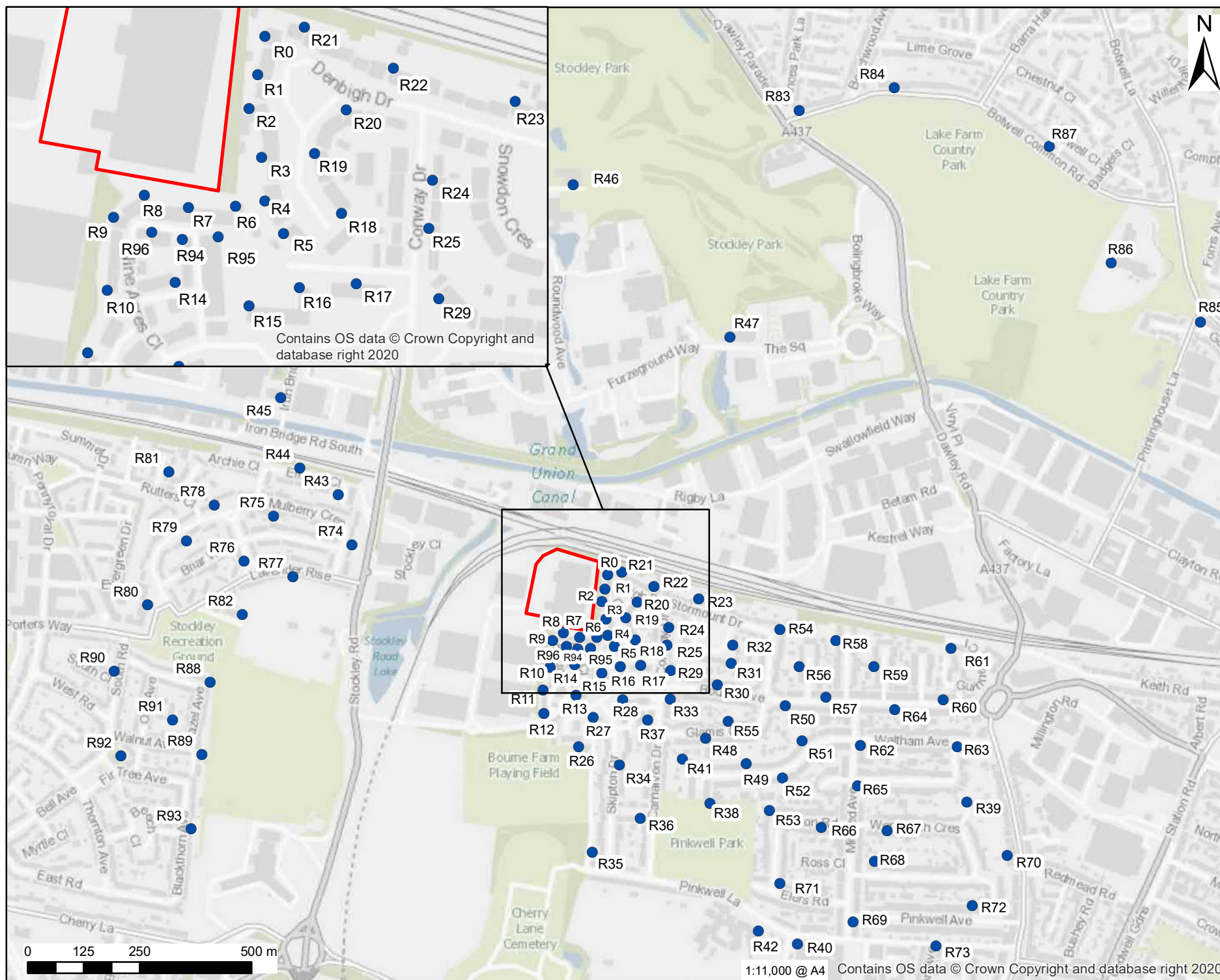
AECOM Limited
Sunley House
4 Bedford Park
Croydon, CR0 2AP
www.aecom.com

 0-20m
 20-50m
 50-100m
 100-200m
 200-350m
 Site Boundary

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Figure 2





PROJECT

Virtus DC6

CLIENT

Virtus Holdco Ltd

CONSULTANT

AECOM Limited
Sunley House
4 Bedford Park
Croydon, CR0 2AP
www.aecom.com

LEGEND

 Site Boundary

- Modelled Receptors

NOTES

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ISSUE PURPOSE

FINAL

PROJECT NUMBER

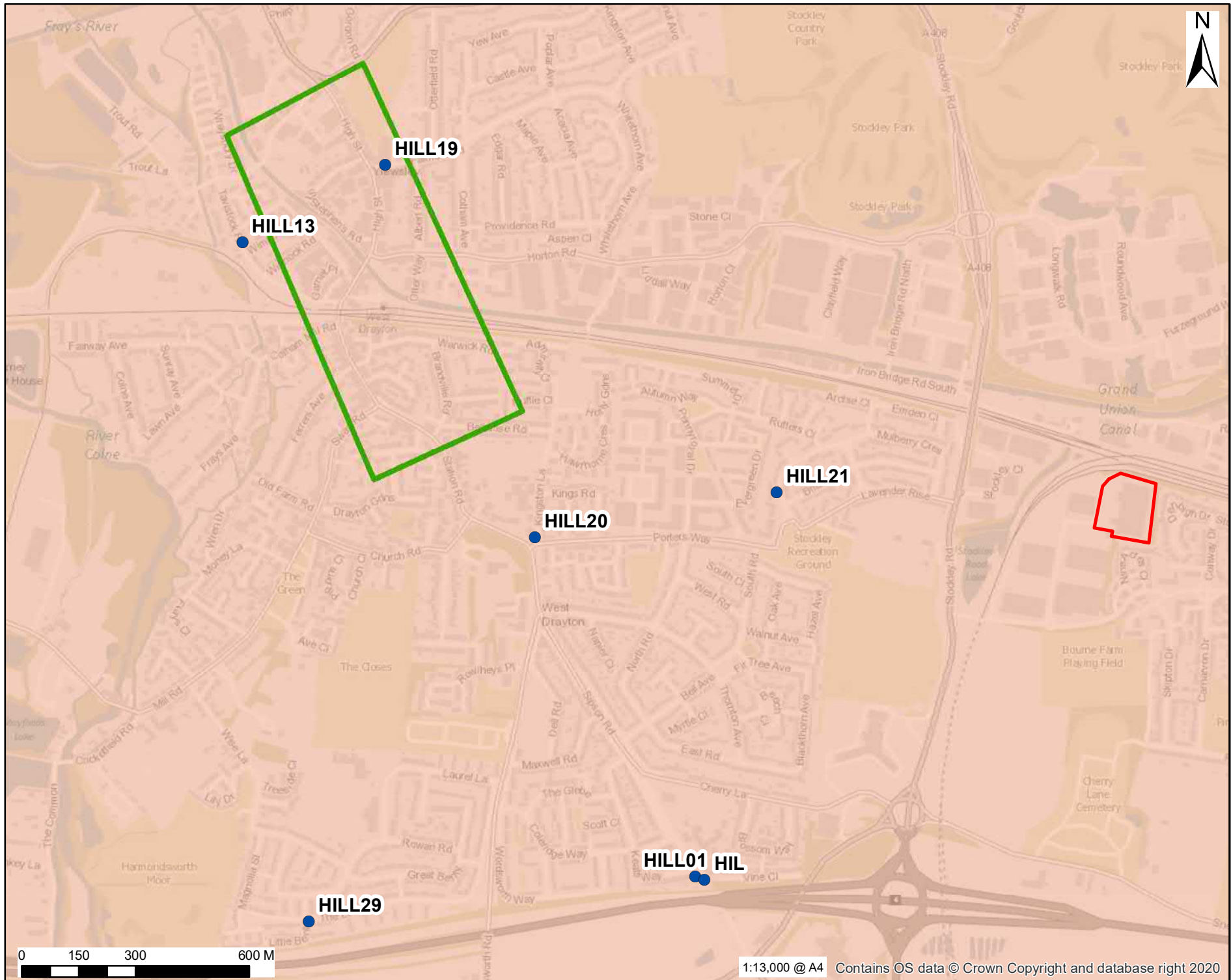
60671881

SHEET TITLE

Modelled Sensitive Receptor Locations

SHEET NUMBER

Figure 4



LEGEND

- Site Boundary
- LBH Monitoring
- AQFA
- AQMA

NOTES

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ISSUE PURPOSE

FINAL

PROJECT NUMBER

60671881

SHEET TITLE

Nearby LBH Air Quality Monitoring Sites

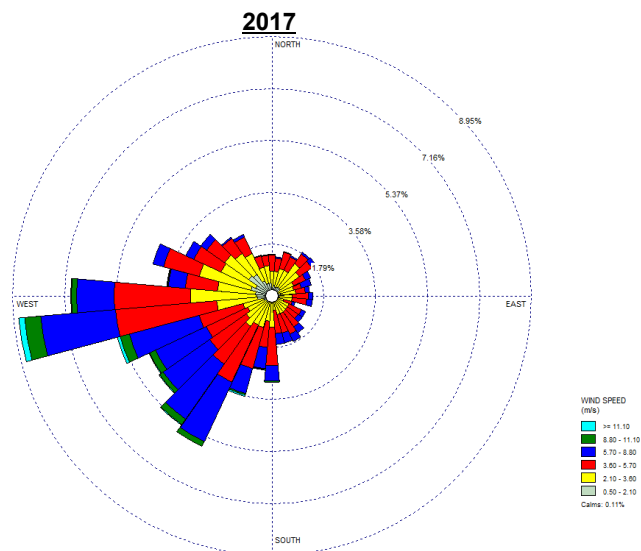
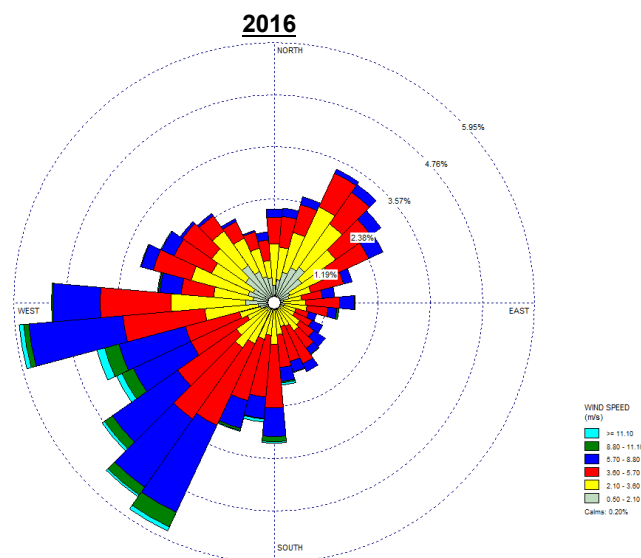
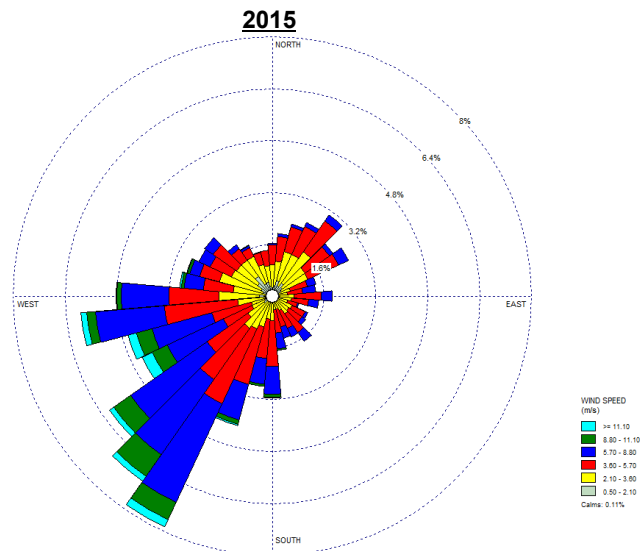
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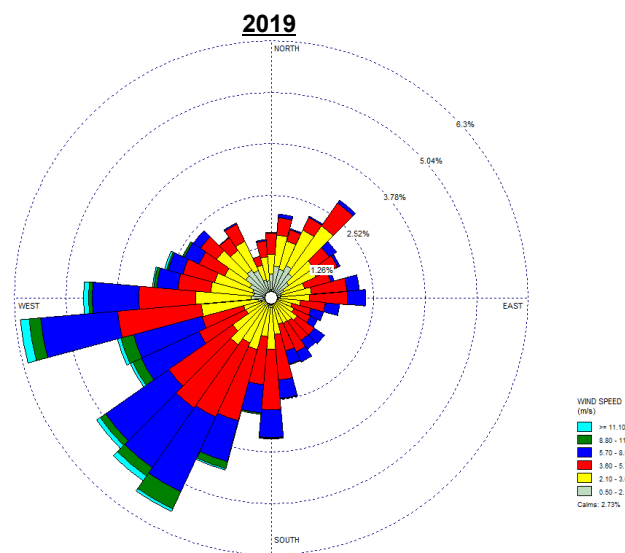
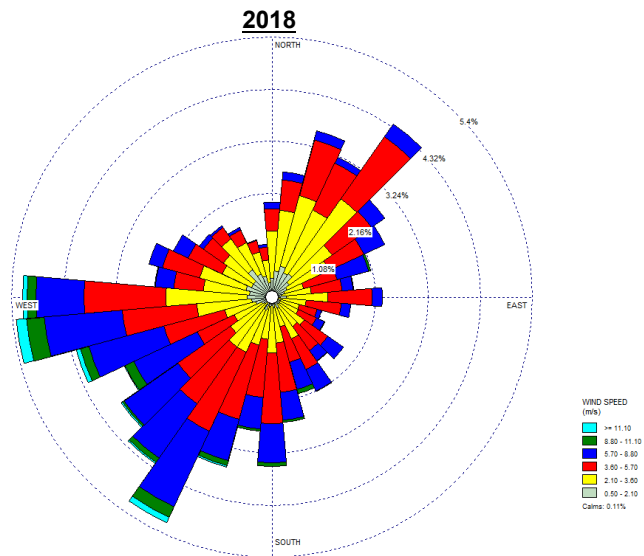
Figure 5

