12 Air Quality

12.1 Introduction

12.1.1 This chapter presents the assessment of potential effects of the Bank Station Capacity Upgrade (BSCU) on local air quality. The assessment takes full account of current policy and technical guidance for the assessment of changes to the concentrations of air pollutants.

12.2 Legislative and Policy Context

Legislation and National Policy

Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (Council of European Communities, 2008)

12.2.1 The Clean Air for Europe (CAFE) programme under the Ambient Air Quality and *Cleaner Air for Europe Directive* revisited the management of Air Quality within the European Union (EU) and replaced various EU Framework Directives with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC.

Air Quality Standards Regulations (H.M. Government, 2010)

12.2.2 The Air Quality Limit Values defined within the above Directive are transcribed into UK legislation by the *Air Quality Standards Regulations (2010)*. These limit values are binding on the UK and have been set with the aim of avoiding, preventing or reducing harmful effects on human health and on the environment as a whole.

National Planning Policy Framework (Department for Communities and Local Government, 2012)

12.2.3 Environmental requirements for new development are framed within the *National Planning Policy Framework* (*NPPF*). *Paragraph 109* of the *NPPF* states that:

the planning system should contribute to and enhance the natural and local environment by: preventing … new … development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of ...air… pollution.

12.2.4 *Paragraph 124* of the *NPPF* states that:

planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air

quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.

12.2.5 The different roles of a planning authority and a pollution control authority are addressed by the *NPPF* in *Paragraph 122,* which states that:

... local planning authorities should focus on whether the development itself is an acceptable use of the land, and the impact of the use, rather than the control of processes or emissions themselves where these are subject to approval under pollution control regimes. Local planning authorities should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

Planning Practice Guidance (Department for Communities and Local Government, 2014)

12.2.6 The *PPG* provides a plain English summary of the air quality issues set out in the *NPPF* and notes that an Environmental Statement should include the following information:

- the existing air quality in the study area (existing baseline);
- the future air quality without the development in place (future baseline); and
- the future air quality with the development in place (with mitigation).

12.2.7 The guidance further advises that the application should proceed to decision with appropriate planning conditions or planning obligation, if the proposed development (including mitigation) would not lead to an unacceptable risk from air pollution, prevent sustained compliance with EU limit values or fail to comply with the requirements of the *Habitats Regulations*.

National Air Quality Strategy (Department for Environment Food and Rural Affairs, 2007)

12.2.8 The most recent revision of the *National Air Quality Strategy* sets objective values for key pollutants as a tool to help local authorities manage local air quality improvements in accordance with the *EU Air Quality Framework Directive*. The air quality objectives referred to in Table 12.1 have been set down in regulation solely for the purposes of local air quality management. Under the local air quality management regime, local authorities have a duty to carry out regular assessments of air quality against the objectives and if it is unlikely that the objectives will be met in the given timescale, they must designate an Air Quality Management Area (AQMA) and prepare an Air Quality

Action Plan (AQAP) with the aim of achieving the objectives. The boundary of an AQMA is set by the governing local authority to define the geographical area that is to be subject to the management measures to be set out in a subsequent action plan. Consequently it is not unusual for the AQMA to include locations where air quality is not at risk of exceeding an air quality objective.

12.2.9 The UK's national air quality objective for the pollutants of relevance to this assessment are displayed in Table 12.1.

Table 12.1: Air Quality Objectives

Pollutant	Averaging Period	Value	Maximum Permitted Exceedances	Target Date
PM_{10}	Annual Mean	40µg/m^3	None	31st December 2004
	24-hour	50µg/m^3	35 times per year	31st December 2004
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	25µg/m^3	None	2020
Nitrogen dioxide (NO_2)	Annual Mean	40µg/m^3	None	1st January 2010
	1-hour	200µg/m^3	18	1st January 2010

Regional Policy and Guidance

The London Plan (Greater London Authority, 2011)

12.2.10 *The London Plan* takes the year 2031 as its formal end date. *Policy 7.14* of *the London Plan* targets to improve air quality, and states that: *Development proposals should minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas […] promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance in the GLA and London Councils 'The control of dust and emissions from construction and demolition'; be at least 'air quality neutral' and not lead to further deterioration of existing poor air quality[…].*

12.2.11 Measures implemented by the Mayor to improve air quality in London include the Low Emission Zone (LEZ), which enables the phasing out of older Heavy Duty Vehicles with less efficient emissions technology over a period of years from driving through central London. More recent measures proposed include the implementation of an Ultra Low Emission Zone (ULEZ), which is intended to reduce car use and promote sustainable travel. It will aspire to increase the proportion of ultra low or zero emission vehicles in London and stimulate the uptake and development of low emission vehicles.

