

# HGS : MSC Phase 1 to 4 air quality

## Air Quality Assessment



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## Executive Summary

This air quality assessment is to support the planning application for constructing a new dry sports hall and refurbishing the existing Mallinson Sports Centre facilities at the Bishopswood Road campus (Lower School) of Highgate School.

## Planning requirements

As the London Borough of Haringey is an Air Quality Management Area (AQMA), it is expected that proposals for new developments will consider air quality in the development's design, construction and operation over its lifetime. This includes considering adverse impacts on potential site occupiers and the wider local area. Therefore the air quality assessment should include identifying the current local air quality and location of sensitive receptors, undertaking an 'air quality neutral' (London Plan Policy SI 1) and considering the method to control dust and emissions during demolition and construction.

## Local Area Air quality

The annual mean nitrogen dioxide and dust particle emissions are within the World Health Organisation stated targets. Highgate School has provided diffusion tube emission monitoring data for 3 months, which, compared with Priory Park data, suggests that air quality is close to background levels and is not affected by major roads or building emissions.

The site is considered sensitive to human health as it is located opposite Highgate Pre-Preparatory school for children under 8 years of age. The construction vehicle routes along Bishopswood Road and Broadlands Road pass by Highgate Pre-Preparatory and Junior School. Continuous air quality monitoring should be considered if demolition or earthwork phases are undertaken during the term.

No ecologically sensitive areas are near the site except for numerous roadside trees, which help reduce dust and noise emissions.

## Air Quality Neutral Building Emission

The proposal is to continue using newly installed ultra-low NO<sub>x</sub> gas boilers installed as part of the Phase 1 swimming pool refurbishment works. New Integral air source heat pumps as part of new sports hall ventilation equipment. Low surface temperature radiators in the Classroom and circulation spaces with heat from the air to water heat pumps. Dance and fitness studios require additional ventilation from a local heat recovery mechanical ventilation unit and heating /cooling via multi-split air source heat pumps.

## Air Quality Neutral Transport Emission

The Mallinson Sports Centre is used by the School and is open for local community use. Most current public users are residents within the Highgate area and generally arrive and depart by walking, cycling or public transport. There are no proposed additional parking facilities for public building users of the sports centre. The transport statement suggests that the redevelopment of the building will not increase the number of building users due to the sporting facilities.

As the building users are either local or school students, there is no expectation that the development will result in additional vehicle trips; therefore, the development is transport neutral.

### Construction dust emissions

The dust and emission risk assessments use the method outlined in the Supplementary Planning Guidance document "The Control of Dust and Emissions During Construction and Demolition" (2014).

Section 6, Construction Dust Risk Assessment, has identified a low risk of dust soiling during the demolition and earthwork phases. The work scale is considered small to medium, and the risk of actual dust emission is Low.

|                         | Demolition | Earthworks | Construction | Track-out |
|-------------------------|------------|------------|--------------|-----------|
| Dust Emission Magnitude | Small      | Small      | Small        | Medium    |
| Dust Soiling            | High       | High       | Medium       | Medium    |
| Human Health            | High       | High       | Medium       | Medium    |
| Ecological              | Low        | Low        | Low          | Low       |

Table 1 Input Axis for the Risk Matrix Tables

| Potential impact | Risk       |            |              |             |
|------------------|------------|------------|--------------|-------------|
|                  | Demolition | Earthworks | Construction | Track-out   |
| Dust Soiling     | Low Risk   | Low Risk   | Low Risk     | Medium Risk |
| Human Health     | Low Risk   | Low Risk   | Low Risk     | Medium Risk |
| Ecological       | Negligible | Negligible | Negligible   | Low Risk    |

Table 2 Combined site risk assessment.

## 1 Introduction

- 1.1 This air quality assessment is to support the planning application for constructing a new dry sports hall and refurbishing the existing Mallinson Sports Centre facilities at the Bishopswood Road campus (Lower School) of Highgate School.
- 1.2 As the London Borough of Haringey is an Air Quality Management Area (AQMA), proposals for new developments will consider air quality in the development's design, construction and operation over its lifetime. This includes considering adverse impacts on potential site occupiers and the wider local area. Some types of uses are very sensitive to air pollution (such as schools, hospitals and residential uses, particularly for older people), and developers should consider this in the site selection process. In line with London Plan Policy 7.14, the Council expects all development to be at least 'air quality neutral'.
- 1.3 The air quality assessment contains the following sections;
- Summary of Local Air Quality at Highgate Lower School Campus along Bishopswood Road
  - Air Quality Neutral Building-Related Emissions
  - Air Quality Neutral Transport Related Emissions
  - Construction site dust risk assessment. For each phase of work (demolition, earthworks, construction, Fitout)
- 1.4 This document should be read in conjunction with:
- Design and Access Statement
  - Energy Statement
  - Transport Statement
  - Flood Risk and Sustainable Urban Drainage Strategy
  - Ecology assessment
  - Construction statement

### Site

- 1.5 The Mallinson Sports Centre (MSC) is located on the Bishopswood Road campus of the school estate, close to other principal school buildings such as the Mills Centre, the Dining Hall, the Pre-Preparatory School and the Junior School.
- 1.6 The address is:
- Mallinson Sports Centre  
Bishopswood Road  
Highgate  
Haringey London N6 4PB
- 1.7 The main building comprises the Pool Hall and associated changing rooms, which was the first building on the site in 1969, followed in 1989 by the main sports hall with associated ancillary accommodation, gym, entrance hall, central offices and other sports spaces

- 1.8 The overriding aim of the design seeks to transform this building and create enhanced building aesthetics within the Conservation Area whilst providing all the sports and related ancillary facilities that the School will need for the foreseeable future.
- 1.9 The intention is to retain the essential elements of the existing building that have significant long-term Value and condition, providing spaces of the required technical standard, and integrate them with alterations and extensions into a unified single sports centre.
- 1.10 The new sports hall is the principal component of the proposed development of the School's indoor sports facilities. As part of the works, the School intends to demolish the existing Fives Court and Squash Courts building to open up a large area within the site that can be more efficiently and architecturally developed. These works are also designed to incorporate a new sports centre building comprising an indoor sports hall, teaching classrooms and staff offices.
- 1.11 The hall's design is to accommodate a National Standard Netball Court within the hall, one that will allow Premier League games to be played. There is an aspiration nationally for netball courts of this standard, for a sport that is increasing in popularity. Many other sports courts will fit within this same interior footprint.



Figure 1 Aerial View of the site in Red



Figure 2 Site Location in Context (Open Street Map)

## The Proposed works

1.12 The proposed works in this submission include:

- Demolition of the Fives Court and Squash Courts building at the site's north end and remove the external games court area and high chain-link fencing.
- New north-west extension for a second indoor sports hall with associated new circulation corridor, viewing gallery, access stairs and lift, ancillary spaces for storage and plant, and a teaching block extension for 'Combined Cadet Force' and 'Outdoor Education' classrooms and offices, with associated storage.
- A new south extension to the existing sports hall for eight (8) no. New external covered Fives Courts with runoff area.
- New south-west extension and alterations to the existing building to create an enhanced entrance with foyer, reception and café, with improved new access stairs down to the existing changing rooms.
- Alterations to the existing sports hall to enhance natural lighting by new roof lights, with interior changes to associated spaces.
- The New east extension in the existing open courtyard provides additional studio/gym spaces and forms connections back to the changing rooms, with ancillary external storage for sports.
- New hard and soft landscaping around the site's perimeter, including removing 3 no. trees and replacement with new semi-mature trees, and forming an entrance courtyard area at the new south main entrance.
- The works are intended to be constructed as a phased development. They are related to the current project on-site for the refurbishment of the existing Pool Hall, which is being retained at the heart of the proposed scheme. This was granted planning permission on 31st May 2018, reference: HGY/2018/1223, and referred to this further project in the Design and Access Statement as a master-planning intention.

1.13 The proposed works will modernise this important indoor sports facility with alterations and extensions and significantly extend the life of the retained elements of the existing building while also providing significant improvements to accessibility, energy efficiency and reduction of the carbon footprint of the whole development.

## Proposed Energy Systems

1.14 The proposal is to keep the recently installed low NOx Gas boilers as these boilers provide heat to the swimming pool, ventilation and domestic hot water system. During the refurbishment process, the designer relocated and reduced the size of the plantroom and added new ventilation to the changing rooms. The changes required a compact system that is achieved by designing a system with a higher flow water temperature 65°C and a low return 30°C achieved, achieved by heating the pool water and ventilation system. The large temperature difference between the flow and return is not compatible with the operation of the current air-to-water heat pumps. Replacing the existing boiler plant with heat pumps requires substantial alteration and replacement of most of the newly installed and energy-efficient plant. Adopting heat pumps will result in higher operational costs and loss of the embodied carbon of the

existing plant. Although heat pumps are often used to heat swimming pools and associated ventilation systems. The ventilation plant installed for the pool hall (Phase 1 ) handles significantly large air volumes which made it difficult to utilise heat pumps due to their restricted flow temperatures. New designs for air-to-water heat pumps using natural refrigerants are being developed for this application. It may become possible to replace the boilers with a similar-sized high-temperature heat pumps in the future.

- 1.15 Natural ventilation is required to reduce air velocities in sports halls for competition badminton use. Additional air shafts are included in the north wall. A very similar system is proposed for the dry sports hall with supplementary radiant heating for when the sports hall is used for examination.
- 1.16 Air-to-water heat pumps will provide the heat source for the low surface temperature radiators used to heat classrooms, circulation spaces and store rooms.

### Pool Hall Phase 1 Works

- 1.17 The phase 1 Pool Hall and changing rooms refurbishment works have been given separate Planning permission, and were completed in 2020. As the Pool Hall is ultimately an interconnected building with the proposed works, these boilers' implications are included in the air quality assessments.
- 1.18 A Clean Air Act (1993) application for a new replacement boiler plant was made in May 2019. The notice of approval of the new pool hall boiler chimney heights was received on 19/08/2019.

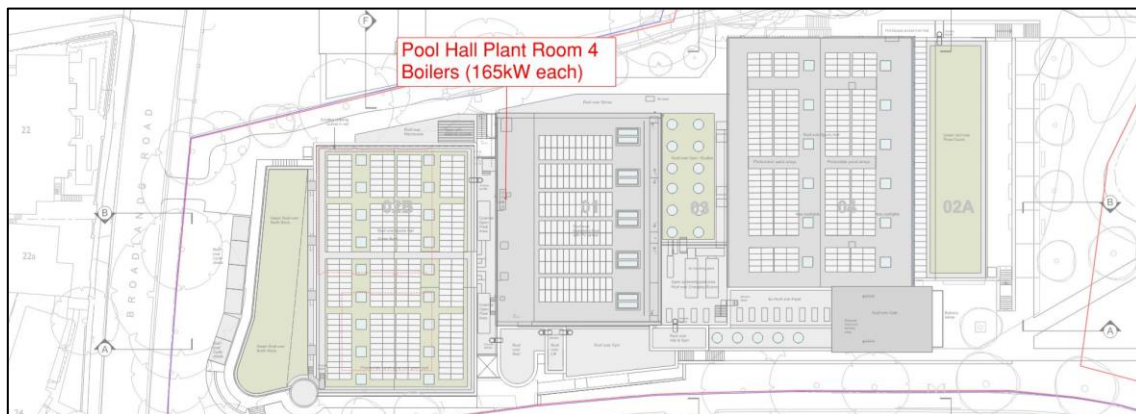


Figure 3 Locations of Boiler Flues – Roof Layout.