Appendix B Modelled Building Details

Building ID	Description	Modelled Height (m)
S1	On-site - Existing Building	14.5
S2	On-site - L02 Gantry Floor	10.4
S3	On-site - Top of Chillers	13.5
S4	On-site - Generator Enclosures	4
A	Off-site	14.5
B	Off-site	14.5
C	Off-site	14.5
D	Off-site	14.5
E	Off-site	14.5
F	Off-site	13
G	Off-site	5.0
H	Off-site	5.0
I	Off-site	7.0
J	Off-site	7.0
K	Off-site	10.0
L	Off-site	36.0
M	Off-site	14.5
N	Off-site	14.5
O	Off-site	10.0
P	Off-site	10.0
Q	Off-site	10.0

Appendix C Wind Roses for London Heathrow Airport 2015 to 2019





Appendix D Generator Source Emissions Datasheet

Performance Number: EM4791

Change Level: 02

SALES MODEL:	3516E	COMBUSTION:	DIRECT INJECTION
BRAND:	CAT	ENGINE SPEED (RPM):	1,500
ENGINE POWER (BKW):	2,649.0	HERTZ:	50
GEN POWER WITH FAN (EKW):	2,400.0	FAN POWER (KW):	115.0
COMPRESSION RATIO:	14	ASPIRATION:	TA
RATING LEVEL:	STANDBY	AFTERCOOLER TYPE:	ATAAC
PUMP QUANTITY:	1	AFTERCOOLER CIRCUIT TYPE:	JW+OC, ATAAC
FUEL TYPE:	DIESEL	INLET MANIFOLD AIR TEMP (C):	47
MANIFOLD TYPE:	DRY	JACKET WATER TEMP (C):	104
GOVERNOR TYPE:	ADEM5	TURBO CONFIGURATION:	PARALLEL
ELECTRONICS TYPE:	ADEM5	TURBO QUANTITY:	4
IGNITION TYPE:	CI	TURBOCHARGER MODEL:	TPX44TV23
INJECTOR TYPE:	MEUI-C	CERTIFICATION YEAR:	2020
FUEL INJECTOR:	5816969	CRANKCASE BLOWBY RATE (M3/HR):	100.5
UNIT INJECTOR TIMING (MM):	0.88	FUEL RATE (RATED RPM) NO LOAD (L/HR):	56.2
REF EXH STACK DIAMETER (MM):	305	PISTON SPD @ RATED ENG SPD (M/SEC):	10.8
MAX OPERATING ALTITUDE (M):	1,750		

INDUSTRY	SUBINDUSTRY	APPLICATION
ELECTRIC POWER	STANDARD	PACKAGED GENSET
OIL AND GAS	LAND PRODUCTION	PACKAGED GENSET

General Performance Data

THIS STANDBY RATING IS FOR A STANDBY ONLY ENGINE ARRANGEMENT. RERATING THE ENGINE TO A PRIME OR CONTINUOUS RATING IS NOT PERMITTED.

THE INLET MANIFOLD AIR TEMP LISTED IN THE HEADER, AND IN THE GENERAL PERFORMANCE DATA, IS THE AVERAGE INLET MANIFOLD TEMP FRONT TO REAR ON THE ENGINE.

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP
EKW	%	BKW	KPA	G/BKW-HR	L/HR	KPA	DEG C	DEG C	KPA	DEG C
2,400.0	100	2,649	2,714	208.8	659.4	304.8	47.4	683.9	192.7	492.7
2,160.0	90	2,392	2,451	212.2	605.2	276.9	47.0	674.0	173.8	493.0
1,920.0	80	2,137	2,189	215.8	549.6	244.3	45.7	668.7	152.1	497.3
1,800.0	75	2,010	2,059	218.2	522.7	227.9	45.0	666.9	141.5	500.3
1,680.0	70	1,883	1,930	221.0	496.3	211.6	44.5	666.1	131.2	504.9
1,440.0	60	1,631	1,671	222.0	431.6	158.7	43.3	674.3	99.2	532.7
1,200.0	50	1,378	1,412	216.3	355.4	92.5	42.3	682.7	60.1	567.6
960.0	40	1,126	1,153	217.3	291.5	57.5	42.6	656.0	41.4	561.7
720.0	30	873	894	222.4	231.4	33.6	42.5	601.8	29.3	525.0
600.0	25	747	765	226.0	201.1	22.9	42.1	563.5	24.2	495.9
480.0	20	620	636	231.2	171.0	13.3	41.5	516.9	19.8	458.8
240.0	10	368	377	255.3	111.9	0.1	39.8	394.2	13.6	356.3

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	ENGINE OUTLET WET EXH VOL FLOW RATE (0 DEG C AND 101 KPA)	ENGINE OUTLET DRY EXH VOL FLOW RATE (0 DEG C AND 101 KPA)
EKW	%	BKW	KPA	DEG C	M3/MIN	M3/MIN	KG/HR	KG/HR	M3/MIN	M3/MIN
2,400.0	100	2,649	324	228.2	208.6	558.3	14,597.2	15,150.4	199.1	181.9
2,160.0	90	2,392	295	214.4	197.0	521.3	13,635.6	14,142.0	185.9	170.1
1,920.0	80	2,137	261	199.1	181.8	480.7	12,508.9	12,969.7	170.4	156.0
1,800.0	75	2,010	244	191.2	173.9	460.5	11,934.3	12,373.0	162.6	148.9
1,680.0	70	1,883	227	183.2	165.9	441.1	11,358.4	11,775.1	154.8	141.8
1,440.0	60	1,631	171	154.2	138.4	377.4	9,411.2	9,773.6	127.9	116.7
1,200.0	50	1,378	101	112.9	103.0	292.3	6,925.4	7,223.5	94.9	85.9
960.0	40	1,126	65	85.9	84.3	236.3	5,640.3	5,884.9	77.3	69.9
720.0	30	873	40	66.2	71.5	190.7	4,772.3	4,966.5	65.3	59.3
600.0	25	747	28	57.6	65.7	168.6	4,382.4	4,551.2	59.9	54.7
480.0	20	620	18	49.9	60.6	147.3	4,036.3	4,179.8	55.0	50.5
240.0	10	368	4	38.5	53.9	111.4	3,585.6	3,679.2	48.3	45.2

Heat Rejection Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXH RECOVERY TO 177C	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BKW	KW	KW	KW	KW	KW	KW	KW	KW	KW
2,400.0	100	2,649	825	164	2,579	1,421	350	783	2,649	6,574	7,003
2,160.0	90	2,392	770	160	2,418	1,326	321	680	2,392	6,033	6,427
1,920.0	80	2,137	710	158	2,257	1,233	292	573	2,137	5,480	5,837
1,800.0	75	2,010	688	157	2,173	1,188	278	522	2,010	5,211	5,551
1,680.0	70	1,883	669	157	2,088	1,147	264	472	1,883	4,948	5,270
1,440.0	60	1,631	642	160	1,825	1,038	229	324	1,631	4,303	4,583
1,200.0	50	1,378	598	163	1,479	850	189	156	1,378	3,543	3,774
960.0	40	1,126	548	153	1,182	682	155	83.6	1,126	2,906	3,096
720.0	30	873	463	135	941	517	123	44.0	873	2,307	2,457
600.0	25	747	428	124	807	431	107	29.9	747	2,005	2,136
480.0	20	620	393	113	670	348	90.8	18.9	620	1,704	1,816
240.0	10	368	310	91.7	414	190	59.4	5.4	368	1,115	1,188

Emissions Data

RATED SPEED POTENTIAL SITE VARIATION: 1500 RPM

GENSET POWER WITH FAN	EKW	2,400.0	1,800.0	1,200.0	600.0	240.0
PERCENT LOAD	%	100	75	50	25	10
ENGINE POWER	BKW	2,649	2,010	1,378	747	368
TOTAL NOX (AS NO2)	G/HR	15,096	9,527	8,007	6,749	5,814
TOTAL CO	G/HR	3,075	3,063	2,806	1,588	1,129
TOTAL HC	G/HR	147	118	52	104	181
PART MATTER	G/HR	265.4	245.9	204.1	113.5	25.0
TOTAL NOX (AS NO2)	(CORR 5% O2) MG/NM3	1,937.9	1,547.4	1,919.3	2,875.1	4,451.5
TOTAL CO	(CORR 5% O2) MG/NM3	389.4	491.6	664.8	671.5	879.6
TOTAL HC	(CORR 5% O2) MG/NM3	16.1	16.4	10.7	38.5	117.3
PART MATTER	(CORR 5% O2) MG/NM3	28.0	33.0	39.6	39.9	16.3
TOTAL NOX (AS NO2)	(CORR 5% O2) PPM	944	754	935	1,400	2,168
TOTAL CO	(CORR 5% O2) PPM	312	393	532	537	704
TOTAL HC	(CORR 5% O2) PPM	30	31	20	72	219
TOTAL NOX (AS NO2)	G/HP-HR	4.28	3.55	4.35	6.75	11.80
TOTAL CO	G/HP-HR	0.87	1.14	1.52	1.59	2.29
TOTAL HC	G/HP-HR	0.04	0.04	0.03	0.10	0.37
PART MATTER	G/HP-HR	0.08	0.09	0.11	0.11	0.05
TOTAL NOX (AS NO2)	LB/HR	33.28	21.00	17.65	14.88	12.82
TOTAL CO	LB/HR	6.78	6.75	6.19	3.50	2.49
TOTAL HC	LB/HR	0.32	0.26	0.12	0.23	0.40
PART MATTER	LB/HR	0.59	0.54	0.45	0.25	0.06