12.2.12 The following regional planning policy and guidance documents also apply to air quality:

- *Air Quality Strategy for London* (Greater London Authority, 2010) contains measures and targets aimed at improving air quality, including the policy for developments to be 'air quality neutral';
- *Mayor's Transport Strategy* (Greater London Authority, 2010) contains several transport related measures aimed at improving air quality; and
- *Control of Dust from Construction and Demolition in London Best Practice Guide* (Greater London Authority, 2006) contains a comprehensive list of dust control measures for construction and demolition activities.
- *Draft Control of Dust and Emissions during Construction and Demolition Supplementary Planning Guidance (Greater London Authority, 2013).* The Mayor of London is currently consulting on this draft guidance which builds upon the current version of the guidance (Greater London Authority, 2006). The draft guidance is informed by dust guidance published by the Institute of Air Quality Management (IAQM) (IAQM, 2014).
- *Sustainable Design and Construction Supplementary Planning Guidance* (Greater London Authority, 2014) was published in April 2014 to accompany the London Plan. It includes guidance on the assessment of the Mayor's air quality neutral policy and the consideration of the control of dust and emissions during construction and demolition.

Local Policy and Guidance

Core Strategy (City of London Corporation (2011a)

12.2.13 The *Core Strategy* presents a spatial framework as well as key strategies and policies for the development of the City of London to 2026 and beyond.

12.2.14 *Policy CS15: Sustainable Development and Climate Change* requires *development to positively address: (i) local air quality, particularly nitrogen dioxide and particulates PM_{10} (the City's Air Quality Management Area pollutants)*

City of London Draft Local Plan (City of London Corporation, 2013)

12.2.15 Once adopted, the *Local Plan* will supersede the *Core Strategy* and the *Unitary Development Plan*.

12.2.16 *Draft Policy DM 15.6* states, inter alia, that:

1) Developers will be required to consider the impact of their proposals on air quality and, where appropriate, provide an Air Quality Impact Assessment.

2) Development that would result in deterioration of the City's nitrogen dioxide or PM_{10} pollution levels will be resisted.

5) Demolition, construction and the transport of construction materials and waste must be carried out in such a way as to minimise air quality impacts. […]

Local Air Quality Management

The Air Quality Strategy (City of London Corporation, 2011)

12.2.17 The whole of the City of London was declared an AQMA in January 2001 for NO_2 and PM_{10} in recognition that the air quality objectives are not being met.

12.2.18 The *Air Quality Strategy* outlines how air quality policy at the City of London Corporation will be developed from 2011 to 2015, and sets out 32 actions to achieve this. Among them:

- *Action 1* states that: *The City of London will continue to monitor air pollutants to ensure that air quality objectives and limit values are being met, and to assess the effectiveness of national, regional and local policies to reduce levels of pollution.*
- *Action 17* states that: *Air quality will be a consideration in all development and the City of London will require developers to undertake detailed air quality impact assessments of major developments adjacent to sensitive premises, such as residential properties, schools…*
- *Actions 24 and 25* relate to construction activities, and state that: *The City of London will continue to establish best practice for minimising emissions from construction, demolition and street works and update the City of London Code of Practice for Demolition and Construction Sites to reflect this.*

12.2.19 The latest *Air Quality Progress Report* for the City of London Corporation was published in April 2013. It presents pollutant monitoring results obtained for the year 2012, and concludes that despite the annual objective for PM_{10} being met at all sites, the 24-hour mean objective was exceeded at both Beech Street and Upper Thames Street. Monitored levels of NO_2 continue to exceed the annual objective across the City of London. Therefore, to date, the whole City of London remains designated an AQMA for NO_2 and PM_{10}.

12.3 Assessment Methodology

Scope of Work

12.3.1 A review of the published ambient air quality data forms the basis for the prediction of current baseline conditions against which the magnitude of predicted impacts due to the BSCU has been assessed. The published ambient air quality data has been supplemented with data gathered during a baseline survey undertaken within the air quality study area.