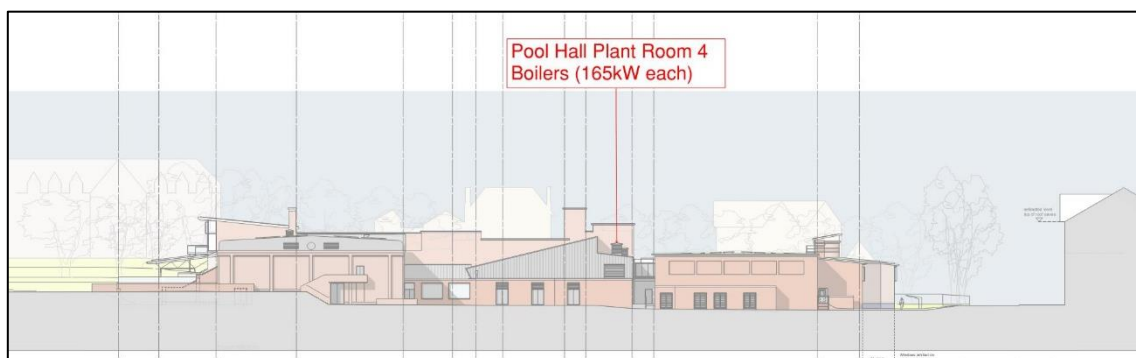


Figure 4 Location of Boiler flues - North Elevation.

| Location                          | Plant                                                     | Use                                                | Energy        | NO <sub>x</sub> Emissions |
|-----------------------------------|-----------------------------------------------------------|----------------------------------------------------|---------------|---------------------------|
| Pool Hall Plant Room<br>(Phase 1) | 4 No Wall Mounted<br>Room sealed Boilers<br>(165 kW each) | Pool Heating<br>and Changing<br>Rooms Hot<br>water | 45,684<br>kWh | 35.0 mg/kW                |

Table 3 Boiler Plant

## 2 Policy and context

### European Legislation

- 2.1 Ambient Air Quality Directive 2008/50/EC and the Fourth Daughter Directive 2004/107/EC are legislations that manage air quality. These directives set limiting values and target values for ambient pollutant concentrations. The limiting values are legally binding and must not be exceeded. In contrast, the target values are to be attained where it is cost-effective.
- 2.2 The Ambient Air Quality Directive provides limiting values for sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), benzene (C<sub>6</sub>H<sub>6</sub>), carbon monoxide (CO), lead (Pb) and particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>). The Fourth Daughter Directive provides target values for arsenic (As), cadmium (Cd), nickel (Ni), benzo (a), pyrene (B (a) P), mercury (Hg) and polycyclic aromatic hydrocarbons (PAH) 4.
- 2.3 The EU limit values have been adopted into UK law via the Air Quality Standards Regulations 2010.
- 2.4 In the context of the proposed development, the primary pollutants of concern are NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> from traffic on roads close to the site. A summary of the European limiting values for the protection of human health for these pollutants is presented in Table 4 below

| Pollutant         | Averaging Period | Limiting Value (µg/m <sup>3</sup> ) | Comments                                                                                                      |
|-------------------|------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------------|
| NO <sub>2</sub>   | 1-hour           | <200                                | Not to be exceeded more than 18 times per calendar year (equivalent to the 99.8th percentile of 1-hour means) |
|                   | Calendar Year    | 40                                  |                                                                                                               |
| PM <sub>10</sub>  | 1-day            | 50                                  | Not to be exceeded more than 35 times per year (equivalent to the 90.4th percentile of 24-hour means)         |
|                   | Calendar Year    | 40                                  |                                                                                                               |
| PM <sub>2.5</sub> | Calendar Year    | 25                                  | Stage 1 LV (to be met by 01/01/15)                                                                            |
|                   | Calendar Year    | 20                                  | Stage 2 LV (to be met by 01/01/20)>                                                                           |

Table 4 Pollutant Limiting Values (WHO).

### The London Plan

- 2.5 Since December 1997, each local authority in the UK has been reviewing and assessing the air quality. This involves measuring air pollution and predicting how it will change in the next few years. The review aims to ensure national air quality objectives are achieved throughout the UK. These objectives have been set to protect people's health and the environment. All London boroughs have air quality problems and are in Air Quality Management Areas. As a result, all new major planning applications are required to assess the impact of the proposed new development on the local air quality.
- 2.6 Air quality is frequently a material planning consideration for major developments in Greater London. The planning process presents valuable opportunities to reduce the impacts of the development and work towards achieving the UK air quality objectives and the EU limiting values. It also presents an

opportunity to reduce exposure to "non-threshold" pollutants such as PM<sub>2.5</sub>. All London boroughs have produced air quality improvement plans and published air quality data progress reports.

2.7 London's air quality problems are primarily a result of a very large number of sources, each contributing a small amount. In light of these issues, the London Plan and the 2010 Mayor's Air Quality Strategy (MAQS) reference new developments being "air quality neutral". The London Plan states:

- Developers should design their schemes to be at least 'air quality neutral'. London Plan policy SI 1.
- Developments should be designed to minimise the generation of air pollution. London Plan policies GG3, D8 & SI 1.
- Developments should be designed to minimise and mitigate against increased exposure to poor air quality. London Plan Policies GG3, D3, SI 1.
- Developers should select a plant that meets the benchmarks for low emissions from Combined Heat and Power and biomass plants to comply with Air Quality Neutral. London Plan policy SI 1.
- Developers and contractors should minimise dust and emissions from construction and demolition SPG when constructing their development. London Plan policy 5.3 & 7.14

2.8 Air quality impact assessments are generally undertaken for developments focusing on the incremental change in local pollutant concentrations associated with the scheme. However, individual developments, even in Greater London, typically generate only small changes to pollutant concentrations, categorised as "Negligible" or "Slight Adverse" using the Institute of Air Quality Management (IAQM) and Environmental Protection UK (EPUK) significance criteria. In addition, the air quality assessments often focus on traffic-related impacts alone and ignore emissions associated with the future operation of the CHP/CCHP/boiler plant. Furthermore, the cumulative impacts of several developments are rarely characterised in any detail, leading to potential concerns regarding a "creeping baseline".

**Policy SI 1 Improving air quality**

- A. *Development Plans, through relevant strategic, site-specific and areabased 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 retro-fitted 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:*
  - 1) *how proposals have considered ways to maximise benefits to local air quality, and*
  - 2) *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 to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, 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.*

2.9 Poor air quality is a public health issue linked to the development of chronic diseases. It can increase the risk of respiratory illness. Action is needed to improve air quality in London. The Mayor's Air Quality Strategy sets out policies and proposals to address these issues by reducing emissions from transport, homes, businesses and industry and increasing awareness of air quality issues. For example, the Low Emission Zone (LEZ) will continue to deliver health benefits by reducing emissions from the oldest heavy diesel engine vehicles. The strategy also included proposals to extend the LEZ to heavier vans and mini buses from 2012 and introduce a new standard for nitrogen oxides (NOx) in 2015. The Mayor is committed to meeting the EU limit values for fine particulate matter (PM10) by 2011 and nitrogen dioxide (NO2 ) by 2015. Other transport policies that contribute to achieving these limit values address:

- Encouraging smarter choices and sustainable travel behaviour.
- Promoting technological change and cleaner vehicles.
- Reducing emissions from public transport and public transport fleets.

- 2.10 The London Plan policies specifically address the spatial implications of the Air Quality Strategy and, in particular, how developments and land use can help achieve its objectives. The Air Quality Strategy includes a mechanism for boroughs to set appropriate emissions reduction targets that will assist in setting out the process and offset negative air quality impacts from developments where required. In this Air Quality Strategy (December 2010), the Mayor also encourages local authorities to publish supplementary planning documents to ensure that air quality is fully embedded within the planning process. The Mayor will also use the Local Implementation Plan (LIP) process to ensure that air quality improvement measures are included in borough transport plans. The detailed air quality assessments that are required for certain types of developments will assist in this process. The GLA will develop a checklist to guide boroughs and developers in assessing potential emissions from the development.
- 2.11 The GLA and London Council's Best Practice Guidance on 'The Control of Dust and Emissions from Construction and Demolition' provides one mechanism by which planning can address such issues. It is proposed that this guidance be reviewed, with a view to it being consulted and published as supplementary guidance to the London Plan.
- 2.12 Recently concerns have been raised over the air quality effects of biomass boilers. The Mayor expects an air quality assessment to be undertaken where planning applications are submitted, including proposals for biomass boilers.
- 2.13 Increased exposure to poor air quality should be minimised by avoiding the introduction of potentially new sensitive receptors in locations where they will be affected by existing sources of air pollution (such as road traffic and industrial processes). Particular attention should be paid to development proposals such as housing, homes for older people, schools and nurseries. Where additional negative air quality impacts from new developments are identified, mitigation measures will be required to lessen these impacts. This approach is consistent with PPS 23 (Planning and Pollution Control). These could include on-site measures such as design solutions, buffer zones and smarter travel measures that support and encourage sustainable travel behaviours. Where it can be clearly shown that on-site mitigation measures are impractical or inappropriate, and where measures having demonstrated equivalent air quality benefits could be taken elsewhere, local planning authorities should use their planning powers to ensure this. The Mayor will produce guidance to assist boroughs in developing supplementary planning policies.

## London Borough of Haringey Air Quality Policy

### Strategic policy

- 2.14 Haringey Council signed the Nottingham Declaration in December 2006. It adopted a Greenest Borough Strategy in July 2008, significantly reducing greenhouse gas emissions. The whole of the Borough of Haringey is an Air Quality Management Area (AQMA) for the pollutants of NO<sub>2</sub> (Nitrogen Dioxide) and PM<sub>10</sub> particulates, which are the most prominent air pollutants). Baseline carbon emissions data (2003) reveals that CO<sub>2</sub> emissions for Haringey are 49% from dwellings, 33% from non-domestic buildings and 18% from transport. Road transport is the dominant source of NO<sub>2</sub> and PM<sub>10</sub> emissions in Haringey,

with various other sources contributing emissions. This has implications for air quality, which is being addressed through the measures outlined in the Council's Air Quality Action Plan.