RATED SPEED NOMINAL DATA: 1500 RPM

GENSET POWER WITH FAN	EKW	2,400.0	1,800.0	1,200.0	600.0	240.0
PERCENT LOAD	%	100	75	50	25	10
ENGINE POWER	BKW	2,649	2,010	1,378	747	368
TOTAL NOX (AS NO2)	G/HR	13,600	8,583	7,213	6,080	5,238
TOTAL CO	G/HR	2,628	2,618	2,398	1,357	965
TOTAL HC	G/HR	124	100	44	88	153
TOTAL CO2	KG/HR	1,775	1,402	954	535	292
PART MATTER	G/HR	190.9	176.9	146.8	81.7	18.0
TOTAL NOX (AS NO2)	(CORR 5% O2) MG/NM3	1,745.8	1,394.1	1,729.1	2,590.1	4,010.3
TOTAL CO	(CORR 5% O2) MG/NM3	332.8	420.1	568.2	574.0	751.8
TOTAL HC	(CORR 5% O2) MG/NM3	13.7	13.9	9.1	32.6	99.4
PART MATTER	(CORR 5% O2) MG/NM3	20.1	23.8	28.5	28.7	11.7
TOTAL NOX (AS NO2)	(CORR 5% O2) PPM	850	679	842	1,262	1,953
TOTAL CO	(CORR 5% O2) PPM	266	336	455	459	601
TOTAL HC	(CORR 5% O2) PPM	26	26	17	61	186
TOTAL NOX (AS NO2)	G/HP-HR	3.85	3.20	3.92	6.08	10.63
TOTAL CO	G/HP-HR	0.74	0.98	1.30	1.36	1.96
TOTAL HC	G/HP-HR	0.04	0.04	0.02	0.09	0.31
PART MATTER	G/HP-HR	0.05	0.07	0.08	0.08	0.04

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TOTAL NOX (AS NO2)	LB/HR	29.98	18.92	15.90	13.40	11.55
TOTAL CO	LB/HR	5.79	5.77	5.29	2.99	2.13
TOTAL HC	LB/HR	0.27	0.22	0.10	0.19	0.34
TOTAL CO2	LB/HR	3,914	3,091	2,103	1,180	644
PART MATTER	LB/HR	0.42	0.39	0.32	0.18	0.04
OXYGEN IN EXH	%	9.3	9.6	7.8	8.9	12.9
DRY SMOKE OPACITY	%	2.3	2.5	3.1	2.7	0.0
BOSCH SMOKE NUMBER		0.76	0.85	1.10	0.97	0.21

Regulatory Information

EPA EMERGENCY STATIONARY			2011 - ----	
GASEOUS EMISSIONS DATA MEASUREMENTS PROVIDED TO THE EPA ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THE "MAX LIMITS" SHOWN BELOW ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE EMERGENCY STATIONARY REGULATIONS.				
Locality	Agency	Regulation	Tier/Stage	Max Limits - G/BKW - HR
U.S. (INCL CALIF)	EPA	STATIONARY	EMERGENCY STATIONARY	CO: 3.5 NOx + HC: 6.4 PM: 0.20

NON-CERTIFIED 1/2 TA LUFT		2002 - ----	
GASEOUS EMISSIONS DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. THIS ENGINE MEETS EMISSION STANDARDS EQUIVALENT TO 1/2 TA LUFT EMISSION LEVELS.			

Altitude Derate Data

A BLANK IN THE ALTITUDE DERATE TABLE SIGNIFIES THAT NO RATING IS AVAILABLE AT THAT SPECIFIED ALTITUDE AND AMBIENT TEMPERATURE.

THE TEMPERATURES LISTED IN THE CHART ARE AMBIENT TEMPERATURES. THE FOLLOWING DERATE CHART WAS CALCULATED ASSUMING A 5 DEG C RISE IN AIR TEMPERATURE BETWEEN THE AIR CLEANER INLET, AND THE TURBOCHARGER INLET.

ALTITUDE CORRECTED POWER CAPABILITY (BKW)

AMBIENT OPERATING TEMP (C)	0	5	10	15	20	25	30	35	40	45	50	55	60	NORMAL
ALTITUDE (M)														
0	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649			2,649
250	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649			2,649
500	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649			2,649
750	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649			2,649
1,000	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,387			2,649
1,250	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649				2,649
1,500	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,649	2,630				2,649
1,750	2,649	2,649	2,649	2,649	2,649	2,649	2,634	2,617	2,572					2,649
2,000	2,649	2,649	2,629	2,614	2,597	2,580	2,562	2,458	2,351					2,624
2,250	2,621	2,604	2,585	2,561	2,532	2,501	2,470	2,324	2,100					2,586
2,500	2,552	2,531	2,501	2,469	2,436	2,408	2,381	2,216	1,983					2,509
2,750	2,469	2,438	2,409	2,381	2,352	2,325	2,299	2,129	1,888					2,429
3,000	2,381	2,354	2,326	2,300	2,273	2,246	2,218	2,033	1,789					2,354
3,250	2,299	2,273	2,246	2,221	2,195	2,163	2,122	1,935	1,675					2,280
3,500	2,217	2,190	2,163	2,139	2,109	2,058	2,006	1,839	1,565					2,208
3,750	2,145	2,113	2,080	2,054	2,026	1,970	1,913	1,733	1,522					2,142
4,000	2,062	2,035	2,007	1,982	1,955	1,894	1,808	1,622	1,520					2,066
4,250	1,993	1,969	1,945	1,921	1,896	1,827	1,700	1,547	1,509					1,999
4,500	1,934	1,912	1,890	1,869	1,848	1,745	1,596	1,547	1,490					1,943

Cross Reference

Test Spec	Setting	Engine Arrangement	Engineering Model	Engineering Model Version	Start Effective Serial Number	End Effective Serial Number
5643870	GG2111	5838330	PG356	XJ	WYH00001	
5643855	LL2847	5930146	PG296	-	ZNL00001	

Supplementary Data

Type	Classification	Performance Number
MULTIPLE FUEL	EN590 FUEL	EM5179
ALTITUDE DATA	HIGH RESOLUTION	EM5384

Performance Parameter Reference

Parameters Reference:DM9600-11 PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600

APPLICATION:

Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request (SERR) test data shall be noted.

PERFORMANCE PARAMETER TOLERANCE FACTORS:

Power +/- 3%

Torque +/- 3%

Exhaust stack temperature +/- 8%

Inlet airflow +/- 5%

Intake manifold pressure-gage +/- 10%

Exhaust flow +/- 6%

Specific fuel consumption +/- 3%

Fuel rate +/- 5%

Specific DEF consumption +/- 3%

DEF rate +/- 5%

Heat rejection +/- 5%

Heat rejection exhaust only +/- 10%

Heat rejection CEM only +/- 10%

Heat Rejection values based on using treated water.

Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.

On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.

These values do not apply to C280/3600. For these models, see the tolerances listed below.

C280/3600 HEAT REJECTION TOLERANCE FACTORS:

Heat rejection +/- 10%

Heat rejection to Atmosphere +/- 50%

Heat rejection to Lube Oil +/- 20%

Heat rejection to Aftercooler +/- 5%

TEST CELL TRANSDUCER TOLERANCE FACTORS:

Torque +/- 0.5%

Speed +/- 0.2%

Fuel flow +/- 1.0%

Temperature +/- 2.0 C degrees

Intake manifold pressure +/- 0.1 kPa

OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.

REFERENCE ATMOSPHERIC INLET AIR

FOR 3500 ENGINES AND SMALLER

SAE J1228 AUG2002 for marine engines, and J1995 JAN2014 for other engines, reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity at the stated aftercooler water temp, or inlet manifold temp.

FOR 3600 ENGINES

Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JANJAN2014 reference atmospheric pressure is 100 KPA (29.61 in hg), and standard temperature is 25deg C (77 deg F) at 30% relative humidity and 150M altitude at the stated aftercooler water temperature.

MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE

Location for air temperature measurement air cleaner inlet at stabilized operating conditions.

REFERENCE EXHAUST STACK DIAMETER

The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust

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stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.

REFERENCE FUEL

DIESEL

Reference fuel is #2 distillate diesel with a 35API gravity;

A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 29 deg C (84.2 deg F), where the density is

838.9 G/Liter (7.001 Lbs/Gal).

GAS

Reference natural gas fuel has a lower heating value of 33.74 KJ/L

(905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on

87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.

ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS EXTERNAL AUXILIARY LOAD

Engine corrected gross output includes the power required to drive

standard equipment; lube oil, scavenge lube oil, fuel transfer,

common rail fuel, separate circuit aftercooler and jacket water

pumps. Engine net power available for the external (flywheel)

load is calculated by subtracting the sum of auxiliary load from

the corrected gross flywheel out put power. Typical auxiliary

loads are radiator cooling fans, hydraulic pumps, air compressors

and battery charging alternators. For Tier 4 ratings additional

Parasitic losses would also include Intake, and Exhaust

Restrictions.

ALTITUDE CAPABILITY

Altitude capability is the maximum altitude above sea level at

standard temperature and standard pressure at which the engine

could develop full rated output power on the current performance

data set.

Standard temperature values versus altitude could be seen on

TM2001.

When viewing the altitude capability chart the ambient temperature

is the inlet air temp at the compressor inlet.

Engines with ADEM MEUI and HEUI fuel systems operating at

conditions above the defined altitude capability derate for

atmospheric pressure and temperature conditions outside the values

defined, see TM2001.

Mechanical governor controlled unit injector engines require a

setting change for operation at conditions above the altitude

defined on the engine performance sheet. See your Caterpillar

technical representative for non standard ratings.

REGULATIONS AND PRODUCT COMPLIANCE

TMI Emissions information is presented at 'nominal' and 'Potential

Site Variation' values for standard ratings. No tolerances are

applied to the emissions data. These values are subject to change

at any time. The controlling federal and local emission

requirements need to be verified by your Caterpillar technical

representative.

Customer's may have special emission site requirements that need

to be verified by the Caterpillar Product Group engineer.

EMISSION CYCLE LIMITS:

Cycle emissions Max Limits apply to cycle-weighted averages only.

Emissions at individual load points may exceed the cycle-weighted

limit.

EMISSIONS DEFINITIONS:

Emissions : DM1176

EMISSION CYCLE DEFINITIONS

1. For constant-speed marine engines for ship main propulsion,

including,diesel-electric drive, test cycle E2 shall be applied,

for controllable-pitch propeller sets

test cycle E2 shall be applied.

2. For propeller-law-operated main and propeller-law-operated

auxiliary engines the test cycle E3 shall be applied.

3. For constant-speed auxiliary engines test cycle D2 shall be

applied.

4. For variable-speed, variable-load auxiliary engines, not

included above, test cycle C1 shall be applied.

HEAT REJECTION DEFINITIONS:

Diesel Circuit Type and HHV Balance : DM9500

HIGH DISPLACEMENT (HD) DEFINITIONS:

3500: EM1500

RATING DEFINITIONS:

Agriculture : TM6008

Fire Pump : TM6009

Generator Set : TM6035

Generator (Gas) : TM6041

Industrial Diesel : TM6010

Industrial (Gas) : TM6040

Irrigation : TM5749

Locomotive : TM6037

Marine Auxiliary : TM6036

Marine Prop (Except 3600) : TM5747

Marine Prop (3600 only) : TM5748

MSHA : TM6042

Oil Field (Petroleum) : TM6011

Off-Highway Truck : TM6039

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On-Highway Truck : TM6038
SOUND DEFINITIONS:
Sound Power : DM8702
Sound Pressure : TM7080
Date Released : 07/10/19

Appendix E AQDRA

The Air Quality Dust Risk Assessment (AQDRA) presented below determines the appropriate level of mitigation required at the site to either avoid or to reduce potential effects to neighbouring sensitive receptors (property and amenity; human health) during construction phase. A list of proposed mitigation measures required to reduce the potential impact from low to negligible risk has been presented in Section 5 of the report.

There are a number of receptors that are sensitive to dust in the immediate vicinity of the Site. In line with IAQM guidance, this assessment considers that the risk of impacts from construction will be low from any given site beyond a distance of 200m. As such, potential construction dust sensitive receptors were identified within 200m of the site boundary.

Potential dust sensitive receptors were identified from publicly available satellite and photography imagery. The majority of receptors are residential properties. There is also a nursery, situated some distance to the west of the Site. Figure 2 within Appendix A shows the locations of construction sensitive receptors.