Demolition and Construction

12.3.2 During the construction phase of the BSCU, there is the potential for demolition, earthworks and construction activities to generate fugitive emissions of particulate matter (dust and Particulate Matter (PM_{10})). There is the risk of such emissions giving rise to adverse effects on amenity or health at receptors located within 350m of the source of emissions (Institute of Air Quality Management (IAQM), 2014) unless appropriate mitigation measures are adopted. As there are receptors located within 350m of the boundaries of the two main work sites (the Whole Block Work Site and the Arthur Street Work Site) and the utilities work sites, an assessment of the significance of effects from fugitive emissions of dust and PM_{10} from these work sites has been undertaken. The assessment includes consideration of the risk of adverse effects associated with the potential track-out of material from construction vehicles onto the local road network at receptors located within 50m of roads extending up to 500m from the site access.

12.3.3 There are no recognised ecological resources in the area, so no assessment of air quality impacts on such sites has been undertaken.

12.3.4 The operation of Non-Road Mobile Machinery (NRMM) and site plant during the demolition and construction phase of the BSCU Project has the potential to affect concentrations of nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and particulate matter (PM_{10} and $PM_{2.5}$) and this has been considered in this assessment.

12.3.5 There is also the potential for construction-related vehicle movements on the public road network that are associated with the BSCU to impact on local air quality. As well as vehicle movements directly associated with the BSCU construction work, the closure of Arthur Street will divert traffic along alternative routes, further changing the flow and/or composition of traffic on the public road network near to the site. This change in vehicle flow and composition has the potential to change the annual mean concentrations of nitrogen dioxide (NO_2) and particulate matter (PM_{10} and $PM_{2.5}$), hourly mean concentrations of NO_2 and daily mean concentrations of PM_{10}, at air quality sensitive receptors located close to the public roads.

Operation

12.3.6 The BSCU does not include any parking provision and during operation it is not anticipated to lead to an increase in traffic on the local road network. As such, an assessment of the impact of operational road traffic emissions has not been considered further in this assessment.

12.3.7 The operational station will be powered by electrical plant only and does not include for any combustion plant, as per *LUL Standard Cat 1, 1-068, Cl.3.3.1*: *There shall be no new or renewed gas, oil or solid fuel installations at sub-surface locations.* Therefore, energy plant emissions have not been considered further in this assessment.

12.3.8 During the operation of the BSCU air will be vented from internal areas via ventilation louvres on King William Street and Nicholas Lane. These emissions could potentially include air from platform and tunnel areas. Research undertaken into emissions from existing London Underground ventilation shafts (4-Rail Services Ltd, 2011; Crossrail Ltd/ERM, 2009) has found little evidence to suggest that ventilation emissions increase the airborne PM_{10} concentrations and/or dust deposition rates beyond baseline levels. As such, an assessment of the impact of operational ventilation emissions is not undertaken as such emissions are not considered to have the potential to result in significant environmental effects. This chapter does, however, provide suggested mitigation to reduce any particulate within the ventilation emissions.

12.3.9 In summary, operational impacts have been scoped out of the assessment.

Overview

12.3.10 There is currently no statutory guidance on the method by which an air quality impact assessment should be undertaken, other than the *Design Manual for Roads and Bridges HA207/07* for the assessment of construction phase air quality emissions for strategic road network schemes. Several non-statutory bodies have published their own guidance relating to air quality and development control (e.g. EPUK, 2010) or to the assessment of the significance of air quality effects (IAQM, 2009; IAQM, 2014).

12.3.11 This section explains the methods used to assess the impact of:

- fugitive emissions of particulate matter from demolition and construction phase activities;
- emissions of PM_{10} and NO_X from demolition and construction phase NRMM (vehicles and site plant); and
- emissions of NO_2, PM_{10} and $PM_{2.5}$ from construction-related road traffic.

12.3.12 Potential receptors have been identified for each element of the assessment and the magnitude of air quality impact for each has been considered. The method for evaluation of potential effects is described later in this section.

Fugitive Emissions of Particulate Matter

12.3.13 Fugitive emissions of airborne particles can come from a wide range of activities including:

- demolition;
- earthworks, including the handling, working and storage of materials;
- construction activities; and
- the transfer of dust-making materials from the site onto the local road network (track-out).

12.3.14 Particulate matter in air is made up of particulates of a variety of sizes, and the concept of a 'size fraction' is used to describe particulates with sizes in a defined range. These definitions are based on the collection efficiency of specific sampling methods and each size fraction is especially associated with different types of impacts. In this assessment the term 'dust' is used to mean particulate matter in the size fraction 1µm - 75µm in diameter, as defined in *BS 6069:1994* (BSI, 1994). Dust impacts are considered in terms of the change in airborne concentration and the change in the rate of deposition of dust onto surfaces.