- 2.15 The Borough of Haringey is an Air Quality Management Area (AQMA) for the pollutants of NO<sub>2</sub> (Nitrogen Dioxide) and PM<sub>10</sub> particulates, the most prominent air pollutants. Road transport is the dominant source of NO<sub>2</sub> and PM<sub>10</sub> emissions in Haringey, with various other sources contributing emissions. This has implications for air quality, which is being addressed through the measures outlined in the Council's Air Quality Action Plan.
- 2.16 Haringey is already taking action to reduce existing pollution and prevent new pollution. For example, monitoring has identified hotspots of poor air quality in the Borough. As part of the requirements to control and reduce potential or actual pollution resulting from development in the Borough, developers will be required to carry out relevant assessments and set out mitigating measures in line with national guidance. Further detail on the Council's approach to environmental protection is set out in the Development Management Policies and the Sustainable Design and Construction SPD. - SP14 Health and Well-being

## Development Management policy

- 2.17 Poor air quality is a public health issue that is linked to the development of chronic diseases. Local authorities should consider how to manage air quality in their areas, such as by ensuring that new development contributes to reducing or mitigating air pollution and the population's exposure to it. National planning policy and guidance seek to promote sustainable communities.
- 2.18 As Haringey is an AQMA, it is expected that proposals for new development will consider air quality in the development's design, construction and operation over its lifetime. This includes considering adverse impacts on potential site occupiers and the wider local area. Some types of uses are very sensitive to air pollution (such as schools, hospitals and residential uses, particularly for older people), and developers should consider this in the site selection process. In line with London Plan Policy 7.14, the Council expects all development to be at least 'air quality neutral'.
- 2.19 The Mayor's 'The Control of Dust Emissions from Construction and Demolition' SPG (2014) should be deferred until it is replaced by equivalent guidance, such as the proposed London Plan supplementary guidance.

## **Policy DM23: Environmental Protection**

### **Air Quality**

5.1 All development proposals should consider air quality and be designed to:

- a) Improve or mitigate the impact on air quality in the Borough; and
  - b) Improve or mitigate the impact on air quality for the occupiers of the building or users of the development.
- B) Where appropriate, air quality assessments will be required for all major development and other development proposals.
- C) Where necessary, adequate mitigation must be provided.

### **Noise and Vibration**

- D) The Council will seek to ensure that new noise sensitive development is located away from existing or planned sources of noise pollution. Proposals for potentially noisy development must suitably demonstrate that measures will be implemented to mitigate its impact.
- E) A noise assessment will be required to be submitted if the proposed development is a noise sensitive development, or an activity with the potential to generate noise.

### **Light Pollution**

- F) Development proposals that include external lighting must mitigate potential adverse impacts from such lighting. Where appropriate, proposals will be required to submit details demonstrating that external lighting is:
  - a) Appropriate for its purpose in its setting;
  - b) Designed to minimise and provide protection from glare and light spillage, particularly to sensitive receptors such as residential properties and natural habitats, including watercourses; and
  - c) Energy efficient.

### **Contaminated Land**

- G) Proposals for new development will only be permitted where it is demonstrated that any risks associated with land contamination, including to human health and the environment, can be adequately addressed in order to make the development safe.
- H) All proposals for new development on land which is known to be contaminated, or potentially contaminated, will be required to submit a preliminary assessment to identify the level and risk of contamination and, where appropriate, a risk management and remediation strategy.

### **Hazardous Substances**

- I) Proposals for development of new hazardous installations, or development of sites located within the vicinity of existing installations, will only be permitted where it is demonstrated that necessary safeguards are incorporated to ensure the development is safe.

## **Health Effects**

### **Nitrogen Dioxide**

2.20 Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. Nitric oxide is not considered to be harmful to health. However, once released into the atmosphere, NO is usually very rapidly oxidised, mainly by ozone (O<sub>3</sub>), to nitrogen dioxide (NO<sub>2</sub>), which can harm health. Nitrogen dioxide and NO are oxides of nitrogen and are referred to as nitrogen oxides (NO<sub>x</sub>).

2.21 Nitrogen dioxide can irritate the lungs and lower resistance to respiratory infections such as influenza. Continued or frequent exposure to concentrations typically much higher than those normally found in the ambient air may cause an increased incidence of acute respiratory illness in children.

### **Fine Particles (PM<sub>10</sub>, PM<sub>2.5</sub> and PM<sub>1</sub>)**

2.22 Fine particles are composed of a wide range of materials arising from a variety of sources, including:

- combustion sources (such as road traffic); secondary particles, mainly sulphate and nitrate, formed by chemical reactions in the atmosphere and often transported from far across Europe;
- Coarse particles, suspended soils and dust (e.g., from the Sahara), sea salt, biological particles and particles from construction work.

2.23 Particles are measured in several size fractions according to their mean aerodynamic diameter. Most monitoring is currently focused on PM<sub>10</sub>, but the finer fractions such as PM<sub>2.5</sub> and PM<sub>1</sub> are becoming increasingly interested in health effects. Fine particles can be carried deep into the lungs, where they can cause inflammation and worsen the condition of people with heart and lung diseases. In addition, they may carry surface-absorbed carcinogenic compounds into the lungs.

### 3 Summary of Local Air Quality at Highgate Lower School Campus along Bishopswood Road.

#### Site location

- 3.1 The Mallinson Sports centre is located at Bishopswood Road and Broadlands Road. The sports centre is surrounded by buildings in the main used by the School with some neighbouring residential buildings. The Highgate Pre Preparatory school (children between 4 to 7 years of age) is located outside the 50m circle on the opposite side of the road from the construction site. The Newstead Nursing Home in Denewood Road is outside the 100m circle. (See Figure 5).

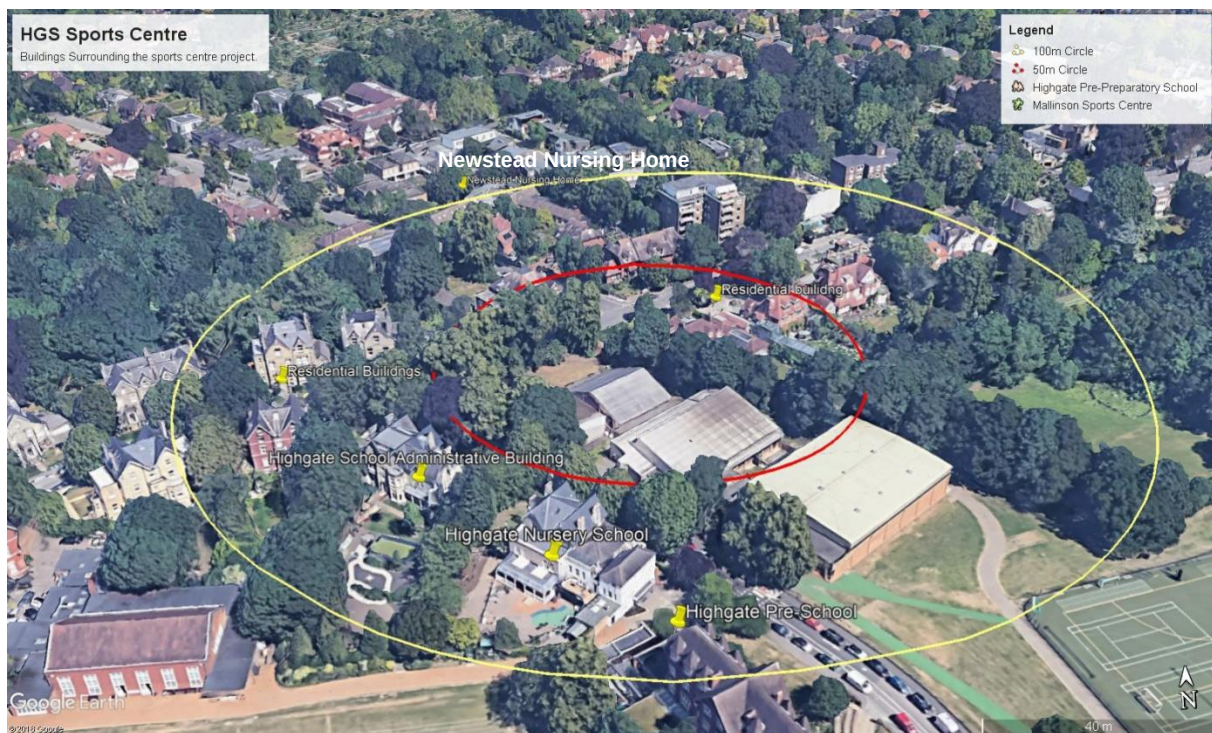
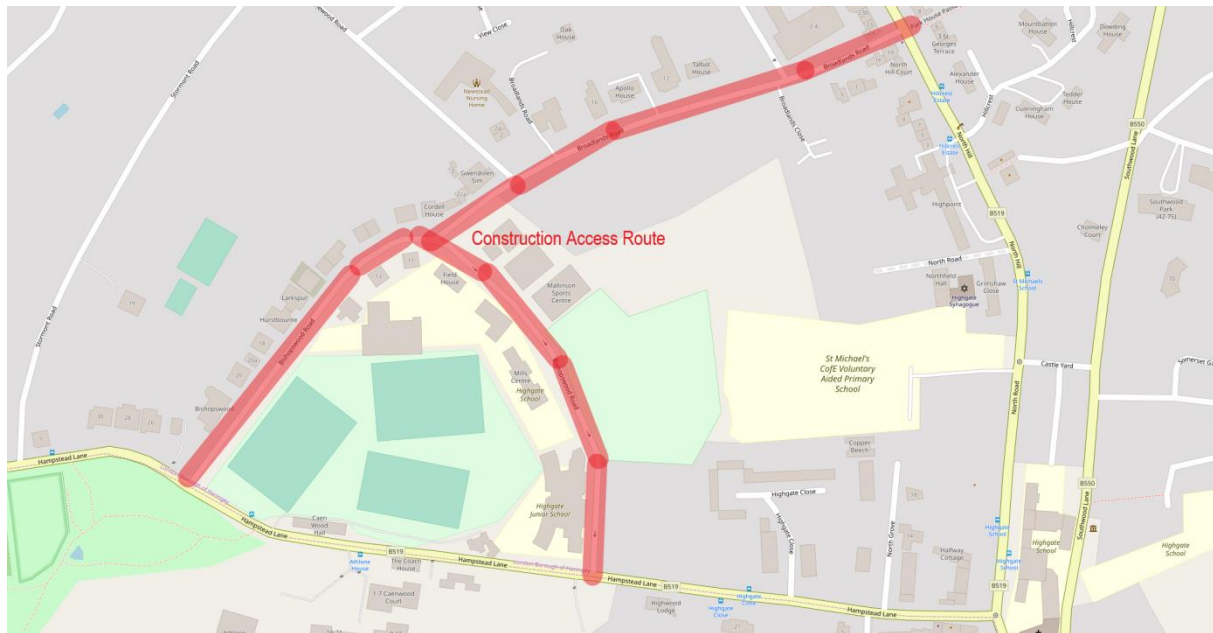


Figure 5 Google Earth Image of HGS Mallinson Sports Centre.

- 3.2 The proposed construction delivery vehicle route is along the residential Broadlands Road and Bishopswood Roads. (See Figure 6).



**Figure 6 Construction Vehicle Delivery Route (Open Street Map).**

- 3.3 Consideration should be given to the Pre Preparatory school (4 to 7 years) and Junior School (7 to 11 years) on Bishopswood Road.
- 3.4 The area, therefore, is considered to have high sensitivity to dust emissions during the project's construction stage.
- 3.5 It is proposed to retain the hardcore material from demolishing the concrete squash courts and fives courts. The resulting hardcore material will be used as a piling pad to stabilise the ground.
- 3.6 The design of the building over three levels uses the site's natural slope to minimise the requirement for groundworks. No areas of Special Scientific Interest or protected species are within 50m of the site.