Table E1. Air Quality and Dust Risk Assessment

STEP 1 – SCREENING

1a.	Is a human receptor site within:	
	50m of site boundary	Y
	50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s)	N
1b.	Is an ecological receptor site within:	
	50m of the site boundary	N
	50m of the route(s) used by construction vehicles on the public highway, up to 500m from the site entrance(s)	N

IF ANSWERS TO 1A OR 1B ARE 'YES' COMPLETE 1C AND COMPLETE THE ASSESSMENT

1c.	<i>Provide a description of the proposed demolition and construction activities, their location and duration and any phasing of the development, including:</i> - <i>The proximity and number of receptors;</i> - <i>The specific sensitivity of the receptor(s), e.g. a primary school or hospital;</i> - <i>The duration for which the sources of dust emissions may be close to the sensitive receptors; and</i> - <i>In the case of PM₁₀ the local background concentration.</i> The works will comprise the modification of an existing building and the construction of a gantry. The anticipated duration of the works is currently unknown, however emission of dust could be considered likely during the construction period. The Site is located in a primarily commercial area, though borders a residential suburb. There are some receptors in close proximity to the Site that may be affected by the works. This includes high sensitivity receptors such as residential properties, as well as medium sensitivity receptors such as commercial and office units. The nearest PM₁₀ monitoring station to the site is London Harlington (HRL) which observed annual mean concentrations of 20.0 µg/m³ in 2020. Defra's corresponding mapped background PM₁₀ concentrations proximal to the site were slightly lower than this, and therefore the measured value was therefore used to determine the dust risk of the proposed development, in order to provide a conservative assessment.
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STEP 2 – ASSESS THE RISK OF DUST IMPACTS

STEP 2A – Define the Potential Dust Emission Magnitude

DEMOLITION PHASE

2a(i)	Is the scale of the demolition works:
-------	---------------------------------------

	Large - Total volume of building to be demolished >50,000m³; or - Potentially dusty construction material (e.g. concrete); or - On-site crushing and screening; or - demolition activities >20m above ground level	-
	Medium - Total volume of building to be demolished 20,000 m³ - 50,000m³; or - Potentially dusty construction material; or - demolition activities 10-20m above ground level	-
	Small - Total volume of building to be demolished <20,000m³; or - Construction material with low potential for dust release (e.g. metal cladding or timber); or - demolition activities <10m above ground level; or - demolition is occurring during wetter months.	Y

EARTHWORKS PHASE

2a(ii)	Is the scale of the earthworks:	
	Large - Total site area >10,000m²; or - Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size); or - >10 heavy earth moving vehicles active at any one time on-site; or - Formation of stockpile enclosures >8m in height; or - Total material moved >100,000 tonnes (where known).	-
	Medium - Total site area 2,500m² - 10,000m²; or - Moderately dusty soil type (e.g. silt); or - 5-10 heavy earth moving vehicles active at any one time on-site; or - Formation of stockpile enclosures 4-8m in height; or - Total material moved 20,000-100,000 tonnes (where known).	-
	Small - Total site area <2,500m²; or - Soil type with large grain size (e.g. sand); or - <5 heavy earth moving vehicles active at any one time onsite; or - Formation of stockpile enclosures <4m in height; or - Total material moved <10,000 tonnes (where known), or earthworks during wetter months.	Y

CONSTRUCTION PHASE

2a(iii)	Is the scale of the works:	
	Large - Total building volume >100,000m³; or - On-site concrete batching; or - Sandblasting.	-
	Medium - Total building volume 25,000m³-100,000m³; or - Potentially dusty construction material (e.g. concrete); or - On-site concrete batching.	-
	Small - Total building volume <25,000m³; or - Construction material with low potential for dust release (e.g. metal cladding or timber).	Y

TRACKOUT

2a(iv)	Only receptors within 50m of the route(s) used by vehicles on the public highway and up to 500m from the site entrance(s) are considered to be at risk from the effects of dust. Will the track out be:
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	Large - >50 HDV (>3,5t) outward movements in one day; - Potentially dusty surface material (e.g. high clay/silt content); or - Unpaved road length > 100m.	-
	Medium - 10-50 HDV (>3,5t) outward movements in any one day; - Moderately dusty surface material (e.g. high clay content); or - Unpaved road length 50-100m (high clay content)	-
	Small - <10 HDV (>3.5t) trips in any one day; - Surface material with low potential for dust release; or - Unpaved road length <50m	Y

STEP 2B – Define the Sensitivity of the Area

Define the Receptor Sensitivity

2b(i)	Sensitivity of People to Dust Soiling Effects	
	Is the location a:	
	- High sensitivity receptor	Y
	- Medium sensitivity receptor	-
	- Low sensitivity receptor	-
2b(ii)	Sensitivity of People to Health Effects of PM ₁₀	
	Is the location a:	
	- High sensitivity receptor	Y
	- Medium sensitivity receptor	-
	- Low sensitivity receptor	-
	Annual Mean PM ₁₀ Concentration (2020)	20 µg/m ³
2b(iii)	Sensitivity of Receptors to Ecological Effects – There are no nationally or European designated ecological receptors within 50m of the Site boundary, within 50m from a route used by construction vehicles on the public highway or up to 500m from the Site entrance. The closest ecological receptor to the site is Wraysbury reservoir, around 6km from the Site. Therefore, the risk of dust effects at a nationally or European designated ecological receptors is not considered further in this assessment.	

Estimate the number of receptors and the distance:

It is estimated that there are 4 sensitive receptors within 20m of the Site boundary, 9 within 50m, 16 within 100m, 28 within 200m and 36 within 250m.

Combined Sensitivity of the area for Dust Soiling Effects = MEDIUM

Combined Sensitivity of the area to Human Health Impacts = LOW

Summary Appraisal and Conclusion of Site-Specific Dust Risk

Table E2. Summary of Dust Emission Magnitude for the Site

Activity	Dust Emission Magnitude
Demolition	Small
Earthworks	Small
Construction	Small
Trackout	Small

Table E3. Summary of Site Sensitivity

<i>Receptor Sensitivity</i>	<i>Sensitivity of the Surrounding Area</i>			
	<i>Demolition</i>	<i>Earthworks</i>	<i>Construction</i>	<i>Trackout</i>
Dust Soiling	Medium	Medium	Medium	Medium
Human Health	Low	Low	Low	Low

Table E4. Summary of Site-Specific Dust Risk

<i>Potential Risk</i>	<i>Risk</i>			
	<i>Demolition</i>	<i>Earthworks</i>	<i>Construction</i>	<i>Trackout</i>
Dust Soiling	Low Risk	Low Risk	Low Risk	Negligible
Human Health	Negligible	Negligible	Negligible	Negligible

Appendix F Results of Dispersion Modelling Assessment

Table F1. Modelling Results – Annual Mean NO₂

Receptor ID	Receptor Description	Location Coordinates		Height	Annual Mean NO ₂ Concentration (µg/m ³)	Impact Assessment		
		X	Y			Without Development	With Development	Change (µg/m ³) Impact Descriptor
R0	Dwelling on Denbigh Drive	508162	179620	1.5	27.1	27.4	0.3	Negligible
R1	Dwelling on Denbigh Drive	508156	179589	1.5	27.3	27.6	0.3	Negligible
R2	Dwelling on Denbigh Drive	508149	179561	1.5	27.2	27.4	0.2	Negligible
R3	Dwelling on Denbigh Drive	508159	179522	1.5	27.3	27.4	0.2	Negligible
R4	Dwelling on Denbigh Drive	508162	179486	1.5	27.3	27.4	0.1	Negligible
R5	Dwelling on Denbigh Drive	508177	179460	1.5	27.4	27.5	0.1	Negligible
R6	Dwelling on Nine Acres Close	508138	179482	1.5	27.3	27.5	0.1	Negligible
R7	Dwelling on Nine Acres Close	508100	179481	1.5	27.5	27.6	0.1	Negligible
R8	Dwelling on Nine Acres Close	508064	179491	1.5	27.5	27.6	0.1	Negligible
R9	Dwelling on Nine Acres Close	508039	179473	1.5	27.5	27.6	0.1	Negligible
R10	Dwelling on Nine Acres Close	508034	179414	1.5	27.8	27.8	<0.1	Negligible
R11	Dwelling on Nine Acres Close	508018	179363	1.5	27.9	27.9	<0.1	Negligible
R12	Dwelling on Nine Acres Close	508020	179311	1.5	28.4	28.5	<0.1	Negligible
R13	Dwelling on Nine Acres Close	508092	179352	1.5	30.4	30.5	<0.1	Negligible
R14	Nine Acres Hotel (ST)	508089	179420	1.5	28.0	28.0	<0.1	Negligible
R15	Dwelling on Nine Acres Close	508149	179401	1.5	27.9	28.0	<0.1	Negligible
R16	Dwelling on Nine Acres Close	508190	179416	1.5	27.6	27.6	<0.1	Negligible
R17	Dwelling on Conway Drive	508236	179419	1.5	27.6	27.7	<0.1	Negligible
R18	Dwelling on Denbigh Drive	508224	179476	1.5	27.5	27.5	<0.1	Negligible
R19	Dwelling on Denbigh Drive	508202	179525	1.5	27.4	27.5	0.1	Negligible
R20	Dwelling on Denbigh Drive	508228	179560	1.5	27.5	27.5	0.1	Negligible
R21	Dwelling on Denbigh Drive	508194	179627	1.5	27.3	27.4	0.1	Negligible
R22	Dwelling on Denbigh Drive	508266	179594	1.5	27.3	27.4	0.1	Negligible
R23	Dwelling on Stormount Drive	508365	179567	1.5	27.4	27.5	<0.1	Negligible
R24	Dwelling on Conway Drive	508298	179503	1.5	27.5	27.6	<0.1	Negligible
R25	Dwelling on Conway Drive	508295	179464	1.5	27.6	27.6	<0.1	Negligible
R26	Sandgate Football Club (ST)	508097	179237	1.5	27.5	27.5	<0.1	Negligible
R27	Dwelling on Bourne Avenue	508130	179303	1.5	27.7	27.8	<0.1	Negligible
R28	Dwelling on Bourne Avenue	508196	179342	1.5	28.0	28.1	<0.1	Negligible
R29	Dwelling on Bourne Circus	508303	179407	1.5	27.9	28.0	<0.1	Negligible
R30	Dwelling on Bourne Avenue	508407	179375	1.5	27.7	27.8	<0.1	Negligible
R31	Dwelling on Snowdon Crescent	508438	179423	1.5	27.4	27.4	<0.1	Negligible
R32	Dwelling on Snowdon Crescent	508442	179464	1.5	27.4	27.5	<0.1	Negligible
R33	Dwelling on Bourne Circus	508302	179343	1.5	28.3	28.3	<0.1	Negligible
R34	Dwelling on Skipton Drive	508188	179197	1.5	28.2	28.2	<0.1	Negligible
R35	Dwelling on Skipton Drive	508128	179002	1.5	27.8	27.8	<0.1	Negligible
R36	Dwelling on Carnarv Drive	508235	179077	1.5	27.8	27.8	<0.1	Negligible
R37	Dwelling on Carnarv Drive	508252	179297	1.5	28.0	28.1	<0.1	Negligible
R38	Tiny Gems Day Nursery (ST)	508390	179110	1.5	27.5	27.5	<0.1	Negligible
R39	Sunflower House Nusery (ST)	508964	179113	1.5	28.2	28.2	<0.1	Negligible
R40	Harlington School (ST)	508586	178796	1.5	29.4	29.4	<0.1	Negligible
R41	Christ Church Hayes (ST)	508329	179210	1.5	27.6	27.7	<0.1	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	Annual Mean NO ₂ Concentration (µg/m ³)		Impact Assessment	
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R42	Pinkwell Primary School (ST)	508498	178826	1.5	28.8	28.8	<0.1	Negligible
R43	Tina Tiney Home Nuser (ST)	507561	179800	1.5	28.1	28.1	<0.1	Negligible
R44	Emden Close Play Area (ST)	507475	179859	1.5	27.8	27.8	<0.1	Negligible
R45	Busy Bees Nursery at Heathrow (ST)	507432	180016	1.5	27.0	27.0	<0.1	Negligible
R46	Stockley Park Golf Club (ST)	508085	180491	1.5	25.3	25.3	<0.1	Negligible
R47	Stockley Park Golf Club (ST)	508435	180152	1.5	26.0	26.0	<0.1	Negligible
R48	Dwelling on Glamis Crescent	508381	179255	1.5	27.6	27.7	<0.1	Negligible
R49	Dwelling on Waltham Avenue	508471	179199	1.5	27.6	27.6	<0.1	Negligible
R50	Dwelling on Bourne Avenue	508559	179329	1.5	27.8	27.8	<0.1	Negligible
R51	Dwelling on Waltham Avenue	508596	179251	1.5	27.7	27.7	<0.1	Negligible
R52	Dwelling on Waltham Avenue	508552	179168	1.5	27.6	27.6	<0.1	Negligible
R53	Dwelling on Seaton Road	508524	179095	1.5	27.5	27.6	<0.1	Negligible
R54	Dwelling on Stormount Drive	508547	179498	1.5	27.4	27.4	<0.1	Negligible
R55	Dwelling on Glamis Crescent	508431	179294	1.5	27.5	27.5	<0.1	Negligible
R56	Dwelling on Clevedon Gardens	508590	179416	1.5	27.6	27.7	<0.1	Negligible
R57	Dwelling on Bourne Avenue	508649	179348	1.5	30.3	30.3	<0.1	Negligible
R58	Dwelling on Burnham Gardens	508672	179473	1.5	27.7	27.7	<0.1	Negligible
R59	Dwelling on Marlow Gardens	508756	179416	1.5	27.9	27.9	<0.1	Negligible
R60	Dwelling on Bourne Avenue	508911	179342	1.5	30.7	30.7	<0.1	Negligible
R61	Dwelling on Guinness Close	508929	179457	1.5	28.4	28.4	<0.1	Negligible
R62	Dwelling on Bourne Avenue	508727	179241	1.5	29.5	29.5	<0.1	Negligible
R63	Dwelling on Waltham Avenue	508943	179238	1.5	29.1	29.1	<0.1	Negligible
R64	Dwelling on Bourne Avenue	508803	179321	1.5	29.3	29.3	<0.1	Negligible
R65	Dwelling on Mildred Avenue	508720	179149	1.5	29.1	29.1	<0.1	Negligible
R66	Dwelling on Seaton Road	508639	179056	1.5	28.1	28.1	<0.1	Negligible
R67	Dwelling on Wentworth Crescent	508786	179050	1.5	28.2	28.2	<0.1	Negligible
R68	Dwelling on Mildred Avenue	508758	178981	1.5	28.3	28.3	<0.1	Negligible
R69	Dwelling on Mildred Avenue	508710	178847	1.5	33.6	33.6	<0.1	Negligible
R70	Dwelling on Dawley Road	509054	178994	1.5	29.6	29.6	<0.1	Negligible
R71	Dwelling on Seaton Road	508547	178932	1.5	28.9	28.9	<0.1	Negligible
R72	Dwelling on Pinkwell Avenue	508976	178882	1.5	29.0	29.0	<0.1	Negligible
R73	Dwelling on Oakington Avenue	508895	178793	1.5	30.0	30.0	<0.1	Negligible
R74	Dwelling on Mulberry Crescent	507592	179687	1.5	30.3	30.3	<0.1	Negligible
R75	Dwelling on Mulberry Crescent	507417	179752	1.5	27.3	27.3	<0.1	Negligible
R76	Dwelling on Jasmine Terrace	507350	179651	1.5	28.3	28.3	<0.1	Negligible
R77	Dwelling on Lavender Rise	507459	179616	1.5	27.7	27.7	<0.1	Negligible
R78	Dwelling on Kebony Close	507284	179777	1.5	26.8	26.8	<0.1	Negligible
R79	Dwelling on Mulberry Cresent	507222	179696	1.5	26.7	26.7	<0.1	Negligible
R80	Dwelling on Potters Way	507135	179553	1.5	26.8	26.8	<0.1	Negligible
R81	Dwelling on Rutters Close	507183	179850	1.5	26.4	26.4	<0.1	Negligible
R82	Dwelling on Lavender Rise	507347	179533	1.5	27.3	27.3	<0.1	Negligible
R83	Dwelling on Botwell Common Road	508590	180658	1.5	27.5	27.5	<0.1	Negligible
R84	Dwelling on Botwell Common Road	508802	180708	1.5	26.6	26.6	<0.1	Negligible
R85	Gurdwara Hayes (ST)	509485	180185	1.5	30.1	30.1	<0.1	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	Annual Mean NO ₂ Concentration (µg/m ³)	Impact Assessment		
		X	Y			Without Development	With Development	Change (µg/m ³) Impact Descriptor
R86	Lake Farm Park Academy (ST)	509286	180317	1.5	26.0	26.0	<0.1	Negligible
R87	Dwelling on Botwell Common Road	509148	180577	1.5	25.9	26.0	<0.1	Negligible
R88	Dwelling on Almond Avenue	507275	179381	1.5	27.2	27.3	<0.1	Negligible
R89	Dwelling on Smaldon Close	507256	179220	1.5	27.4	27.4	<0.1	Negligible
R90	Dwelling on South Close	507061	179406	1.5	27.1	27.1	<0.1	Negligible
R91	Dwelling on Hazel Avenue	507191	179297	1.5	27.1	27.1	<0.1	Negligible
R92	Bell Farm Church	507076	179216	1.5	27.0	27.0	<0.1	Negligible
R93	Dwelling on Blackthorn Avenue	507232	179053	1.5	27.8	27.8	<0.1	Negligible
R94	Residential dwelling on Nine acres close	508095	179455	1.5	28.3	28.4	0.1	Negligible
R95	Residential dwelling on Nine acres close	508124	179457	1.5	27.5	27.6	0.1	Negligible
R96	Residential dwelling on Nine acres close	508070	179461	1.5	28.2	28.3	0.1	Negligible