12.3.15 The size fraction called 'PM_{10}' is composed of material with a diameter of less than 10 µm and overlaps with the size fraction for dust. Air quality objectives (H.M. Government, 2010) for PM_{10} have been set for the protection of human health and the term PM_{10} is only used in this assessment when referring to the potential impact of emissions of particulate matter from demolition and construction activities on human health receptors. The short term, 24 hour mean objective for airborne concentrations of PM_{10} is the appropriate air quality objective for assessing the potential impact on health of short term fugitive emissions from demolition and construction sites.

12.3.16 When considering the significance of effects from emissions of fugitive particulate matter the Institute of Air Quality Management (IAQM, 2014) adopts a broad approach that includes the potential for changes in airborne concentration, changes in deposition rates and the risk to human health and public amenity. In this assessment, specific reference is made to the impacts associated with specific size fractions (dust, PM_{10}) within the assessment narrative, before considering the overall effect on receptors using an approach that is consistent with the IAQM guidance.

12.3.17 In general receptors associated with higher baseline dust deposition rates (such as light or heavy industry) are less sensitive to impacts, whereas some hi-technology industries or food processing plants operate under clean air conditions and are thus more sensitive.

12.3.18 Particulate matter may have an impact when airborne or through deposition. Receptors vary in their sensitivity to impacts from both depending on their activity.

12.3.19 The sensitivity of receptor types to different impacts is listed in Appendix A12.1 (Table A12.1). The BSCU construction activities are within an area that is dominated by commercial office space (low sensitivity), with a limited number of residential properties and small scale food retailers (medium sensitivity).

Road Traffic Emissions

12.3.20 The incomplete combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene and 1,3-butadiene, and sulphur dioxide (SO_2), carbon monoxide (CO), PM_{10} and $PM_{2.5}$ in exhaust emissions. In addition, at the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and the fuel is oxidised to form NO_X, mainly in the form of nitric oxide (NO), which is then converted to NO_2 in the atmosphere. NO_2 is associated with adverse effects on human health. Better emission control technology and fuel specifications are expected to reduce emissions per vehicle in the long term.

12.3.21 Exhaust emissions from road vehicles have the potential to affect the concentrations of principal pollutants of concern; NO_2, PM_{10} and $PM_{2.5}$, at sensitive receptors in the vicinity of the BSCU. Therefore, these pollutants have been the focus of the assessment of the significance of road traffic impacts.

12.3.22 Although SO_2, CO, benzene and 1,3-butadiene are also present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of the BSCU. Road traffic emissions of these substances have been reviewed by the City of London Corporation and nowhere within their administrative areas is at risk of exceeding the objectives for these substances. The BSCU would not be capable of compromising the achievement of the relevant air quality objectives. Emissions of SO_2, CO, benzene and 1,3-butadiene from road traffic are therefore not considered relevant to the assessment and further analysis is not appropriate or required.

12.3.23 With regard to road traffic emissions, the change in pollutant concentrations with respect to baseline concentrations has been calculated using traffic flow data and quantified at existing representative receptors within the study area.

The absolute magnitude of pollutant concentrations in the baseline and construction phase scenario has also been quantified and used to consider the risk of the air quality limit values being exceeded at sensitive receptor locations.

Non-Road Mobile Machinery Emissions

12.3.24 During the construction phase, there is the potential for emissions of NO_X, SO_2, PM_{10} and $PM_{2.5}$ from on-site NRMM (vehicles and plant) to affect local air quality. It is anticipated that peak site preparation/construction work will comprise a number of different types of plant, as detailed within the draft Code of Construction Practice (CoCP) (Appendix A4.1).

Use of Measurement Data

12.3.25 The air quality assessment makes use of measured air quality data gathered within the study area to inform the model verification exercise (described in Appendix A12.2).

12.3.26 The City of London Corporation and neighbouring London Boroughs carry out monitoring and measurement of NO_2 and particulate matter in the vicinity of the BSCU Work Sites. Where suitable, this data has been used in the air quality assessment, including that gathered by the automatic continuous monitoring station at Walbrook Wharf.