## Ecology

- 3.7 The site, surrounding area, and construction vehicle route contain many large mature trees and shrubs. Trees provide natural shelter reducing the risk of wind-blown dust.

## Description of proposed Works

- 3.8 The proposal is to replace the existing Fives Courts building with a new build sports hall and classrooms. The new build will be a partly sucken two-story construction not exceeding the height of the existing building. The new building is for use by both teaching and Sports departments, full details of which can be reviewed within the corresponding Design and Access Statement.
- 3.9 Works will include:
  - Demolition of the existing Fives Courts
  - New Foundations
  - Basement excavation
  - Basement retaining walls

- Basement and Ground floor construction
- Superstructure Frame and upper floors
- Roof
- Stairs and ramps
- External Walls
- Windows and external doors
- Internal walls, partitions and internal doors
- Internal finishes, fixtures and fittings
- The new plant room and mechanical and electrical services throughout
- New fully Part M compliant disabled lift to all floors
- New toilets, shower and changing facilities
- External hard and soft landscaping

## Operational impact

- 3.10 The proposed development intends to relocate and make improvements compared to the existing buildings. The building shall remain a Non-Residential (D1) use the educational facility, so it will not result in increased traffic emissions as student and staff numbers will not increase.

## Site Data

| Activity                                                           | Quantity             | Risk Level                          |
|--------------------------------------------------------------------|----------------------|-------------------------------------|
| Construction site Area                                             | 7,000m <sup>2</sup>  | Small Risk                          |
| Building being demolished (squash court, five courts and corridor) | 3,250m <sup>3</sup>  | Small Risk (<20,000m <sup>3</sup> ) |
| Building Volume                                                    | 12,000m <sup>3</sup> | Small                               |
| Soil                                                               | Clay and hard core   | Small                               |
| Earthworks                                                         | 2,250 tonnes         | Small (<10, 00 tonnes)              |
| Vehicle movements (average 1 per hour)                             | 0 to 8 per day       | Small (<10 HDV)                     |

Table 5 Building Construction Data

## HGS Air Monitoring Data.

- 3.11 The school authorities have undertaken intermittent nitrogen dioxide air monitoring on campus. The School has installed diffusion tubes in the locations shown in figure 7.

### Air Quality Monitoring Locations

|                                     |                                 |
|-------------------------------------|---------------------------------|
| A: Field House                      | F: Senior School Medical Centre |
| B: Pre-Preparatory School           | G: Entrance Lodge               |
| C: Mills Centre                     | H: Chapel Quad                  |
| D: Junior School (Pupil Entrance)   | I: Dyne House                   |
| E: Junior School (Visitor Entrance) | J: Science Quad                 |



**Figure 7 Locations of HGS Diffusion Tubes.**

- 3.12 Diffusion tubes are a cheap and easy way to measure nitrogen dioxide. They are supplied and analysed by laboratories. Councils use them to indicate air pollution levels across their Borough by putting tubes in many different places. Residents and schools use diffusion tubes to measure local air quality for citizen science projects.
- 3.13 Diffusion tubes are small plastic tubes with a cap at each end, one of which is coloured. Under the coloured cap is a steel mesh disc coated with triethanolamine (TEA), a chemical that absorbs nitrogen dioxide. When gases pass over this mesh, the chemical changes, this chemical change tells us how much nitrogen dioxide was in the air during the monitoring period.
- 3.14 The diffusion tubes were left in suitable clear air at the locations shown in Figure 7 above. Grado Environmental Laboratories analysed the tubes. Unfortunately, not all tubes collected reliable data. The sample is only over 3 months-one year apart.
- 3.15 The tube data (A to E) along Bishopswood Road is compared with the air quality data collected by Haringey at Priory Park South. This is a similar location next to a large open green space.

### ***London Haringey Priory Park South (HG4, an AURN site)***

- 3.16 The monitoring station is located within the grounds of Priory Park and is approximately 150 meters south of A504 Priory Road. The nearest road is approximately 20 metres from the station and is a quiet residential access road. The traffic flow on Priory Road is approximately 27,000 vehicles per day. The manifold inlet is approximately 2.5 meters from the ground.



Figure 8 Location of Priory Park South (HG4, an AURN site)

|                                | Sample Number       | Start | Finish              | Time (hr) | ug/m³ | ppb   | Total NO₂ |
|--------------------------------|---------------------|-------|---------------------|-----------|-------|-------|-----------|
| Bishopswood Road Campus        |                     |       |                     |           |       |       |           |
| Field House                    | 1120560             | 26/03 | 16/04               | 503.85    | 34.74 | 18.13 | 1.27 ug   |
| Pre-Prep Entrance              | 1120561             | 26/03 | 16/04               | 503.80    | 31.00 | 16.18 | 1.14 ug   |
| Junior School Visitor Entrance | 1120562             | 26/03 | 16/04               | 503.77    | 28.43 | 14.84 | 1.04 ug   |
| Senior School Medical Centre   | 1120565             | 26/03 | 16/04               | 503.60    | 7.46  | 3.89  | 0.27 ug   |
| Senior School Campus           |                     |       |                     |           |       |       |           |
| Chapel Quad                    | 1120567             | 26/03 | 16/04               | 503.48    | 57.39 | 29.95 | 2.10 ug   |
| Dyne House                     | 1120568             | 26/03 | 16/04               | 503.47    | 32.19 | 16.80 | 1.18 ug   |
|                                |                     |       | Bishopswood Average |           | 25.41 |       |           |
|                                | Bishopswood Average |       |                     |           | 25.00 | 1.27  |           |

Table 6 Diffusion Tube Monitoring Results from March 2018

- 3.17 The tube data collected at Bishopswood Road Campus average NO<sub>2</sub> is similar to the Priory Park Average

|                                | Sample Number |                          | Date off            | Time (hr) | ug/m <sup>3</sup> | ppb   | Total NO <sub>2</sub> |
|--------------------------------|---------------|--------------------------|---------------------|-----------|-------------------|-------|-----------------------|
| Bishopswood Road Campus        |               |                          |                     |           |                   |       |                       |
| Field House                    | 1139453       | 18/04                    | 08/05               | 474.75    | 32.69             | 17.06 | 1.13 ug               |
| Pre-Prep Entrance              | 1139453       | 18/04                    | 08/05               | 474.85    | 29.67             | 15.49 | 1.02 ug               |
| Junior School Visitor Entrance | 1139456       | 18/04                    | 08/05               | 474.53    | 32.71             | 17.07 | 1.13 ug               |
| Senior School Medical Centre   | 1139457       | 18/04                    | 08/05               | 475.67    | 49.52             | 25.85 | 1.71 ug               |
| Senior School Campus           |               |                          |                     |           |                   |       |                       |
| Senior School Medical Centre   | 1139457       | 18/04                    | 08/05               | 475.67    | 49.52             | 25.85 | 1.71 ug               |
| Entrance Lodge                 | 1139458       | 18/04                    | 08/05               | 475.57    | 52.45             | 27.38 | 1.81 ug               |
| Chapel Quad                    | 1139459       | 18/04                    | 08/05               | 475.67    | 57.33             | 29.92 | 1.98 ug               |
| Dyne House                     | 1139460       | 18/04                    | 08/05               | 475.58    | 36.13             | 18.86 | 1.25 ug               |
| Science Quad                   | 1139461       | 18/04                    | 08/05               | 475.58    | 38.48             | 20.08 | 1.33 ug               |
|                                |               | Bishopswood road Average |                     |           | 36.15             |       |                       |
|                                |               |                          | Priory Park Average |           | 23.00             | 1.79  |                       |

**Table 7 Diffusion Tube Monitoring Results from March 2018**

- 3.18 The tube data collected at Bishopswood Road Campus average NO<sub>2</sub> is higher than Priory Park Average. This is interesting as the School is located at the northern and higher end of Hampstead Heath, while Priory Park is in the valley between Crouch End and Muswell Hill. The expectation is that heavily polluted street air would be more likely to be found at Priory Park. It is impossible to judge based on one month of data.

|                                | Sample Number | Start                    | Finish              | Time (hr) | ug/m <sup>3</sup> | ppb   | Total NO <sub>2</sub> |
|--------------------------------|---------------|--------------------------|---------------------|-----------|-------------------|-------|-----------------------|
| Bishopswood Road Campus        |               |                          |                     |           |                   |       |                       |
| Pre-Prep Entrance              | 1356752       | 25/04                    | 23/05               | 673.98    | 18.21             | 9.50  | 0.89 ug               |
| Junior School Visitor Entrance | 1356755       | 25/04                    | 23/05               | 673.70    | 19.10             | 9.97  | 0.94 ug               |
| Senior School Campus           |               |                          |                     |           |                   |       |                       |
| Senior School Medical Centre   | 1356756       | 25/04                    | 23/05               | 672.68    | 25.96             | 13.55 | 1.27 ug               |
| Chapel Quad                    | 1356758       | 25/04                    | 23/05               | 658.80    | 25.48             | 13.30 | 1.22 ug               |
| Dyne House                     | 1356759       | 25/04                    | 23/05               | 672.67    | 22.97             | 11.99 | 1.12 ug               |
| Science Quad                   | 1356760       | 25/04                    | 23/05               | 672.55    | 23.40             | 12.21 | 1.14 ug               |
|                                |               | Bishopswood Road Average |                     |           | 18.66             |       |                       |
|                                |               |                          | Priory Park Average |           | 18.10             | 1.24  |                       |

**Table 8 Diffusion Tube Monitoring Results April/May 2019.**

- 3.19 The latest nitrogen dioxide air diffusion tube results are similar to the Priory Park results. The readings are below the World Health Authority standards of 40mg/m<sup>3</sup> (see Table 4).

## Local Air Quality

- 3.20 The whole of Haringey is an Air Quality Management Area (AQMA) as it does not meet national air quality objectives for nitrogen dioxide (NO<sub>2</sub>) and because it is widely accepted that there is no safe level for particulates (PM<sub>10</sub> and smaller). Air quality is particularly severe along major roads throughout the Borough and in the south of the Borough, which is characterised by high traffic levels. Major roads are either in the Transport for London Road Network or designated as a Major Road by the authorities.