Table F2. Modelling Results – Hourly Mean NO₂

Receptor ID	Receptor Description	Location Coordinates		Height	1-Hour	Mean	NO ₂	Concentration	Impact Assessment	
		X	Y		Z				(µg/m³)	Without Development
R0	Dwelling on Denbigh Drive	508162	179620	1.5	54.2			105.4	51.1	Moderate adverse
R1	Dwelling on Denbigh Drive	508156	179589	1.5	54.7			98.6	43.9	Moderate adverse
R2	Dwelling on Denbigh Drive	508149	179561	1.5	54.3			96.8	42.5	Moderate adverse
R3	Dwelling on Denbigh Drive	508159	179522	1.5	54.5			99.2	44.7	Moderate adverse
R4	Dwelling on Denbigh Drive	508162	179486	1.5	54.7			79.4	24.7	Slight adverse
R5	Dwelling on Denbigh Drive	508177	179460	1.5	54.9			72.4	17.5	Negligible
R6	Dwelling on Nine Acres Close	508138	179482	1.5	54.7			102.8	48.1	Moderate adverse
R7	Dwelling on Nine Acres Close	508100	179481	1.5	55.0			91.7	36.7	Slight adverse
R8	Dwelling on Nine Acres Close	508064	179491	1.5	55.0			83.0	28.1	Slight adverse
R9	Dwelling on Nine Acres Close	508039	179473	1.5	55.1			80.0	24.9	Slight adverse
R10	Dwelling on Nine Acres Close	508034	179414	1.5	55.6			69.7	14.1	Negligible
R11	Dwelling on Nine Acres Close	508018	179363	1.5	55.8			66.9	11.1	Negligible
R12	Dwelling on Nine Acres Close	508020	179311	1.5	56.9			65.9	9.0	Negligible
R13	Dwelling on Nine Acres Close	508092	179352	1.5	60.9			72.6	11.7	Negligible
R14	Nine Acres Hotel (ST)	508089	179420	1.5	55.9			71.5	15.6	Negligible
R15	Dwelling on Nine Acres Close	508149	179401	1.5	55.8			70.7	14.9	Negligible
R16	Dwelling on Nine Acres Close	508190	179416	1.5	55.1			70.0	14.9	Negligible
R17	Dwelling on Conway Drive	508236	179419	1.5	55.3			69.1	13.8	Negligible
R18	Dwelling on Denbigh Drive	508224	179476	1.5	54.9			70.8	15.9	Negligible
R19	Dwelling on Denbigh Drive	508202	179525	1.5	54.9			73.1	18.2	Negligible
R20	Dwelling on Denbigh Drive	508228	179560	1.5	54.9			71.4	16.5	Negligible
R21	Dwelling on Denbigh Drive	508194	179627	1.5	54.5			85.7	31.2	Slight adverse
R22	Dwelling on Denbigh Drive	508266	179594	1.5	54.6			69.9	15.3	Negligible
R23	Dwelling on Stormount Drive	508365	179567	1.5	54.8			66.3	11.4	Negligible
R24	Dwelling on Conway Drive	508298	179503	1.5	55.0			68.0	13.0	Negligible
R25	Dwelling on Conway Drive	508295	179464	1.5	55.1			68.1	13.0	Negligible
R26	Sandgate Football Club (ST)	508097	179237	1.5	54.9			62.7	7.7	Negligible
R27	Dwelling on Bourne Avenue	508130	179303	1.5	55.5			66.0	10.6	Negligible
R28	Dwelling on Bourne Avenue	508196	179342	1.5	56.1			67.9	11.9	Negligible
R29	Dwelling on Bourne Circus	508303	179407	1.5	55.9			67.7	11.8	Negligible
R30	Dwelling on Bourne Avenue	508407	179375	1.5	55.5			64.8	9.3	Negligible
R31	Dwelling on Snowdon Crescent	508438	179423	1.5	54.7			63.8	9.1	Negligible
R32	Dwelling on Snowdon Crescent	508442	179464	1.5	54.9			64.1	9.3	Negligible
R33	Dwelling on Bourne Circus	508302	179343	1.5	56.5			67.1	10.6	Negligible
R34	Dwelling on Skipton Drive	508188	179197	1.5	56.4			64.6	8.2	Negligible
R35	Dwelling on Skipton Drive	508128	179002	1.5	55.6			60.9	5.3	Negligible
R36	Dwelling on Carnarv Drive	508235	179077	1.5	55.5			62.4	6.9	Negligible
R37	Dwelling on Carnarv Drive	508252	179297	1.5	56.1			66.2	10.1	Negligible
R38	Tiny Gems Day Nursery (ST)	508390	179110	1.5	55.0			62.3	7.3	Negligible
R39	Sunflower House Nusery (ST)	508964	179113	1.5	56.4			59.0	2.6	Negligible
R40	Harlington School (ST)	508586	178796	1.5	58.8			61.7	2.9	Negligible
R41	Christ Church Hayes (ST)	508329	179210	1.5	55.3			64.0	8.7	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	1-Hour Mean NO ₂ Concentration	Impact Assessment		
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R42	Pinkwell Primary School (ST)	508498	178826	1.5	57.7	61.1	3.4	Negligible
R43	Tina Tiney Home Nuser (ST)	507561	179800	1.5	56.1	60.8	4.7	Negligible
R44	Emden Close Play Area (ST)	507475	179859	1.5	55.6	59.7	4.0	Negligible
R45	Busy Bees Nursery at Heathrow (ST)	507432	180016	1.5	54.0	57.4	3.4	Negligible
R46	Stockley Park Golf Club (ST)	508085	180491	1.5	50.6	52.2	1.6	Negligible
R47	Stockley Park Golf Club (ST)	508435	180152	1.5	51.9	56.7	4.8	Negligible
R48	Dwelling on Glamis Crescent	508381	179255	1.5	55.3	64.3	9.0	Negligible
R49	Dwelling on Waltham Avenue	508471	179199	1.5	55.1	62.9	7.8	Negligible
R50	Dwelling on Bourne Avenue	508559	179329	1.5	55.7	63.4	7.8	Negligible
R51	Dwelling on Waltham Avenue	508596	179251	1.5	55.3	62.1	6.8	Negligible
R52	Dwelling on Waltham Avenue	508552	179168	1.5	55.2	61.9	6.7	Negligible
R53	Dwelling on Seaton Road	508524	179095	1.5	55.1	61.4	6.3	Negligible
R54	Dwelling on Stormount Drive	508547	179498	1.5	54.8	62.7	7.9	Negligible
R55	Dwelling on Glamis Crescent	508431	179294	1.5	55.0	64.0	9.0	Negligible
R56	Dwelling on Clevedon Gardens	508590	179416	1.5	55.3	62.9	7.7	Negligible
R57	Dwelling on Bourne Avenue	508649	179348	1.5	60.7	67.1	6.5	Negligible
R58	Dwelling on Burnham Gardens	508672	179473	1.5	55.4	61.7	6.2	Negligible
R59	Dwelling on Marlow Gardens	508756	179416	1.5	55.8	61.1	5.3	Negligible
R60	Dwelling on Bourne Avenue	508911	179342	1.5	61.4	65.0	3.6	Negligible
R61	Dwelling on Guinness Close	508929	179457	1.5	56.7	60.1	3.4	Negligible
R62	Dwelling on Bourne Avenue	508727	179241	1.5	59.0	64.4	5.4	Negligible
R63	Dwelling on Waltham Avenue	508943	179238	1.5	58.3	61.2	2.9	Negligible
R64	Dwelling on Bourne Avenue	508803	179321	1.5	58.6	63.3	4.7	Negligible
R65	Dwelling on Mildred Avenue	508720	179149	1.5	58.2	63.0	4.8	Negligible
R66	Dwelling on Seaton Road	508639	179056	1.5	56.1	61.1	4.9	Negligible
R67	Dwelling on Wentworth Crescent	508786	179050	1.5	56.5	59.9	3.4	Negligible
R68	Dwelling on Mildred Avenue	508758	178981	1.5	56.7	60.0	3.3	Negligible
R69	Dwelling on Mildred Avenue	508710	178847	1.5	67.2	70.0	2.8	Negligible
R70	Dwelling on Dawley Road	509054	178994	1.5	59.2	60.9	1.7	Negligible
R71	Dwelling on Seaton Road	508547	178932	1.5	57.8	62.2	4.4	Negligible
R72	Dwelling on Pinkwell Avenue	508976	178882	1.5	58.0	59.6	1.6	Negligible
R73	Dwelling on Oakington Avenue	508895	178793	1.5	59.9	61.6	1.6	Negligible
R74	Dwelling on Mulberry Crescent	507592	179687	1.5	60.6	63.8	3.1	Negligible
R75	Dwelling on Mulberry Crescent	507417	179752	1.5	54.6	56.7	2.1	Negligible
R76	Dwelling on Jasmine Terrace	507350	179651	1.5	56.7	58.8	2.1	Negligible
R77	Dwelling on Lavender Rise	507459	179616	1.5	55.4	58.1	2.7	Negligible
R78	Dwelling on Kebony Close	507284	179777	1.5	53.5	55.1	1.6	Negligible
R79	Dwelling on Mulberry Crescent	507222	179696	1.5	53.4	55.0	1.6	Negligible
R80	Dwelling on Potters Way	507135	179553	1.5	53.5	54.9	1.4	Negligible
R81	Dwelling on Rutters Close	507183	179850	1.5	52.9	54.1	1.2	Negligible
R82	Dwelling on Lavender Rise	507347	179533	1.5	54.6	57.4	2.8	Negligible
R83	Dwelling on Botwell Common Road	508590	180658	1.5	54.9	56.8	1.9	Negligible
R84	Dwelling on Botwell Common Road	508802	180708	1.5	53.2	55.0	1.7	Negligible
R85	Gurdwara Hayes (ST)	509485	180185	1.5	60.2	61.7	1.5	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	1-Hour Mean NO ₂ Concentration	Impact Assessment		
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R86	Lake Farm Park Academy (ST)	509286	180317	1.5	52.0	53.6	1.6	Negligible
R87	Dwelling on Botwell Common Road	509148	180577	1.5	51.9	53.5	1.6	Negligible
R88	Dwelling on Almond Avenue	507275	179381	1.5	54.5	57.2	2.7	Negligible
R89	Dwelling on Smaldon Close	507256	179220	1.5	54.8	57.1	2.2	Negligible
R90	Dwelling on South Close	507061	179406	1.5	54.1	55.4	1.3	Negligible
R91	Dwelling on Hazel Avenue	507191	179297	1.5	54.2	56.0	1.8	Negligible
R92	Bell Farm Church	507076	179216	1.5	54.0	55.2	1.2	Negligible
R93	Dwelling on Blackthorn Avenue	507232	179053	1.5	55.5	57.0	1.5	Negligible
R94	Residential dwelling on Nine acres close	508095	179455	1.5	56.6	95.8	39.2	Slight adverse
R95	Residential dwelling on Nine acres close	508124	179457	1.5	55.1	82.1	27.1	Slight adverse
R96	Residential dwelling on Nine acres close	508070	179461	1.5	56.5	93.4	37.0	Slight adverse