12.3.27 URS have also undertaken a six month baseline NO_2 diffusion tube survey within the study area. Data from the diffusion tube survey has been used to supplement that gathered by the Walbrook Wharf continuous monitoring station for the verification of the baseline road traffic emissions model (described in Appendix A12.2).

12.3.28 Background pollutant concentration data has been sourced from the background pollutant maps published by Defra (2012), a summary of which is provided in Appendix A12.3.

Air Quality Sensitive Receptors

Receptors Potentially Affected by Emissions from Construction

12.3.29 When assessing the impact of dust emissions generated during construction works, the nearest potentially sensitive receptors to the boundary of the site in each direction are considered. The sensitivity of the receptors for this phase is further described in Appendix A12.1.

Receptors Potentially Affected by Construction Phase Road Traffic Emissions

12.3.30 The air quality objective values for pollutants associated with road traffic have been set by the Expert Panel of Air Quality Standards at a level below the lowest concentration at which the more sensitive members of society have

been observed to be adversely affected by exposure to each pollutant. Therefore all receptors are of equal sensitivity as any member of the public could be present at the assessment locations. Each of the receptor locations chosen has been selected to represent locations where people are likely to be present. They are also representative of other receptor locations in their vicinity.

12.3.31 The individual receptor locations used to represent exposure to emissions are described in Section 12.4.

Prediction of Impacts

Construction Phase Dust Impacts

12.3.32 At present, there are no statutory UK or EU standards relating to the assessment of nuisance dust. The emphasis of the regulation and control of demolition and construction dust should therefore be the adoption of best practicable means and implementation of IAQM and GLA guidance to mitigate potential impacts. Use of such measures should avoid the potential for significant adverse environmental effects to occur (see Section 12.5).

12.3.33 Examples of accepted good site practice, which are generally assumed to form the foundation of best practicable means mitigation, include guidelines published by the Building Research Establishment (Building Research Establishment, 2003), the Greater London Authority (Mayor of London, 2006 and 2013), the most recent version of which is informed by current IAQM guidance on the assessment of dust from construction and demolition (IAQM, 2014), and Considerate Contractor Schemes. These guidance documents have been used to inform the draft CoCP for the BSCU (Appendix A4.1).

12.3.34 A qualitative assessment has been undertaken to assess the significance of any effects on sensitive receptors. The steps in the assessment process are to consider potential sources of emissions on the basis of the four main activity groupings of demolition, earthworks, construction and track-out.

12.3.35 The steps in this assessment are to:

- identify the nature, duration and the location of activities being carried out;
- review the proposed embedded mitigation measures for good site practice;
- establish any residual significant effects that are likely as a result of activities, assuming the proposed embedded mitigation;
- identify additional mitigation measures, if necessary, to reduce the risk of a significant adverse effect occurring at receptors; and

- summarise the overall effect of the works with respect to fugitive emissions of particulate matter and then report the significance of the effects.

Non-Road Mobile Machinery Emissions Impacts

12.3.36 The assessment of the effects of emissions from NRMM (vehicles and site plant) has been considered qualitatively. The assessment is based on the suitability of control measures incorporated into the design of the construction works. The control measures to be implemented are summarised at Section 12.5 and described in greater detail within the draft CoCP, which will be adhered to during the BSCU.

Construction Phase Road Traffic Emissions Impacts

12.3.37 This assessment has used the latest version of dispersion model software 'ADMS-Roads' to quantify baseline and construction phase pollution levels at selected receptors. ADMS-Roads is a modern dispersion model that has an extensive published track record of use in the UK for the assessment of local air quality impacts, including model validation and verification studies (CERC, 2014). The dispersion modelling methodology is described in Appendix A12.2.

Assessment of Significance

Construction Dust

12.3.38 For amenity effects (including those related to dust deposition), the aim is to minimise the potential for complaints generated as a result of the BSCU.

12.3.39 The scale of potential adverse impacts occurring is determined by reference to the sensitivity of receptors in the surrounding area and the potential magnitude of dust emissions as a result of demolition and construction activities. The sensitivity of the surrounding area is also classified using low, medium or high, depending on the nature of the nearby properties and their density. As described within IAQM guidance (IAQM, 2014), the magnitude of dust and PM_{10} emissions is classified using the terms high, medium or low risk, depending on the scale and nature of the activity being undertaken. The basis for assigning the magnitude of impact category is set out in the subsequent impact sections for each element of the construction works (demolition, earthworks, construction and track-out).