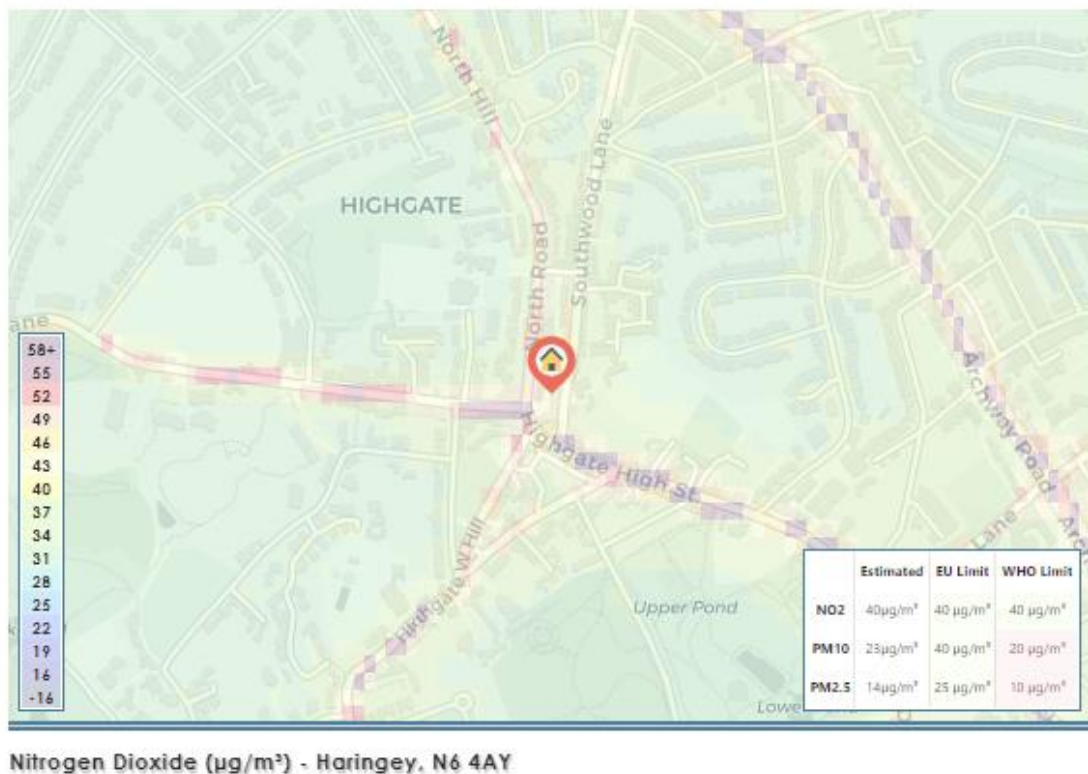


Figure 9 Nitrogen Dioxide (<https://londonair.org.uk/map-maker/>)

- 3.21 This map was used with permission from The Greater London Authority and Transport for London, who fund, develop and maintain the London Atmospheric Emissions Inventory. For more information, please visit <https://data.london.gov.uk/>.
- 3.22 The map in Figure 9 shows the annual mean pollution for NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> for N6 4AY, and the data is based on the most recent year for which an accurate model was available in 2016.
- 3.23 The site passes annual mean Nitrogen Dioxide targets but exceeds the WHO airborne particle targets. There are bus routes along Hampstead Lane, a busy road linking Highgate with Hampstead. The slow-moving traffic creates air pollution which can be measured as far as the sports centre. Busy road elevates NO<sub>x</sub> and particle measurements.

|                   | Estimated           | EU Limit            |      | WHO Limit           |            |
|-------------------|---------------------|---------------------|------|---------------------|------------|
| NO <sub>2</sub>   | 40µg/m <sup>3</sup> | 40µg/m <sup>3</sup> | Pass | 40µg/m <sup>3</sup> | Pass       |
| PM <sub>10</sub>  | 23µg/m <sup>3</sup> | 40µg/m <sup>3</sup> | Pass | 20µg/m <sup>3</sup> | Fail (WHO) |
| PM <sub>2.5</sub> | 14µg/m <sup>3</sup> | 25µg/m <sup>3</sup> | Pass | 10µg/m <sup>3</sup> | Fail (WHO) |

**Table 9 Annual Air quality Limits** The construction site air quality plan outlines how dust emission from demolition and construction is to be controlled and delivery vehicle movements reduced.

- 3.25 All Air Quality parameters are within annual target limits. The predication is that air quality will improve as a result of planning policies that include limiting the application of combustion heating for larger developments, restriction on personal car ownership through reducing the number of car parking spaces per development, increasing the ultra-low emission zone to within the London Circular Road, and general promotion of improved public transport and cycle lanes.

## 4 Air Quality Neutral Building-Related Emissions.

- 4.1 This section presents an air quality neutral assessment following The London Plan. It is found that the proposed development will be Air Quality Neutral concerning building-related emissions.

### BUILDING EMISSIONS

- 4.2 The air quality neutral assessment for building-related emissions compares the emissions from the existing gas-fired boilers at the site with benchmarked emissions based on the floor space as specified in the Air Quality Neutral Planning Support Document (PSD) 27

#### *Building Emission Rate Input for Heating:*

- 4.3 For the air quality neutral assessments, the school sporting facilities buildings are Class D2,
- 4.4 The existing phase 1 pool hall boilers are high-efficiency wall-mounted room sealed boilers with heat outputs of 165kW each. ERP Class 6 Boiler with a typical low NO<sub>x</sub> emission rate of 35mg/kWh.
- 4.5 The pool hall building heating and the hot water energy consumption are calculated using Simplified Building Energy Model.
- 4.6 Building Emission Benchmark Emission factor is taken from table 6 of GLA 80371 Air Quality Neutral Planning Support (2014). Class D2 (a-d) NO<sub>2</sub> 90.3 g/m<sup>2</sup>.
- 4.7 The Building Emission Benchmarks (BEBs) and benchmarked emissions for the proposed development are presented in Table 9.

| HGS MSC                   | Area                 | Heating & HWS          | Boiler          |           |
|---------------------------|----------------------|------------------------|-----------------|-----------|
| School leisure (D2)       |                      |                        | NO <sub>2</sub> | Emissions |
| Pool Hall                 | 1,200 m <sup>2</sup> | 45,684 kWh             | 35.0 mg/kWh     | 1.60 kg   |
| Total GAS Boiler Emission |                      |                        |                 | 1.60 kg   |
| Benchmark (table 6)       | Area                 | NO <sub>2</sub> (anon) |                 |           |
| Total Building Area       | 5,524 m <sup>2</sup> | 90.3 g/m <sup>2</sup>  |                 | 498.82 kg |
| Result                    |                      |                        |                 | Pass      |

Table 10 Compares the Building Emission rate with the GLA Air Quality Neutral Benchmark.

- 4.8 Building-related emissions for the proposed development have been derived from the SBEM predicated energy consumption and the proposed Class 6 NO<sub>2</sub> Emission rate.
- 4.9 The annual building NO<sub>2</sub> emission for the proposed development is below the benchmarked emission; therefore, the proposed development is Air Quality Neutral concerning building-related emissions.

### Conclusion

- 4.10 The boiler flue gas emission from the existing Phase 1 swimming pool plant room is considerably lower than the Air Quality Neutral benchmark for Class D2 leisure buildings.

## 5 Air Quality Neutral Transport Related Emissions

### 5.1 Highgate School Transport Statement by Transport Planning Associates Chapter 5 Transport Impact.

#### 5 TRANSPORT IMPACT

##### Impact on Trip Generation

5.1 *As noted in this TS and the site-wide TS, the Site benefits from a sustainable location, with easy access for pedestrians and cyclists and good public transport accessibility in form of buses and London Underground services, with school bus services also provided. The Site is located within close proximity to a number of residential areas..*

5.2 *As also noted, there are no plans to increase staff or pupil numbers as part of the proposals.*

5.3 *Although the proposed development will increase the GEA at the Site, the development proposals will not result in an increase student or staffing numbers at the School, and as such there would be no increase in traffic levels and therefore no impact on the local highway network. There are also no anticipated increases in the number of pedestrian, cyclists or public transport users accessing the Site.*

5.4 *A similar, earlier application at the Site for the “Refurbishment and extension of the Mallinson Sport Centre, including part single and part double storey extension to the front and a part one storey extension and two storey rear infillextension, as well as internal and external alterations” was granted planning permission receiving the following consultation response from Haringey Transport officer: “[...] the proposed increase in floor area will not result in any additional pupils or staff, we have therefore considered that the proposed application would not impact on the transportation and highways network, consequently the transportation and highways authority would not object to this application subject to a Construction Management Plan”.*

5.5 *As noted, the Site will be open to the community as per existing arrangements. Any external trips as a result are expected to be outside network peak hour periods and will consequently have a negligible impact on the transport network.*

5.2 Any additional vehicle movements associated with the proposed development will generate exhaust emissions, such as NO<sub>2</sub> and PM<sub>10</sub>, on the local and regional road networks.

5.3 Information on anticipated trip generation associated with the development was not available at the time of assessment. However, as evidenced in the transport statement, this development is unlikely to generate additional trips as it is not anticipated to experience an increase in pupil or staff numbers as a result of this development. There is no additional parking, and the area is within a controlled parking zone. Therefore, most MSC public users will arrive and depart having walked, cycled or used public transport.

5.4 The Design Manual for Roads and Bridges (DMRB) guides the change in traffic flow required to affect air quality significantly. The DMRB provides the following criteria for the determination of road links potentially affected by changes in traffic flow:

- Daily AADT flows change by 1,000 or more;
- Daily HDV AADT flows change by 200 or more;
- Daily average speed changes by 10km/hr or more; or,
- Peak hour speed changes by 20km/hr or more.

5.5 Should these criteria not be met, the DMRB considers air quality impacts associated with a scheme to be negligible and no further assessment is required.

- 5.6 Although specific information on trip generation from the development was not available, it is considered unlikely that the proposals would change AADT flows of more than 1,000, produce over 200 HDV movements per day or significantly affect average speeds on the local road network. Potential air quality impacts associated with operational phase road vehicle exhaust emissions are negligible.
- 5.7 The Environmental Protection UK (EPUK) Development Control: Planning for Air Quality (2010 update) guidance document states the following criteria to help establish when an air quality assessment is likely to be considered necessary:
- Proposals that will generate or increase traffic congestion, where 'congestion' manifests itself as an increase in periods of stop-start driving;
  - Proposals that will give rise to a significant change in either traffic volumes, typically a change in AADT or peak traffic flows of greater than  $\pm 5\%$  or  $\pm 10\%$ , depending on local circumstances (a change of  $\pm 5\%$  will be appropriate for traffic flows within an AQMA), or in-vehicle speed (typically of more than  $\pm 10\text{km/hr}$ ), or both, usually on the road with more than 10,000 AADT (5,000 if 'narrow and congested');
  - Proposals that would significantly alter the traffic composition on local roads, for instance, increase the number of HDVs by 200 movements or more per day; or, Proposals that include significant new car parking, which may be taken to be more than 100 spaces outside and AQMA or 50 spaces inside an AQMA.
- 5.8 It is considered unlikely that the proposed development would meet any of the abovementioned criteria. As such, it is considered that air quality impacts due to operational phase road vehicle exhaust emissions will be negligible.

## Conclusion

- 5.9 Although the building transport trip data has not been generated, the Transport statement suggests that the number of trips will not change.
- 5.10 The School and local community are the main building users in the Highgate area. They will generally arrive and depart using public transport, cycle or walk.
- 5.11 The quiet residential location and lack of car parking facilities will encourage public user sports facilities to arrive and depart on foot or cycle.
- 5.12 As the proposed development is not predicted to change the number of trips, the expectation is for the development to remain transport neutral.