Table F3. Modelling Results – Annual Mean PM₁₀

Receptor ID	Receptor Description	Location Coordinates		Height	Annual Mean PM ₁₀ Concentration (µg/m ³)	Impact Assessment		
		X	Y			Without Development	With Development	Change (µg/m ³) Impact Descriptor
R0	Dwelling on Denbigh Drive	508162	179620	1.5	15.3	15.4	<0.1	Negligible
R1	Dwelling on Denbigh Drive	508156	179589	1.5	15.4	15.4	<0.1	Negligible
R2	Dwelling on Denbigh Drive	508149	179561	1.5	15.3	15.3	<0.1	Negligible
R3	Dwelling on Denbigh Drive	508159	179522	1.5	15.3	15.3	<0.1	Negligible
R4	Dwelling on Denbigh Drive	508162	179486	1.5	15.3	15.3	<0.1	Negligible
R5	Dwelling on Denbigh Drive	508177	179460	1.5	15.3	15.3	<0.1	Negligible
R6	Dwelling on Nine Acres Close	508138	179482	1.5	15.3	15.3	<0.1	Negligible
R7	Dwelling on Nine Acres Close	508100	179481	1.5	15.3	15.3	<0.1	Negligible
R8	Dwelling on Nine Acres Close	508064	179491	1.5	15.3	15.3	<0.1	Negligible
R9	Dwelling on Nine Acres Close	508039	179473	1.5	15.4	15.4	<0.1	Negligible
R10	Dwelling on Nine Acres Close	508034	179414	1.5	15.4	15.4	<0.1	Negligible
R11	Dwelling on Nine Acres Close	508018	179363	1.5	15.4	15.4	<0.1	Negligible
R12	Dwelling on Nine Acres Close	508020	179311	1.5	15.6	15.6	<0.1	Negligible
R13	Dwelling on Nine Acres Close	508092	179352	1.5	16.3	16.3	<0.1	Negligible
R14	Nine Acres Hotel (ST)	508089	179420	1.5	15.5	15.5	<0.1	Negligible
R15	Dwelling on Nine Acres Close	508149	179401	1.5	15.4	15.4	<0.1	Negligible
R16	Dwelling on Nine Acres Close	508190	179416	1.5	15.3	15.3	<0.1	Negligible
R17	Dwelling on Conway Drive	508236	179419	1.5	15.3	15.3	<0.1	Negligible
R18	Dwelling on Denbigh Drive	508224	179476	1.5	15.3	15.3	<0.1	Negligible
R19	Dwelling on Denbigh Drive	508202	179525	1.5	15.3	15.3	<0.1	Negligible
R20	Dwelling on Denbigh Drive	508228	179560	1.5	15.4	15.4	<0.1	Negligible
R21	Dwelling on Denbigh Drive	508194	179627	1.5	15.4	15.4	<0.1	Negligible
R22	Dwelling on Denbigh Drive	508266	179594	1.5	15.3	15.3	<0.1	Negligible
R23	Dwelling on Stormount Drive	508365	179567	1.5	15.3	15.3	<0.1	Negligible
R24	Dwelling on Conway Drive	508298	179503	1.5	15.3	15.3	<0.1	Negligible
R25	Dwelling on Conway Drive	508295	179464	1.5	15.3	15.3	<0.1	Negligible
R26	Sandgate Football Club (ST)	508097	179237	1.5	15.2	15.2	<0.1	Negligible
R27	Dwelling on Bourne Avenue	508130	179303	1.5	15.3	15.3	<0.1	Negligible
R28	Dwelling on Bourne Avenue	508196	179342	1.5	15.4	15.4	<0.1	Negligible
R29	Dwelling on Bourne Circus	508303	179407	1.5	15.4	15.4	<0.1	Negligible
R30	Dwelling on Bourne Avenue	508407	179375	1.5	15.3	15.3	<0.1	Negligible
R31	Dwelling on Snowdon Crescent	508438	179423	1.5	15.2	15.2	<0.1	Negligible
R32	Dwelling on Snowdon Crescent	508442	179464	1.5	15.3	15.3	<0.1	Negligible
R33	Dwelling on Bourne Circus	508302	179343	1.5	15.5	15.5	<0.1	Negligible
R34	Dwelling on Skipton Drive	508188	179197	1.5	15.5	15.5	<0.1	Negligible
R35	Dwelling on Skipton Drive	508128	179002	1.5	15.2	15.2	<0.1	Negligible
R36	Dwelling on Carnarv Drive	508235	179077	1.5	15.2	15.2	<0.1	Negligible
R37	Dwelling on Carnarv Drive	508252	179297	1.5	15.4	15.4	<0.1	Negligible
R38	Tiny Gems Day Nursery (ST)	508390	179110	1.5	15.1	15.1	<0.1	Negligible
R39	Sunflower House Nusery (ST)	508964	179113	1.5	15.6	15.6	<0.1	Negligible
R40	Harlington School (ST)	508586	178796	1.5	15.6	15.6	<0.1	Negligible
R41	Christ Church Hayes (ST)	508329	179210	1.5	15.2	15.2	<0.1	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	Annual Mean PM ₁₀ Concentration (µg/m ³)		Impact Assessment	
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R42	Pinkwell Primary School (ST)	508498	178826	1.5	15.4	15.4	<0.1	Negligible
R43	Tina Tiney Home Nuser (ST)	507561	179800	1.5	16.6	16.6	<0.1	Negligible
R44	Emden Close Play Area (ST)	507475	179859	1.5	16.6	16.6	<0.1	Negligible
R45	Busy Bees Nursery at Heathrow (ST)	507432	180016	1.5	17.0	17.0	<0.1	Negligible
R46	Stockley Park Golf Club (ST)	508085	180491	1.5	16.6	16.6	<0.1	Negligible
R47	Stockley Park Golf Club (ST)	508435	180152	1.5	15.4	15.4	<0.1	Negligible
R48	Dwelling on Glamis Crescent	508381	179255	1.5	15.2	15.2	<0.1	Negligible
R49	Dwelling on Waltham Avenue	508471	179199	1.5	15.2	15.2	<0.1	Negligible
R50	Dwelling on Bourne Avenue	508559	179329	1.5	15.4	15.4	<0.1	Negligible
R51	Dwelling on Waltham Avenue	508596	179251	1.5	15.3	15.3	<0.1	Negligible
R52	Dwelling on Waltham Avenue	508552	179168	1.5	15.2	15.2	<0.1	Negligible
R53	Dwelling on Seaton Road	508524	179095	1.5	15.1	15.1	<0.1	Negligible
R54	Dwelling on Stormount Drive	508547	179498	1.5	15.3	15.3	<0.1	Negligible
R55	Dwelling on Glamis Crescent	508431	179294	1.5	15.2	15.2	<0.1	Negligible
R56	Dwelling on Clevedon Gardens	508590	179416	1.5	15.4	15.4	<0.1	Negligible
R57	Dwelling on Bourne Avenue	508649	179348	1.5	16.4	16.4	<0.1	Negligible
R58	Dwelling on Burnham Gardens	508672	179473	1.5	15.5	15.5	<0.1	Negligible
R59	Dwelling on Marlow Gardens	508756	179416	1.5	15.6	15.6	<0.1	Negligible
R60	Dwelling on Bourne Avenue	508911	179342	1.5	16.6	16.6	<0.1	Negligible
R61	Dwelling on Guinness Close	508929	179457	1.5	15.9	15.9	<0.1	Negligible
R62	Dwelling on Bourne Avenue	508727	179241	1.5	16.0	16.0	<0.1	Negligible
R63	Dwelling on Waltham Avenue	508943	179238	1.5	16.1	16.1	<0.1	Negligible
R64	Dwelling on Bourne Avenue	508803	179321	1.5	16.0	16.0	<0.1	Negligible
R65	Dwelling on Mildred Avenue	508720	179149	1.5	15.8	15.8	<0.1	Negligible
R66	Dwelling on Seaton Road	508639	179056	1.5	15.3	15.3	<0.1	Negligible
R67	Dwelling on Wentworth Crescent	508786	179050	1.5	15.5	15.5	<0.1	Negligible
R68	Dwelling on Mildred Avenue	508758	178981	1.5	15.4	15.4	<0.1	Negligible
R69	Dwelling on Mildred Avenue	508710	178847	1.5	17.1	17.1	<0.1	Negligible
R70	Dwelling on Dawley Road	509054	178994	1.5	16.0	16.0	<0.1	Negligible
R71	Dwelling on Seaton Road	508547	178932	1.5	15.6	15.6	<0.1	Negligible
R72	Dwelling on Pinkwell Avenue	508976	178882	1.5	15.7	15.7	<0.1	Negligible
R73	Dwelling on Oakington Avenue	508895	178793	1.5	16.0	16.0	<0.1	Negligible
R74	Dwelling on Mulberry Crescent	507592	179687	1.5	17.4	17.4	<0.1	Negligible
R75	Dwelling on Mulberry Crescent	507417	179752	1.5	16.1	16.1	<0.1	Negligible
R76	Dwelling on Jasmine Terrace	507350	179651	1.5	16.2	16.2	<0.1	Negligible
R77	Dwelling on Lavender Rise	507459	179616	1.5	15.9	15.9	<0.1	Negligible
R78	Dwelling on Kebony Close	507284	179777	1.5	15.9	15.9	<0.1	Negligible
R79	Dwelling on Mulberry Crescent	507222	179696	1.5	15.6	15.6	<0.1	Negligible
R80	Dwelling on Potters Way	507135	179553	1.5	15.2	15.2	<0.1	Negligible
R81	Dwelling on Rutters Close	507183	179850	1.5	15.9	15.9	<0.1	Negligible
R82	Dwelling on Lavender Rise	507347	179533	1.5	15.4	15.4	<0.1	Negligible
R83	Dwelling on Botwell Common Road	508590	180658	1.5	16.2	16.2	<0.1	Negligible
R84	Dwelling on Botwell Common Road	508802	180708	1.5	15.9	15.9	<0.1	Negligible
R85	Gurdwara Hayes (ST)	509485	180185	1.5	17.0	17.0	<0.1	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	Annual (µg/m³)	Mean	PM10	Concentration	Impact Assessment	
		X	Y						Z	Without Development
R86	Lake Farm Park Academy (ST)	509286	180317	1.5	15.5			15.5	<0.1	Negligible
R87	Dwelling on Botwell Common Road	509148	180577	1.5	15.5			15.5	<0.1	Negligible
R88	Dwelling on Almond Avenue	507275	179381	1.5	15.2			15.2	<0.1	Negligible
R89	Dwelling on Smaldon Close	507256	179220	1.5	15.2			15.2	<0.1	Negligible
R90	Dwelling on South Close	507061	179406	1.5	15.2			15.2	<0.1	Negligible
R91	Dweling on Hazel Avenue	507191	179297	1.5	15.1			15.1	<0.1	Negligible
R92	Bell Farm Church	507076	179216	1.5	15.1			15.1	<0.1	Negligible
R93	Dwelling on Blackthorn Avenue	507232	179053	1.5	15.3			15.3	<0.1	Negligible
R94	Residential dwelling on Nine acres close	508095	179455	1.5	15.7			15.7	<0.1	Negligible
R95	Residential dwelling on Nine acres close	508124	179457	1.5	15.3			15.3	<0.1	Negligible
R96	Residential dwelling on Nine acres close	508070	179461	1.5	15.6			15.6	<0.1	Negligible