12.3.40 The risk of dust impacts occurring is used to inform the level of mitigation likely to be required at the work sites. The use of such mitigation should be capable of controlling emissions of dust and PM_{10} so that complaints as a result of the demolition and construction works are unlikely. Use of such measures should avoid the potential for significant adverse environmental effects to occur (see Section 12.5).

Non-Road Mobile Machinery Impacts

12.3.41 For effects associated with emissions from NRMM (vehicles and site plant) during the demolition and construction (including earthworks) phases, the aim is to implement a scheme that incorporates mitigation measures that minimise the potential for significant effects to occur. Such measures are detailed within the CoCP.

12.3.42 The risk of effects occurring is defined by the sensitivity of the nearest surrounding receptors, and the magnitude of emissions, which is informed by the number and duration of use of NRMM and site plant.

12.3.43 The risk of impacts occurring is used to inform the level of NRMM mitigation likely to be required at the work sites. The use of such mitigation should be capable of controlling NRMM emissions so that the potential for significant adverse environmental effects is avoided (see Section 12.5).

Construction Phase Road Traffic Emissions

12.3.44 With regard to road traffic emissions, the change in pollutant concentrations with respect to baseline concentrations has been described at receptors that are representative of exposure to impacts on local air quality within the study area. The absolute magnitude of pollutant concentrations in the baseline and with development scenario is also described and this is used to consider the risk of the air quality limit values being exceeded in each scenario.

12.3.45 The IAQM have published recommendations for describing the magnitude of impacts at individual receptors (Table 12.2) and describing the significance (Table 12.3) of such impacts (IAQM, 2009).

Table 12.2: Magnitude of Changes in Ambient Pollutant Concentrations of NO_2, PM_{10} and $PM_{2.5}$

Magnitude of Change	Annual Mean NO_2 Conc. ($\mu g/m^3$)	Annual Mean PM_{10} Conc. ($\mu g/m^3$)	Annual Mean $PM_{2.5}$ Conc. ($\mu g/m^3$)	Exceedances of the 24-hr PM_{10} Objective (Days)
Large	Increase/ decrease > 4	Increase/ decrease > 4	Increase/ decrease >2.5	Increase/ decrease > 4
Medium	Increase/ decrease 2 - 4	Increase/ decrease 2 - 4	Increase/ decrease 1.25 - 2.5	Increase/ decrease 2 to 4
Small	Increase/ decrease 0.4 - 2	Increase/ decrease 0.4 - 2	Increase/ decrease 0.25 - 1.25	Increase/ decrease 1 to 2
Imperceptible	Increase/ decrease < 0.4	Increase/ decrease < 0.4	Increase/ decrease < 0.25	Increase/ decrease < 1

12.3.46 A change in predicted annual mean concentrations of NO_2, or PM_{10} of less than 0.4µg/m^3 is considered to be so small as to be imperceptible (IAQM, 2009). A change (impact) that is imperceptible, given normal bounds of variation, would not be capable of having a direct effect on local air quality that could be considered to be significant.

12.3.47 The criteria in Table 12.2 relate to air quality statistics that are elevated above the objective values in many urban locations: this is not the case with $PM_{2.5}$. A change in the annual mean concentration of $PM_{2.5}$ equivalent to 1 per cent of the objective value is 0.25µg/m^3.

12.3.48 The magnitude of the change in the predicted number of exceedances of the 24-hour objective is directly derived from the predicted annual mean value using the relationship defined in LAQM.TG(03) (Defra, 2003). The magnitude descriptors in Table 12.2 are as proposed by Environmental Protection UK (EPUK, 2010).

12.3.49 The air quality objective values have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such the sensitivity of receptors was considered in the definition of the air quality objective values and therefore no additional subdivision of human health receptors on the basis of building or location type has been necessary.

12.3.50 For receptors that are predicted to experience a perceptible change, the effect of the change on local air quality and the risk of exceeding the air quality objective value is summarised in Table 12.3. A small increase in annual mean concentrations, at receptors exposed to baseline concentrations that are just below the objective value (36µg/m^3 to 40µg/m^3) is considered to have a minor adverse effect as there is a small increase in the risk of exceeding the objective value. However, a small increase in annual mean concentration at receptors exposed to baseline concentrations that are below or well below (< 36µg/m^3) is not likely to affect the achievement of the objective value and is therefore not considered a significant effect (negligible).