## 6 Construction Dust Risk Assessment

### Introduction

- 6.1 The Dust Risk Assessment (DRA) section is part of the Air Quality Statement. The document includes:
- The Risk Assessment for each phase of work (demolition, earthworks, construction, Track-out) incorporates the risk evaluation process below. It identifies suitable mitigation measures (see Chapter 5) for the appropriate level of risk.
  - Identify whether each phase of on-site activity represents a low, medium or high risk by following the guidance set in "The Control of Dust and Emissions during Construction and Demolition (SPG)", July 2014, Mayor of London.
- 6.2 Once appointed to the project, the Main Contractor will conduct a more detailed assessment. This shall form the Air Quality and Dust Management Plan (AQDMP) and will be submitted to the Local Authority before works commence on-site following the guidance within the Mayor's Controlling Dust Emissions during Construction (SPG), July 2014.

### Phases

- 6.3 The Air Quality and Dust Risk Assessment consider the following four phases of development:
- Demolition
  - Earthworks
  - Construction
  - Track-out

### *Dust Emission Magnitude*

- The dust emission magnitude is based on the scale of the anticipated works. It is classified as Small, Medium, or Large, and the classification will be noted for each of the four phases.

## Demolition Phase

### *Phase Description*

- 6.4 Demolition covers the partial demolition of elements within the building, including the removal of the existing staircase, apertures for the new staircase, and connection details associated with the two new extensions, as indicated in the proposed demolition drawings.

### *Demolition Phase Dust Emission Magnitude*

- 6.5 The proposed development is classified as small, and it complies with the relevant criteria:
- 3,250m<sup>3</sup> total volume of building to be demolished <20,000m<sup>3</sup>
  - Demolition activities <10m above ground

## Earthworks phase

### Phase Description

- 6.6 Earthworks primarily cover excavation, haulage, tipping and stockpiling of soil-type materials. This includes levelling the site and landscaping.
- 6.7 The proposed development includes excavation to form a new basement and associated foundations.
- 6.8 Earthworks Phase Dust Emission Magnitude
- 6.9 The development is classified as **Small** as it complies with the relevant criteria:
- Total site area  $7,500\text{m}^3 < 10,000\text{m}^2$
  - Soil type with small grain size (e.g. Clay), to cover with demolition hardcore to reduce dust emission as the ground is worked
  - <5 heavy earth-moving vehicles active at any one time, formation of stockpile enclosures <4m in height
  - Total material moved 2,250 tonnes <10,000 tonnes

## Construction phase

- 6.10 The key issues when determining the potential scale of dust emission during the construction phase include the building(s)/infrastructure, construction method, construction materials, and the build duration.

### Construction Phase Dust Emission Magnitude

- 6.11 The proposed development is classified as **small**, and it complies with the criteria below:
- Total building volume  $12,000\text{m}^3 < 25,000\text{m}^3$
  - Construction material with low potential (e.g. metal cladding or timber)

## Track-out phase

### Phase Description

- 6.12 Factors determining the risk of dust emissions from Track-out are vehicle size, speed, numbers, geology and duration.
- 6.13 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 at risk from dust's effects.
- 6.14 Track-out Phase Dust Emission Magnitude
- 6.15 The development is considered **Medium** as it complies with the following criteria:
- 10-50 HDV (>3.5t) outward Movements in any one day
  - Moderately dusty surface material (e.g. high clay content)
  - Unpaved road length 50 m – 100 m (high clay content).

### *Dust Emission Magnitude for all phases*

6.16 Overall, the Dust Emission Magnitude for each phase is presented in the table below:

| Activity     | Dust Emission Magnitude |
|--------------|-------------------------|
| Demolition   | Small                   |
| Earthworks   | Small                   |
| Construction | Small                   |
| Track-out    | Medium                  |

Table 11 Dust Emission Magnitude during Development Phases

### **Area sensitivity**

6.17 The sensitivity of the area takes account of several factors:

- The specific sensitivities of receptors in the area
- The proximity and number of those receptors
- In the case of PM10, the local background concentration
- Site-specific factors, such as whether there are natural shelters, such as trees or other vegetation, reduce the risk of wind-blown dust.

### **Sensitivity of People to Dust Soiling Effects**

6.18 It is estimated that there are approximately 100 number (HGS Pre Preparatory school) 'receptors' within 20m of the boundary of the site, 100 number 'receptors' within 50 m of the boundary of the site and no areas of high ecological Value (ecological receptor) within 50m of the boundary of the site (the School's receptors, i.e. Junior School and Mills Centre have been excluded from this calculation).

6.19 All receptors are assumed to have **High Sensitivity** under the following criteria:

6.20 Users can reasonably expect to enjoy a high level of amenities.

6.21 The appearance, aesthetics or Value of their property would be diminished by soiling. The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal land use pattern.

6.22 Indicative examples include dwellings, museums and other culturally important collections, medium and long-term car parks and showrooms.

### **Sensitivities of People to the Health Effects of PM10**

6.23 All receptors are assumed to have High Sensitivity. Typical criteria include:

6.24 Locations where public members are exposed over a period relevant to the air quality objective for PM10 (in the case of the 24-hour objectives, a suitable location would be one where individuals may be exposed for eight hours or more daily).

6.25 Indicative examples include residential properties, hospitals, schools, and residential care homes should also be considered as having equal sensitivity to residential areas for this assessment.

## Sensitivities of Receptors to Ecological Effects

6.26 There are no known receptors within 50m. Typical criteria include:

- Dust deposition may affect locations with a local designation where the features may be affected.
- An indicative example is a Local Nature Reserve with dust-sensitive features.

### Overall Area Sensitivity

6.27 The SPG provides tables to calculate the area sensitivity based on the number of receptors, distance from the proposed development and their sensitivity, as presented above.

6.28 The area sensitivity will be calculated for the following categories:

6.29 Dust and soiling effects on people and property

6.30 Human health impacts (based on PM10 concentration increased due to the proposed development)

6.31 Ecological Impact

### Dust and Soiling effects on people and property

6.32 Receptors and their sensitivity and respectful distance from the proposed development are used in the table below to determine the area sensitivity. The area is considered to be of **High Sensitivity**.

| Receptor Sensitivity | Number of Receptors | Distance from the source (m) |        |        |      |
|----------------------|---------------------|------------------------------|--------|--------|------|
|                      |                     | <20                          | <50    | <100   | <350 |
| High                 | >100                | High                         | High   | Medium | Low  |
|                      | 10-100              | High                         | Medium | Low    | Low  |
|                      | 1-10                | Medium                       | Low    | Low    | Low  |
| Medium               | >1                  | Medium                       | Low    | Low    | Low  |
| Low                  | >1                  | Low                          | Low    | Low    | Low  |

Table 12 Sensitivity of the Area to Dust and Soiling Effects on People and Property

### 3.1 Human Health impacts

6.33 Receptors and their sensitivity and respectful distance from the proposed development are used in the table below to determine the area sensitivity. The area is considered to be of **High Sensitivity**.

| Receptor Sensitivity | Annual Mean PM10 concentration C | Number of Receptors | Distance from the source (m) |        |        |        |      |
|----------------------|----------------------------------|---------------------|------------------------------|--------|--------|--------|------|
|                      |                                  |                     | <20                          | <50    | <100   | <200   | <350 |
| High                 | >32ug/m <sup>3</sup>             | >100                | High                         | High   | High   | Medium | Low  |
|                      |                                  | 10-100              | High                         | High   | Medium | Low    | Low  |
|                      |                                  | 1-10                | High                         | Medium | Low    | Low    | Low  |
|                      | 28-32ug/m <sup>3</sup>           | >100                | High                         | High   | Medium | Low    | Low  |

| Receptor Sensitivity | Annual Mean PM10 concentration C | Number of Receptors | Distance from the source (m) |        |      |      |      |
|----------------------|----------------------------------|---------------------|------------------------------|--------|------|------|------|
|                      |                                  |                     | <20                          | <50    | <100 | <200 | <350 |
|                      |                                  | 10-100              | High                         | Medium | Low  | Low  | Low  |
|                      |                                  | 1-10                | High                         | Medium | Low  | Low  | Low  |
|                      | 24-28ug/m <sup>3</sup>           | >100                | High                         | Medium | Low  | Low  | Low  |
|                      |                                  | 10-100              | High                         | Medium | Low  | Low  | Low  |
|                      |                                  | 1-10                | Medium                       | Low    | Low  | Low  | Low  |
|                      | <24ug/m <sup>3</sup>             | >100                | Medium                       | Low    | Low  | Low  | Low  |
|                      |                                  | 10-100              | Low                          | Low    | Low  | Low  | Low  |
|                      |                                  | 1-10                | Low                          | Low    | Low  | Low  | Low  |
|                      |                                  |                     |                              |        |      |      |      |
| Medium               |                                  | >10                 | High                         | Medium | Low  | Low  | Low  |
|                      |                                  | 1-10                | Medium                       | Low    | Low  | Low  | Low  |
| Low                  |                                  | 1-10                | Low                          | Low    | Low  | Low  | Low  |

Table 13 Sensitivity of the Area to Human Health Impacts.

- 6.34 The conclusion is that the area is sensitive to human health impacts of dust emission. Therefore measure is required to limit dust emissions from the site, including the recommendation of air quality dust monitoring during demolition and earthworks phases.

## Ecological Impacts

- 6.35 There are numerous Plane trees which help to trap dust emissions. There are no locations within 100m of the site which are known ecological habits or areas of specific scientific interest. Receptors and their sensitivity and respectful distance from the proposed development are used in the table below to determine the area sensitivity. The area is considered to be of Low Sensitivity.

| Receptor Sensitivity | Distance from the source (m) |        |
|----------------------|------------------------------|--------|
|                      | <20                          | <50    |
| High                 | High                         | Medium |
| Medium               | Medium                       | Low    |
| Low                  | Low                          | Low    |

Table 14 Sensitivity of the Area to Ecological Impacts

## Defining the Sensitivity of the Area

- 6.36 The dust emission magnitude determined above is combined with the area's sensitivity to determine the risk of impacts with no mitigation applied.
- 6.37 The SPG provides the Risk tables below, which will be used to calculate the Risk of Dust Impacts for each of the four phases, i.e. Demolition, Earthworks, Construction and Track-out.

| Receptor Sensitivity | Sensitivity of the Surrounding Area |            |              |           |
|----------------------|-------------------------------------|------------|--------------|-----------|
|                      | Demolition                          | Earthworks | Construction | Track-out |
| Dust Soiling         | High                                | High       | Medium       | Medium    |
| Human Health         | High                                | High       | Medium       | Medium    |
| Ecological           | Low                                 | Low        | Low          | Low       |

Table 15 the Outcome of Defining the Sensitivity of the Area

|                         | Demolition | Earthworks | Construction | Track-out |
|-------------------------|------------|------------|--------------|-----------|
| Sensitivity of Area     | High       | High       | Medium       | Medium    |
| Dust Emission Magnitude | Small      | Small      | Small        | Medium    |

Table 16 Dust emission magnitude during development phases

#### Demolition Phase Risk Matrix

- 6.38 The Demolition phase risk matrix for the Receptors/Sensitivity of Area/Dust Emission Magnitude is as follows:

| Sensitivity of area | Dust Emission Magnitude |             |            |
|---------------------|-------------------------|-------------|------------|
|                     | Large                   | Medium      | Small      |
| High                | High Risk               | Medium Risk | Low Risk   |
| Medium              | Medium Risk             | Medium Risk | Low Risk   |
| Low                 | Low Risk                | Low Risk    | Negligible |