Table F4. Modelling Results – Daily Mean PM₁₀ Exceedances

Receptor ID	Receptor Description	Location Coordinates		Height Z	# Days PM ₁₀ >50 µg/m ³ (days)		Impact Assessment	
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R0	Dwelling on Denbigh Drive	508162	179620	1.5	0	0	0	Negligible
R1	Dwelling on Denbigh Drive	508156	179589	1.5	0	0	0	Negligible
R2	Dwelling on Denbigh Drive	508149	179561	1.5	0	0	0	Negligible
R3	Dwelling on Denbigh Drive	508159	179522	1.5	0	0	0	Negligible
R4	Dwelling on Denbigh Drive	508162	179486	1.5	0	0	0	Negligible
R5	Dwelling on Denbigh Drive	508177	179460	1.5	0	0	0	Negligible
R6	Dwelling on Nine Acres Close	508138	179482	1.5	0	0	0	Negligible
R7	Dwelling on Nine Acres Close	508100	179481	1.5	0	0	0	Negligible
R8	Dwelling on Nine Acres Close	508064	179491	1.5	0	0	0	Negligible
R9	Dwelling on Nine Acres Close	508039	179473	1.5	0	0	0	Negligible
R10	Dwelling on Nine Acres Close	508034	179414	1.5	0	0	0	Negligible
R11	Dwelling on Nine Acres Close	508018	179363	1.5	0	0	0	Negligible
R12	Dwelling on Nine Acres Close	508020	179311	1.5	0	0	0	Negligible
R13	Dwelling on Nine Acres Close	508092	179352	1.5	0	0	0	Negligible
R14	Nine Acres Hotel (ST)	508089	179420	1.5	0	0	0	Negligible
R15	Dwelling on Nine Acres Close	508149	179401	1.5	0	0	0	Negligible
R16	Dwelling on Nine Acres Close	508190	179416	1.5	0	0	0	Negligible
R17	Dwelling on Conway Drive	508236	179419	1.5	0	0	0	Negligible
R18	Dwelling on Denbigh Drive	508224	179476	1.5	0	0	0	Negligible
R19	Dwelling on Denbigh Drive	508202	179525	1.5	0	0	0	Negligible
R20	Dwelling on Denbigh Drive	508228	179560	1.5	0	0	0	Negligible
R21	Dwelling on Denbigh Drive	508194	179627	1.5	0	0	0	Negligible
R22	Dwelling on Denbigh Drive	508266	179594	1.5	0	0	0	Negligible
R23	Dwelling on Stormount Drive	508365	179567	1.5	0	0	0	Negligible
R24	Dwelling on Conway Drive	508298	179503	1.5	0	0	0	Negligible
R25	Dwelling on Conway Drive	508295	179464	1.5	0	0	0	Negligible
R26	Sandgate Football Club (ST)	508097	179237	1.5	0	0	0	Negligible
R27	Dwelling on Bourne Avenue	508130	179303	1.5	0	0	0	Negligible
R28	Dwelling on Bourne Avenue	508196	179342	1.5	0	0	0	Negligible
R29	Dwelling on Bourne Circus	508303	179407	1.5	0	0	0	Negligible
R30	Dwelling on Bourne Avenue	508407	179375	1.5	0	0	0	Negligible
R31	Dwelling on Snowdon Crescent	508438	179423	1.5	0	0	0	Negligible
R32	Dwelling on Snowdon Crescent	508442	179464	1.5	0	0	0	Negligible
R33	Dwelling on Bourne Circus	508302	179343	1.5	0	0	0	Negligible
R34	Dwelling on Skipton Drive	508188	179197	1.5	0	0	0	Negligible
R35	Dwelling on Skipton Drive	508128	179002	1.5	0	0	0	Negligible
R36	Dwelling on Carnarv Drive	508235	179077	1.5	0	0	0	Negligible
R37	Dwelling on Carnarv Drive	508252	179297	1.5	0	0	0	Negligible
R38	Tiny Gems Day Nursery (ST)	508390	179110	1.5	0	0	0	Negligible
R39	Sunflower House Nursery (ST)	508964	179113	1.5	0	0	0	Negligible
R40	Harlington School (ST)	508586	178796	1.5	0	0	0	Negligible
R41	Christ Church Hayes (ST)	508329	179210	1.5	0	0	0	Negligible
R42	Pinkwell Primary School (ST)	508498	178826	1.5	0	0	0	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	# Days PM ₁₀ >50 µg/m ³ (days)		Impact Assessment	
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R43	Tina Tiney Home Nursery (ST)	507561	179800	1.5	0	0	0	Negligible
R44	Emden Close Play Area (ST)	507475	179859	1.5	0	0	0	Negligible
R45	Busy Bees Nursery at Heathrow (ST)	507432	180016	1.5	1	1	0	Negligible
R46	Stockley Park Golf Club (ST)	508085	180491	1.5	0	0	0	Negligible
R47	Stockley Park Golf Club (ST)	508435	180152	1.5	0	0	0	Negligible
R48	Dwelling on Glamis Crescent	508381	179255	1.5	0	0	0	Negligible
R49	Dwelling on Waltham Avenue	508471	179199	1.5	0	0	0	Negligible
R50	Dwelling on Bourne Avenue	508559	179329	1.5	0	0	0	Negligible
R51	Dwelling on Waltham Avenue	508596	179251	1.5	0	0	0	Negligible
R52	Dwelling on Waltham Avenue	508552	179168	1.5	0	0	0	Negligible
R53	Dwelling on Seaton Road	508524	179095	1.5	0	0	0	Negligible
R54	Dwelling on Stormount Drive	508547	179498	1.5	0	0	0	Negligible
R55	Dwelling on Glamis Crescent	508431	179294	1.5	0	0	0	Negligible
R56	Dwelling on Clevedon Gardens	508590	179416	1.5	0	0	0	Negligible
R57	Dwelling on Bourne Avenue	508649	179348	1.5	0	0	0	Negligible
R58	Dwelling on Burnham Gardens	508672	179473	1.5	0	0	0	Negligible
R59	Dwelling on Marlow Gardens	508756	179416	1.5	0	0	0	Negligible
R60	Dwelling on Bourne Avenue	508911	179342	1.5	0	0	0	Negligible
R61	Dwelling on Guinness Close	508929	179457	1.5	0	0	0	Negligible
R62	Dwelling on Bourne Avenue	508727	179241	1.5	0	0	0	Negligible
R63	Dwelling on Waltham Avenue	508943	179238	1.5	0	0	0	Negligible
R64	Dwelling on Bourne Avenue	508803	179321	1.5	0	0	0	Negligible
R65	Dwelling on Mildred Avenue	508720	179149	1.5	0	0	0	Negligible
R66	Dwelling on Seaton Road	508639	179056	1.5	0	0	0	Negligible
R67	Dwelling on Wentworth Crescent	508786	179050	1.5	0	0	0	Negligible
R68	Dwelling on Mildred Avenue	508758	178981	1.5	0	0	0	Negligible
R69	Dwelling on Mildred Avenue	508710	178847	1.5	1	1	0	Negligible
R70	Dwelling on Dawley Road	509054	178994	1.5	0	0	0	Negligible
R71	Dwelling on Seaton Road	508547	178932	1.5	0	0	0	Negligible
R72	Dwelling on Pinkwell Avenue	508976	178882	1.5	0	0	0	Negligible
R73	Dwelling on Oakington Avenue	508895	178793	1.5	0	0	0	Negligible
R74	Dwelling on Mulberry Crescent	507592	179687	1.5	1	1	0	Negligible
R75	Dwelling on Mulberry Crescent	507417	179752	1.5	0	0	0	Negligible
R76	Dwelling on Jasmine Terrace	507350	179651	1.5	0	0	0	Negligible
R77	Dwelling on Lavender Rise	507459	179616	1.5	0	0	0	Negligible
R78	Dwelling on Kebony Close	507284	179777	1.5	0	0	0	Negligible
R79	Dwelling on Mulberry Crescent	507222	179696	1.5	0	0	0	Negligible
R80	Dwelling on Potters Way	507135	179553	1.5	0	0	0	Negligible
R81	Dwelling on Rutters Close	507183	179850	1.5	0	0	0	Negligible
R82	Dwelling on Lavender Rise	507347	179533	1.5	0	0	0	Negligible
R83	Dwelling on Botwell Common Road	508590	180658	1.5	0	0	0	Negligible
R84	Dwelling on Botwell Common Road	508802	180708	1.5	0	0	0	Negligible
R85	Gurdwara Hayes (ST)	509485	180185	1.5	0	0	0	Negligible
R86	Lake Farm Park Academy (ST)	509286	180317	1.5	0	0	0	Negligible
R87	Dwelling on Botwell Common Road	509148	180577	1.5	0	0	0	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	# Days PM ₁₀ >50 µg/m ³ (days)		Impact Assessment	
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R88	Dwelling on Almond Avenue	507275	179381	1.5	0	0	0	Negligible
R89	Dwelling on Smaldon Close	507256	179220	1.5	0	0	0	Negligible
R90	Dwelling on South Close	507061	179406	1.5	0	0	0	Negligible
R91	Dwelling on Hazel Avenue	507191	179297	1.5	0	0	0	Negligible
R92	Bell Farm Church	507076	179216	1.5	0	0	0	Negligible
R93	Dwelling on Blackthorn Avenue	507232	179053	1.5	0	0	0	Negligible
R94	Residential dwelling on Nine acres close	508095	179455	1.5	0	0	0	Negligible
R95	Residential dwelling on Nine acres close	508124	179457	1.5	0	0	0	Negligible
R96	Residential dwelling on Nine acres close	508070	179461	1.5	0	0	0	Negligible