Achievement of Air Quality Objectives

12.3.51 The significance of all reported effects is also considered for the development in strategic terms, as the potential to contribute to or interfere with the successful implementation of policies and strategies for the management of local air quality. However, the principal focus is on whether there would be any change to the likelihood of future achievement of the air quality objective values set out in Table 12.1.

12.3.52 The achievement of local authority goals for local air quality management is directly linked to the achievement of the air quality objective values described

above and as such this assessment focuses on the likelihood of future achievement of these air quality objective values.

Table 12.3: Air Quality Impact Descriptors for Changes in Ambient Pollutant Concentrations of NO_2 and PM_{10}

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration			
	Large	**Medium**	**Small**	**Imperceptible**
Increase with BSCU				
Above Air Quality Standard or Guideline With project (>100%)	Major Adverse	Moderate Adverse	Minor Adverse	Negligible
Just Below Air Quality Standard or Guideline With project (90%-100%)	Moderate Adverse	Moderate Adverse	Minor Adverse	Negligible
Below Air Quality Standard or Guideline With project (75%-90%)	Minor Adverse	Minor Adverse	Negligible	Negligible
Well Below Air Quality Standard or Guideline With project (<75%)	Minor Adverse	Negligible	Negligible	Negligible
Decrease with BSCU				
Above Air Quality Standard or Guideline With project (>100%)	Major Beneficial	Moderate Beneficial	Minor Beneficial	Negligible
Just Below Air Quality Standard or Guideline With project (90%-100%)	Moderate Beneficial	Moderate Beneficial	Minor Beneficial	Negligible
Below Air Quality Standard or Guideline With project (75%-90%)	Minor Beneficial	Minor Beneficial	Negligible	Negligible
Well Below Air Quality Standard or Guideline With project (<75%)	Minor Beneficial	Negligible	Negligible	Negligible

12.3.53 Effects are reported as being either ‘not significant’ or ‘significant’. If the overall effect of the development on local air quality or on amenity is found to be ‘moderate’ or ‘major’ this is deemed to be ‘significant’, and may therefore jeopardise strategic ambition. Effects found to be ‘minor’ are considered to be ‘not significant’, although they may be a matter of local concern. ‘Negligible’ effects are also considered to be ‘not significant’ (See Table 12.3).

12.4 Baseline Conditions

Receptors Potentially Affected by Emissions from Construction Works

12.4.1 There are a number of receptors that are sensitive to dust in the immediate vicinity of the BSCU. For the Whole Block Site, sensitive receptors include the nearest residential properties located in and on:

- Abchurch Yard (No. 1);
- St. Swithins Lane (No. 20); and
- Bush Lane (No. 35 & 29).

12.4.2 Sensitive receptors also include nearby commercial properties on:

- King William Street;
- Cannon Street; and
- Abchurch Lane.

12.4.3 For the Arthur Street Work Site, sensitive receptors include the nearest residential properties on:

- Laurence Pountney Lane (No. 5 & 7a); and
- Martin Lane (No. 28 & 6).

12.4.4 Sensitive receptors also include nearby commercial properties on:

- Martin Lane;
- Arthur Street;
- Upper Thames Street; and
- King William Street.

12.4.5 Buildings in proximity to utilities works and the Walbrook grout shaft site also have the potential to be affected by dust impacts.

12.4.6 The receptors potentially affected by NRMM (vehicles and site plant) emissions are those located in close proximity to the Whole Block Site, Arthur Street Work Site, the Walbrook grout shaft site and utilities work sites. These include the commercial and residential sensitive receptors on King William Street, Abchurch Lane, Cannon Street, Martin Lane and Arthur Street.

12.4.7 The location of these receptors is displayed in Figure 12.1 (See ES Figures Volume).

Receptors Potentially Affected by Construction Phase Road Traffic Emissions

12.4.8 Impacts from road traffic emissions have been quantified at 15 receptors located along roads anticipated to be affected by the BSCU construction works. The location of these receptors are listed in Table 12.4 and displayed in Figure 12.1 (See ES Figures Volume).