Table 17 Risk of Dust Impacts – Demolition Phase

#### Earthworks Phase Risk Matrix

- 6.39 The Earthworks phase risk matrix for the Receptors / Sensitivity of Area / Dust Emission Magnitude is as follows:

| Sensitivity of area | Dust Emission Magnitude |             |            |
|---------------------|-------------------------|-------------|------------|
|                     | Large                   | Medium      | Small      |
| High                | High Risk               | High Risk   | Low Risk   |
| Medium              | Medium Risk             | Medium Risk | Low Risk   |
| Low                 | Low Risk                | Low Risk    | Negligible |

Table 18 Risk of Dust Impacts – Earthworks

#### Construction Phase Risk Matrix

- 6.40 The Construction phase risk matrix for the Receptors / Sensitivity of Area / Dust Emission Magnitude is as follows:

| Sensitivity of area | Dust Emission Magnitude (Construction Phase) |             |            |
|---------------------|----------------------------------------------|-------------|------------|
|                     | Large                                        | Medium      | Small      |
| High                | High Risk                                    | Medium Risk | Low Risk   |
| Medium              | Medium Risk                                  | Medium Risk | Negligible |
| Low                 | Low Risk                                     | Low Risk    | Negligible |

Table 19 Risk of Dust Impacts – Construction Phase

#### Track-out Phase Risk Matrix

- 6.41 The Track-out phase risk matrix for the Receptors / Sensitivity of Area / Dust Emission Magnitude is as follows:

| Sensitivity of area | Dust Emission Magnitude (Track-out Phase) |             |            |
|---------------------|-------------------------------------------|-------------|------------|
|                     | Large                                     | Medium      | Small      |
| High                | High Risk                                 | Medium Risk | Low Risk   |
| Medium              | Medium Risk                               | Medium Risk | Negligible |
| Low                 | Low Risk                                  | Low Risk    | Negligible |

Table 20 Risk of Dust Impacts – Track-out Phase

## Conclusion

#### Combined Risk Matrix for Each Phase

| Potential impact | Risk       |            |              |             |
|------------------|------------|------------|--------------|-------------|
|                  | Demolition | Earthworks | Construction | Track-out   |
| Dust Soiling     | Low Risk   | Low Risk   | Low Risk     | Medium Risk |
| Human Health     | Low Risk   | Low Risk   | Low Risk     | Medium Risk |
| Ecological       | Negligible | Negligible | Negligible   | Low Risk    |

Table 21 Summary Dust Risk Table

- 6.42 Although the area has a high sensitivity to dust emissions, the actual construction emissions are small in scale with a low risk of dust emissions.
- 6.43 As the developments involve the demolition of existing buildings and earthwork using large machinery, it is recommended that these works be carried out outside the school term and air quality monitoring is undertaken.

## 7 Construction Dust Mitigation Measures

- 7.1 The developer will implement the appropriate dust and pollution control measures set out below to ensure the air quality impacts of construction and demolition are minimised and any effective mitigation measures. This is expected to minimise the formation of dust and harmful emissions. Best practice methods will be adopted, and staff will be trained to implement these correctly.
- 7.2 These measures are summarised below and divided according to key construction and demolition stages and site risk. All measures are compulsory for site staff unless not feasible, and alternative arrangements are agreed upon with site management. These measures are intended to be effective, deliverable, and in line with best practices.
- 7.3 The focus of the dust and pollution control measures to be outlined is to reduce health and dust annoyance impacts on existing local receptors. The site's health and safety documentation will also consider potential health impacts from dust emissions from on-site personnel.
- 7.4 Contact details for the person responsible for dust and emissions generated from the site will be displayed on the site boundary so that residents and businesses can contact the main contractor to raise any issues they may have and report complaints. The site management has the authority to deal with complaints.

### Site inspections

- 7.5 The main contractor will actively monitor the site to ensure the control of dust and emissions. Dry and windy conditions increase the likelihood of dust and emissions being produced and dispersed, so extra site monitoring will occur during these times.

### *Preparing and maintaining the site*

#### Site layout

- Machinery and dust-generating activities will be located within the development enclosure and away from receptors
- Solid screens or Monaflex sheeting will be used to enclose the site. Additional barriers will be provided around dust-generating activities.
- Materials will always be covered to prevent wind whipping.
- The site will be cleaned daily, and any loose materials will be removed as soon as possible as part of site maintenance
- The Main Contractor will keep their construction site clean and in good order. Measures will include:
  - Eliminate runoff and mud as it can lead to dust once dry
  - Hoardings, fencing, barriers and scaffolding will be regularly cleaned as required

### *Dealing with spillages*

- Spillages can occur with a wide range of liquid and materials. The following measures will address this issue:

- Use bunded areas wherever practicable
- Regularly inspect the site area for spillages
- Have spillage kits readily available
- Vacuum or sweep regularly to prevent the build-up of fine waste dust material, which has spilt on the site and is designated as waste that is no longer fit for use

## *Reducing emissions from vehicles*

- Emissions from vehicles associated with construction sites can significantly add to local air pollution levels, so best practices must be employed to reduce these.
- All mobile vehicles associated with the demolition/construction will comply with the London Low Emission Zone standards. For HGVs, the standard is Euro IV for PM; for heavier vans and minibuses, it is Euro 3.

## *Reducing vehicle idling*

- Site management will work with suppliers and other contractors to ensure vehicles do not have to wait to park safely.
- If vehicles have to load/unload, they will not stay idle unless required to operate the vehicle safely.

## *Construction Traffic*

- The contractor will create a site-specific Construction Traffic Management Plan to evaluate the impact on the local environment. Generally, site management is responsible to ensure deliveries and removals are managed so that they are made when they are most needed, at times when they will contribute less to congestion and at locations where loading and unloading can take place safely. Deliveries will be consolidated so fewer journeys are needed.
- These measures will reduce congestion in the local area and inconvenience local road users.

## **Operations**

### *Diesel or petrol generators*

- Generators will generally be avoided. The use will be allowed only in emergencies, and site management will approve use only when no other option is available.

### *Cutting, grinding and sawing*

- 7.6 Cutting, grinding and sawing will be reduced. Where possible, materials will be prepared off-site. In cases where such work must occur, spraying water over the material as it is being cut will greatly reduce the dust generated.
- 7.7 Suppose scabbling (grinding concrete using a machine tipped with steel or carbide material) is required. In that case, the following measures will be in place to comply with best practices:
- Pre-wash work surfaces
  - Screen off the work area
  - Sweeping away or using an electric vacuum

## 3.1.1 Chutes, conveyors and skips

- 7.8 Skips, chutes, and the electric conveyor belt will be completely covered and, if necessary, completely enclosed to ensure that dust does not escape. Similarly, drop heights will be minimised to control the fall of materials.

## Waste Management

- No burning of any material is permitted on-site
- Any excess material should be reused or recycled on or off-site in accordance with appropriate legislation
- The Main Contractor will identify the waste types that are likely to be produced and aim to reduce the amount of waste as much as possible by identifying routes to reuse or recycle materials. The Main Contractor will refer to the Waste and Resources Action Programme (WRAP- [www.wrap.org.uk](http://www.wrap.org.uk)), which provides a list of ten quick wins for reducing and reusing waste
- Control access to storage areas to minimise the risk of theft or damage
- Set up a dedicated store for timber, from which workers can reuse supplies
- Store any materials away from sensitive locations in fenced-off areas
- Employ a just-in-time policy to deliver materials to reduce the storage time on the site
- Recycled materials will be used where possible, and any materials used on site will be recycled rather than disposed of (including timber, aggregates, soil, bricks, masonry, and concrete).

## Mitigation measures specific to demolition

- 7.9 Demolition activities can generate significant dust and also cause re-suspension of dust currently within the building. The Main Contractor will perform soft stripping to screen dust and prevent dispersion. Water suppression will be used to damp down dust and other debris that could generate dust, where practical, manual or mechanical demolition techniques will be used.

## Measures specific to construction

- 7.10 Cement, sand, fine aggregates and other fine powders will be sealed after use and, if necessary, stored in enclosed or banded containers or silos. Some materials should be kept damp to reduce the risk of drying out.
- 7.11 For a comprehensive table of mitigation measures for Low, Medium and High-Risk Sites, please refer to Table 22 Highly Recommended Mitigation Measures and Table 23 Desirable Mitigation Measures
- Description Mitigation

## Site Monitoring

- 7.12 The correct implementation of the best practice methods identified above is expected to minimise the formation of dust and harmful emissions from the proposed development.
- 7.13 In addition, continuous site monitoring will allow the developer to manage dust generation, including PM10 and PM2.5 and NO<sub>2</sub> emissions during construction and demolition. The site is considered to be

Low Risk. For a Low-Risk site, the Control of Dust and Emissions during Construction and Demolition SPG July 2014 recommends:-

- Take into account the impact of air quality and dust on occupational exposure standards to minimise worker exposure and breaches of air quality objectives that may occur outside the site boundary, such as by visual assessment
- Keep an accurate log of complaints from the public and the measures taken to address any complaints where they were required.

## Highly Recommended Mitigation Measures

| Description                                        | Mitigation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General                                            | <p>Display the name and contact details of the person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site Manager.</p> <p>Display the head or regional office contact information.</p>                                                                                                                                                                                                                                                                                                                                                                         |
| Site management                                    | <p>Record all dust and air quality complaints, identify the cause(s), take appropriate measures to reduce emissions on time, and record the measures taken.</p> <p>Make the complaints log available to the local authority when asked.</p> <p>Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.</p>                                                                                                                                                                                                                         |
| Monitoring                                         | <p>Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.</p> <p>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 during prolonged dry or windy conditions.</p>                                                                                                                                                                                                               |
| Preparing and maintaining the site                 | <p>Plan site layout so that machinery and dust-causing activities are located away from receptors, as far as possible.</p> <p>Erect solid screens or barriers around dusty activities or at the site boundary are at least as high as any stockpiles on site.</p> <p>Avoid site runoff of water or mud.</p>                                                                                                                                                                                                                                                                                                                              |
| Operating vehicle/machinery and sustainable travel | <p>Ensure all on-road vehicles comply with the London Low Emission Zone requirements and the London NRMM standards, where applicable.</p> <p>Ensure all vehicles switch off engines when stationary - no-idling vehicles.</p> <p>Avoid using diesel or petrol-powered generators and use mains electricity or battery-powered equipment where practicable.</p> <p>Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).</p>                                                                                                                                     |
| Operations                                         | <p>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.</p> <p>Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.</p> <p>Use enclosed chutes and conveyors and covered skips.</p> <p>Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.</p> |
| Waste management                                   | <p>Reuse and recycle waste to reduce dust from waste materials</p> <p>Avoid bonfires and burning of waste materials</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Table 22 Highly Recommended Mitigation Measures