Table F5. Modelling Results – Annual Mean PM_{2.5}

Receptor ID	Receptor Description	Location Coordinates		Height	Annual Mean PM _{2.5} Concentration (µg/m ³)		Impact Assessment	
		X	Y	Z	Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R0	Dwelling on Denbigh Drive	508162	179620	1.5	10.1	10.1	<0.1	Negligible
R1	Dwelling on Denbigh Drive	508156	179589	1.5	10.2	10.2	<0.1	Negligible
R2	Dwelling on Denbigh Drive	508149	179561	1.5	10.1	10.1	<0.1	Negligible
R3	Dwelling on Denbigh Drive	508159	179522	1.5	10.1	10.1	<0.1	Negligible
R4	Dwelling on Denbigh Drive	508162	179486	1.5	10.1	10.1	<0.1	Negligible
R5	Dwelling on Denbigh Drive	508177	179460	1.5	10.1	10.1	<0.1	Negligible
R6	Dwelling on Nine Acres Close	508138	179482	1.5	10.1	10.1	<0.1	Negligible
R7	Dwelling on Nine Acres Close	508100	179481	1.5	10.2	10.2	<0.1	Negligible
R8	Dwelling on Nine Acres Close	508064	179491	1.5	10.2	10.2	<0.1	Negligible
R9	Dwelling on Nine Acres Close	508039	179473	1.5	10.2	10.2	<0.1	Negligible
R10	Dwelling on Nine Acres Close	508034	179414	1.5	10.2	10.2	<0.1	Negligible
R11	Dwelling on Nine Acres Close	508018	179363	1.5	10.2	10.2	<0.1	Negligible
R12	Dwelling on Nine Acres Close	508020	179311	1.5	10.2	10.2	<0.1	Negligible
R13	Dwelling on Nine Acres Close	508092	179352	1.5	10.5	10.5	<0.1	Negligible
R14	Nine Acres Hotel (ST)	508089	179420	1.5	10.2	10.2	<0.1	Negligible
R15	Dwelling on Nine Acres Close	508149	179401	1.5	10.2	10.2	<0.1	Negligible
R16	Dwelling on Nine Acres Close	508190	179416	1.5	10.1	10.1	<0.1	Negligible
R17	Dwelling on Conway Drive	508236	179419	1.5	10.2	10.2	<0.1	Negligible
R18	Dwelling on Denbigh Drive	508224	179476	1.5	10.1	10.1	<0.1	Negligible
R19	Dwelling on Denbigh Drive	508202	179525	1.5	10.2	10.2	<0.1	Negligible
R20	Dwelling on Denbigh Drive	508228	179560	1.5	10.2	10.2	<0.1	Negligible
R21	Dwelling on Denbigh Drive	508194	179627	1.5	10.1	10.1	<0.1	Negligible
R22	Dwelling on Denbigh Drive	508266	179594	1.5	10.1	10.1	<0.1	Negligible
R23	Dwelling on Stormount Drive	508365	179567	1.5	10.1	10.1	<0.1	Negligible
R24	Dwelling on Conway Drive	508298	179503	1.5	10.2	10.2	<0.1	Negligible
R25	Dwelling on Conway Drive	508295	179464	1.5	10.2	10.2	<0.1	Negligible
R26	Sandgate Football Club (ST)	508097	179237	1.5	10.1	10.1	<0.1	Negligible
R27	Dwelling on Bourne Avenue	508130	179303	1.5	10.2	10.2	<0.1	Negligible
R28	Dwelling on Bourne Avenue	508196	179342	1.5	10.2	10.2	<0.1	Negligible
R29	Dwelling on Bourne Circus	508303	179407	1.5	10.2	10.2	<0.1	Negligible
R30	Dwelling on Bourne Avenue	508407	179375	1.5	10.1	10.1	<0.1	Negligible
R31	Dwelling on Snowdon Crescent	508438	179423	1.5	10.1	10.1	<0.1	Negligible
R32	Dwelling on Snowdon Crescent	508442	179464	1.5	10.1	10.1	<0.1	Negligible
R33	Dwelling on Bourne Circus	508302	179343	1.5	10.2	10.2	<0.1	Negligible
R34	Dwelling on Skipton Drive	508188	179197	1.5	10.2	10.2	<0.1	Negligible
R35	Dwelling on Skipton Drive	508128	179002	1.5	10.1	10.1	<0.1	Negligible
R36	Dwelling on Carnarv Drive	508235	179077	1.5	10.1	10.1	<0.1	Negligible
R37	Dwelling on Carnarv Drive	508252	179297	1.5	10.2	10.2	<0.1	Negligible
R38	Tiny Gems Day Nursery (ST)	508390	179110	1.5	10.1	10.1	<0.1	Negligible
R39	Sunflower House Nusery (ST)	508964	179113	1.5	10.2	10.2	<0.1	Negligible
R40	Harlington School (ST)	508586	178796	1.5	10.2	10.2	<0.1	Negligible
R41	Christ Church Hayes (ST)	508329	179210	1.5	10.1	10.1	<0.1	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	Annual Mean PM _{2.5} Concentration (µg/m ³)		Impact Assessment	
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R42	Pinkwell Primary School (ST)	508498	178826	1.5	10.1	10.1	<0.1	Negligible
R43	Tina Tiney Home Nuser (ST)	507561	179800	1.5	10.4	10.4	<0.1	Negligible
R44	Emden Close Play Area (ST)	507475	179859	1.5	10.3	10.3	<0.1	Negligible
R45	Busy Bees Nursery at Heathrow (ST)	507432	180016	1.5	10.3	10.3	<0.1	Negligible
R46	Stockley Park Golf Club (ST)	508085	180491	1.5	10.1	10.1	<0.1	Negligible
R47	Stockley Park Golf Club (ST)	508435	180152	1.5	10.0	10.0	<0.1	Negligible
R48	Dwelling on Glamis Crescent	508381	179255	1.5	10.1	10.1	<0.1	Negligible
R49	Dwelling on Waltham Avenue	508471	179199	1.5	10.1	10.1	<0.1	Negligible
R50	Dwelling on Bourne Avenue	508559	179329	1.5	10.1	10.1	<0.1	Negligible
R51	Dwelling on Waltham Avenue	508596	179251	1.5	10.1	10.1	<0.1	Negligible
R52	Dwelling on Waltham Avenue	508552	179168	1.5	10.1	10.1	<0.1	Negligible
R53	Dwelling on Seaton Road	508524	179095	1.5	10.1	10.1	<0.1	Negligible
R54	Dwelling on Stormount Drive	508547	179498	1.5	10.1	10.1	<0.1	Negligible
R55	Dwelling on Glamis Crescent	508431	179294	1.5	10.1	10.1	<0.1	Negligible
R56	Dwelling on Clevedon Gardens	508590	179416	1.5	10.2	10.2	<0.1	Negligible
R57	Dwelling on Bourne Avenue	508649	179348	1.5	10.5	10.5	<0.1	Negligible
R58	Dwelling on Burnham Gardens	508672	179473	1.5	10.2	10.2	<0.1	Negligible
R59	Dwelling on Marlow Gardens	508756	179416	1.5	10.2	10.2	<0.1	Negligible
R60	Dwelling on Bourne Avenue	508911	179342	1.5	10.5	10.5	<0.1	Negligible
R61	Dwelling on Guinness Close	508929	179457	1.5	10.3	10.3	<0.1	Negligible
R62	Dwelling on Bourne Avenue	508727	179241	1.5	10.3	10.3	<0.1	Negligible
R63	Dwelling on Waltham Avenue	508943	179238	1.5	10.3	10.3	<0.1	Negligible
R64	Dwelling on Bourne Avenue	508803	179321	1.5	10.3	10.3	<0.1	Negligible
R65	Dwelling on Mildred Avenue	508720	179149	1.5	10.3	10.3	<0.1	Negligible
R66	Dwelling on Seaton Road	508639	179056	1.5	10.1	10.1	<0.1	Negligible
R67	Dwelling on Wentworth Crescent	508786	179050	1.5	10.2	10.2	<0.1	Negligible
R68	Dwelling on Mildred Avenue	508758	178981	1.5	10.2	10.2	<0.1	Negligible
R69	Dwelling on Mildred Avenue	508710	178847	1.5	10.7	10.7	<0.1	Negligible
R70	Dwelling on Dawley Road	509054	178994	1.5	10.3	10.3	<0.1	Negligible
R71	Dwelling on Seaton Road	508547	178932	1.5	10.2	10.2	<0.1	Negligible
R72	Dwelling on Pinkwell Avenue	508976	178882	1.5	10.2	10.2	<0.1	Negligible
R73	Dwelling on Oakington Avenue	508895	178793	1.5	10.3	10.3	<0.1	Negligible
R74	Dwelling on Mulberry Crescent	507592	179687	1.5	10.6	10.6	<0.1	Negligible
R75	Dwelling on Mulberry Crescent	507417	179752	1.5	10.3	10.3	<0.1	Negligible
R76	Dwelling on Jasmine Terrace	507350	179651	1.5	10.4	10.4	<0.1	Negligible
R77	Dwelling on Lavender Rise	507459	179616	1.5	10.3	10.3	<0.1	Negligible
R78	Dwelling on Kebony Close	507284	179777	1.5	10.2	10.2	<0.1	Negligible
R79	Dwelling on Mulberry Crescent	507222	179696	1.5	10.1	10.1	<0.1	Negligible
R80	Dwelling on Potters Way	507135	179553	1.5	10.1	10.1	<0.1	Negligible
R81	Dwelling on Rutters Close	507183	179850	1.5	10.1	10.1	<0.1	Negligible
R82	Dwelling on Lavender Rise	507347	179533	1.5	10.2	10.2	<0.1	Negligible
R83	Dwelling on Botwell Common Road	508590	180658	1.5	10.3	10.3	<0.1	Negligible
R84	Dwelling on Botwell Common Road	508802	180708	1.5	10.2	10.2	<0.1	Negligible
R85	Gurdwara Hayes (ST)	509485	180185	1.5	10.6	10.6	<0.1	Negligible

Receptor ID	Receptor Description	Location Coordinates		Height	Annual Mean PM _{2.5} Concentration (µg/m ³)		Impact Assessment	
		X	Y		Without Development	With Development	Change (µg/m ³)	Impact Descriptor
R86	Lake Farm Park Academy (ST)	509286	180317	1.5	10.0	10.0	<0.1	Negligible
R87	Dwelling on Botwell Common Road	509148	180577	1.5	10.0	10.0	<0.1	Negligible
R88	Dwelling on Almond Avenue	507275	179381	1.5	10.2	10.2	<0.1	Negligible
R89	Dwelling on Smaldon Close	507256	179220	1.5	10.1	10.1	<0.1	Negligible
R90	Dwelling on South Close	507061	179406	1.5	10.2	10.2	<0.1	Negligible
R91	Dwelling on Hazel Avenue	507191	179297	1.5	10.1	10.1	<0.1	Negligible
R92	Bell Farm Church	507076	179216	1.5	10.1	10.1	<0.1	Negligible
R93	Dwelling on Blackthorn Avenue	507232	179053	1.5	10.2	10.2	<0.1	Negligible
R94	Residential dwelling on Nine acres close	508095	179455	1.5	10.2	10.2	<0.1	Negligible
R95	Residential dwelling on Nine acres close	508124	179457	1.5	10.3	10.3	<0.1	Negligible
R96	Residential dwelling on Nine acres close	508070	179461	1.5	10.3	10.3	<0.1	Negligible