## Desirable Mitigation Measures Description Mitigation

| Description                                        | Mitigation Measure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Preparing and maintaining the site                 | Fully enclose the site or specific operations with a high potential for dust production; the site is active for an extensive period.<br>Keep site fencing, barriers and scaffolding clean using wet methods.<br>Remove materials that have the potential to produce dust from the site as soon as possible unless being reused on site.                                                                                                                                                                                                                                                                                   |
| Operating vehicle/machinery and sustainable travel | Impose and signpost a maximum speed limit of 10mph on surfaced haul routes and work areas (if long haul routes are required, these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).                                                                                                                                                                                                                                                                                     |
| Construction                                       | Avoid scabbling (roughening of concrete surfaces) if possible.<br>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. This ensures that appropriate additional control measures are in place.                                                                                                                                                                                                                                                                                                                                    |
| Track-out                                          | Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site.<br>Avoid dry sweeping of large areas.<br>Ensure vehicles entering and leaving sites are securely covered to prevent the escape of materials during transport.<br>Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud before leaving the site reasonably practicable).                                                                                                                                                                       |
| Demolition                                         | Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust).                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Earthworks                                         | Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces.<br>Use Hessian, mulches or tackifiers where it is impossible to re-vegetate or cover with topsoil.<br>Only remove secure covers in small areas during work and not all at once.                                                                                                                                                                                                                                                                                                                                                           |
| Construction                                       | Avoid scabbling (roughening of concrete surfaces) if possible.<br>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. This ensures that appropriate additional control measures are in place.<br>Ensure bulk cement and fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent material escape and overfill during delivery.<br>For smaller supplies of fine powder, materials ensure bags are sealed after use and stored appropriately to prevent dust. |
| Trackout                                           | Regularly use a water-assisted dust sweeper on the access and local roads, as necessary, to remove any material tracked out of the site.<br>Avoid dry sweeping of large areas.<br>Ensure vehicles entering and leaving sites are securely covered to prevent the escape of materials during transport.<br>Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud before leaving the site where reasonably practicable)                                                                                                                                                                  |

Table 23 Desirable Mitigation Measures Description Mitigation

## 8 Conclusion

- 8.1 This document identifies the dust risks associated with the proposed development. As the development is located opposite Highgate Pre-Preparatory school, it is required that the contractor undertakes best practice methods which have been identified and proposed to minimise the formation of dust and harmful emissions from the construction. The contractor will be required to monitor site dust emission through the demolition and earthworks construction phases as part of the appropriate mitigation measures.
- 8.2 Concerning operational impact, it is expected that the new Heat pumps and improved thermal performance of the new building envelope will greatly reduce the emissions of PM10 and NO<sub>2</sub>. It is anticipated that there will be no change in road traffic as a result of the proposed development.

Appendix A Highgate School Diffusion Tube Test Results



(A division of Gradko International Ltd.)

St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH  
tel.: 01962 860331 fax: 01962 841339 e-mail: diffusion@gradko.co.uk



## LABORATORY ANALYSIS REPORT

## NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V. SPECTROPHOTOMETRY

REPORT NUMBER M03591R  
BOOKING IN REFERENCE M03591  
DESPATCH NOTE 43437  
CUSTOMER Highgate School Attn: Julia Lipton  
Mills Centre  
5 Bishopswood Road  
London  
N6 4PP  
DATE SAMPLES RECEIVED 09/05/2018

| Location                        | Sample Number | Exposure Data |            | Time (hr.) | $\mu\text{g}/\text{m}^3$ * | ppb * | TOTAL<br>$\mu\text{g NO}_2$ |
|---------------------------------|---------------|---------------|------------|------------|----------------------------|-------|-----------------------------|
|                                 |               | Date On       | Date Off   |            |                            |       |                             |
| Field House                     | 1139452       | 18/04/2018    | 08/05/2018 | 474.75     | 32.69                      | 17.06 | 1.13                        |
| Pre-Prep Entrance               | 1139453       | 18/04/2018    | 08/05/2018 | 474.85     | 29.67                      | 15.49 | 1.02                        |
| Juniour School Visitor Entrance | 1139456       | 18/04/2018    | 08/05/2018 | 474.53     | 32.71                      | 17.07 | 1.13                        |
| Senior School Medical Centre    | 1139457       | 18/04/2018    | 08/05/2018 | 475.67     | 49.52                      | 25.85 | 1.71                        |
| Entrance Lodge                  | 1139458       | 18/04/2018    | 08/05/2018 | 475.57     | 52.45                      | 27.38 | 1.81                        |
| Chapel Quad                     | 1139459       | 18/04/2018    | 08/05/2018 | 475.67     | 57.33                      | 29.92 | 1.98                        |
| Dyne House                      | 1139460       | 18/04/2018    | 08/05/2018 | 475.58     | 36.13                      | 18.86 | 1.25                        |
| Science Quad                    | 1139461       | 18/04/2018    | 08/05/2018 | 475.58     | 38.48                      | 20.08 | 1.33                        |
| Laboratory Blank                |               |               |            | 475.67     | 0.06                       | 0.03  | 0.002                       |

Comment: Results are not blank subtracted  
Results have been corrected to a temperature of 293 K (20 °C)

Overall M.U.  $\pm 9.7\%$

Tube Preparation : 20% TEA / Water

Analyst Name Amber Silvester

Limit of Detection 0.028  $\mu\text{g NO}_2$

Analysed on UV CARY1

Report Checked By Jacob Harland

Date of Analysis 22/05/2018

Date of Report 22/05/2018

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

The Diffusion Tubes have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures calculations and assessments involving the exposure procedures and periods provided by the client are not within the scope of our UKAS accreditation. Those results obtained using exposure data shall be indicated by an asterisk (\*). Any queries concerning the data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.  
Form LQF32b Issue 7 – Oct 2016

Report Number M03591R

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REPORT OFFICIALLY CHECKED

Gradko International Ltd  
This signature confirms the authenticity of these results  
Signed *[Signature]*  
L. Gates, Laboratory Manager



(A division of Gradko International Ltd.)

St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH

tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk



2187

## LABORATORY ANALYSIS REPORT

## NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

REPORT NUMBER M03103R

BOOKING IN REFERENCE M03103

DESPATCH NOTE 42545

CUSTOMER Highgate School

Field House

9 Bishopswood Road Highgate

London

N6 4PD

DATE SAMPLES RECEIVED 18/04/2018

| Location         | Sample Number | Exposure Data |            |            | $\mu\text{g}/\text{m}^3$ * | ppb * | TOTAL $\mu\text{g NO}_2$ |
|------------------|---------------|---------------|------------|------------|----------------------------|-------|--------------------------|
|                  |               | Date On       | Date Off   | Time (hr.) |                            |       |                          |
| Field House      | 1120560       | 26/03/2018    | 16/04/2018 | 503.85     | 34.74                      | 18.13 | 1.27                     |
| Pre-Prep         | 1120561       | 26/03/2018    | 16/04/2018 | 503.80     | 31.00                      | 16.18 | 1.14                     |
| Mills Center     | 1120562       | 26/03/2018    | 16/04/2018 | 503.77     | 28.43                      | 14.84 | 1.04                     |
| Medical Center   | 1120565       | 26/03/2018    | 16/04/2018 | 503.60     | 7.46                       | 3.89  | 0.27                     |
| Chapel Quad      | 1120567       | 26/03/2018    | 16/04/2018 | 503.48     | 57.39                      | 29.95 | 2.10                     |
| Dyne House       | 1120568       | 26/03/2018    | 16/04/2018 | 503.47     | 32.19                      | 16.80 | 1.18                     |
| Laboratory Blank |               |               |            | 503.85     | 0.16                       | 0.09  | 0.01                     |

Comment: Results are not blank subtracted

Results have been corrected to a temperature of 293 K (20°)

Overall M.U.  $\pm 9.7\%$ 

Tube Preparation : 20% TEA / Water

Limit of Detection 0.031  $\mu\text{gNO}_2$ 

Analysed on UV CARY2

Analyst Name Toni Attrill

Report Checked By K. Kotrych

Date of Analysis 09/05/2018

Date of Report 09/05/2018

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

The Diffusion Tubes have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures calculations and assessments involving the exposure procedures and periods provided by the client are not within the scope of our UKAS accreditation. Those results obtained using exposure data shall be indicated by an asterisk (\*). Any queries concerning the data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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Report Number M03103R

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Gradko International Ltd  
This signature confirms the authenticity of these results  
Signed: L. Gates, Laboratory Manager



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St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH  
tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk



2187

## LABORATORY ANALYSIS REPORT

### NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY

**REPORT NUMBER** N03960R  
**BOOKING IN REFERENCE** N03960  
**DESPATCH NOTE** 70476  
**CUSTOMER** Highgate School Attn: Jodie Clarke  
North Road  
London  
N6 4AY  
United Kingdom  
**DATE SAMPLES RECEIVED** 28/05/2019

| Location            | Sample Number | Exposure Data |            | Time (hr.) | $\mu\text{g}/\text{m}^3$ * | ppb * | $\mu\text{g NO}_2$ on tube |
|---------------------|---------------|---------------|------------|------------|----------------------------|-------|----------------------------|
|                     |               | Date On       | Date Off   |            |                            |       |                            |
| Pre-Prep            | 1356752       | 25/04/2019    | 23/05/2019 | 673.98     | 18.21                      | 9.50  | 0.89                       |
| JS Visitor Entrance | 1356755       | 25/04/2019    | 23/05/2019 | 673.70     | 19.10                      | 9.97  | 0.94                       |
| Medical Centre      | 1356756       | 25/04/2019    | 23/05/2019 | 672.68     | 25.96                      | 13.55 | 1.27                       |
| Chapel Quad         | 1356758       | 25/04/2019    | 23/05/2019 | 658.80     | 25.48                      | 13.30 | 1.22                       |
| Dyne House          | 1356759       | 25/04/2019    | 23/05/2019 | 672.67     | 22.97                      | 11.99 | 1.12                       |
| Science Quad        | 1356760       | 25/04/2019    | 23/05/2019 | 672.55     | 23.40                      | 12.21 | 1.14                       |
| Laboratory Blank    |               |               |            | 673.98     | 0.00                       | 0.00  | 0.000                      |

Comment: Results are not blank subtracted

Tubes 1356751, 1356753, 1356754 & 1346757 were not received for analysis.

Tube 1356758 contained water droplets. Result may be compromised.

Results have been corrected to a temperature of 293 K (20°)

|                                   |                |                      |                         |
|-----------------------------------|----------------|----------------------|-------------------------|
| Overall M.U.                      | ±9.7%          | Limit of Detection   | 0.030 $\mu\text{gNO}_2$ |
| Tube Preparation: 20% TEA / Water |                | Analysed on UV CARY3 |                         |
| Analyst Name                      | Agata Szymonik | Report Checked By    | Adam Robinson           |
| Date of Analysis                  | 05/06/2019     | Date of Report       | 05/06/2019              |

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (\*), these calculations and results are not within the scope of our UKAS accreditation. The results within this report relate only to the items tested. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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REPORT OFFICIALLY CHECKED

Gradko International Ltd  
This signature confirms the authenticity of these results  
Signed.....  
L. Gates, Laboratory Manager