Table 12.4: Road Traffic Emissions Sensitive Receptors

Receptor ID	Description	Grid Reference	
		x	y
R1	Flat 1-6, 20 St Swithins Lane	532720	180951
R2	1Abchurch Lane	532742	180905
R3	1-7 Bush Lane, facing onto Cannon Street	532695	180886
R4	Manager's flat, The Bell PH at 29 Bush Lane	532677	180853
R5	1-4 Brook Court, 5 Laurence Pountney Lane	532750	180835
R6	1-6 Union House, 6 Martin Lane	532785	180792
R7	Flat 1-9, 28 St Martin Lane	532825	180815
R8	Presbytery at Church of St Magnus the Martyr	532893	180657
R9	Flat 1-38, Werna House, 31 Monument Street	533020	180713
R10	Apartments 1-23, 3 Lovat Lane	533052	180783
R11	Flat 1-14, 9b Eastcheap	532989	180835
R12	Flats A-C, 4 Bulls Head Passage	533057	181021
R13	New Moon Public House, 88 Gracechurch Street	533027	181065
R14	4 Dowgate Hill	532571	180892
R15	30 College Street, near to Upper Thames Street	532537	180835

Monitoring and Measurement Data

12.4.9 The City of London Corporation undertakes the measurement of PM_{10} and $PM_{2.5}$ concentrations in its administrative area, as part of its review and assessment of local air quality management duties. The locations of the automatic continuous monitoring stations operated within the study area are displayed in Figure 12.1 (see ES Figures Volune). A summary of the concentrations monitored within the City is provided in Appendix A12.3. Measured annual mean concentrations of PM_{10} were above the national air quality objective value at the monitoring station on Upper Thames Street (CT8) in 2013, and have been at risk of an exceedance there for the past few years. Elsewhere, monitored annual mean concentrations are below the air quality objective value for that pollutant. The same station has also reported 24 hour mean PM_{10} concentration values that are above the objective value in each

year between 2009 and 2012. An exceedance of this objective has also occurred over the past three years at the continuous monitoring station located on Beech Street (CT4).

12.4.10 $PM_{2.5}$ is monitored at one location within the City of London. The measured annual mean concentration in 2013 was in excess of the national air quality objective values. The monitoring site is representative of a kerbside location and is situated adjacent to a busy road (Farringdon Street), outside of the study area. Annual mean $PM_{2.5}$ concentrations monitored at that location are therefore not considered representative of conditions experienced at receptor locations within the study area.

12.4.11 The City of London Corporation monitors NO_2 at six automatic monitoring stations and undertakes measurements using diffusion tubes at five locations within the borough. One of these sites is located within the air quality study area, adjacent to Upper Thames Street (CT6). A description of these monitoring sites and a summary of the data gathered over recent years are provided in Appendix A12.3. Pollutant data from the automatic monitoring stations can be obtained from the London Air Quality Network (www.londonair.org.uk).

12.4.12 Measured annual mean NO_2 concentrations have been above the national air quality objective value at all locations for a number of years, except for one location at the Speed House (Barbican Centre), where concentrations were below the national objective value for the years 2010 to 2012. The 1 hour NO_2 objective is also regularly exceeded at locations near to the City of London's busy roads. At all of the measurement sites, the dominant contribution to total annual mean NO_2 pollutant concentrations is from background sources as projected by Defra (2012). The contribution from these background sources is already above the objective value before considering the contribution from any other local sources, such as traffic on local roads.

12.4.13 The *London Atmospheric Emissions Inventory* (Mayor of London, 2010) (www.cleanerairforlondon.org.uk) is a database of pollutant emissions and sources in Greater London extending out to the M25 motorway. The *Inventory* shows that baseline annual mean concentrations of NO_2 and PM_{10} are exceeding the national air quality objectives for those pollutants at numerous areas across London, including the City of London. The inventory also suggests that pollutant concentrations are expected to fall over coming years, as emissions technology improves. However, it projects that exceedances are likely at locations near busy roads up to and beyond 2020. Emissions are likely to decrease over the coming years due to the enforcement of the current LEZ and the proposed ULEZ.

Predicted Baseline Pollutant Concentrations

12.4.14 Predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$, and the number of days when the 24 hour PM_{10} objective value is exceeded, at the selected receptors during the current baseline scenario (2013), are listed in Table 12.5. The location of these receptors is provided in Figure 12.1. Text in bold denotes concentration values that are above their respective objective value.

Table 12.5: Air Quality Statistics Predicted at Receptors for the Current Baseline Scenario (2013)

Receptor	Annual Mean NO_2 Conc. ($\mu g/m^3$)	Annual Mean PM_{10} Conc. ($\mu g/m^3$)	Annual Mean $PM_{2.5}$ Conc. ($\mu g/m^3$)	Exceedances of the 24-hr PM_{10} Objective (Days)
R1	**55.2**	24.3	17.1	11
R2	**58.4**	24.7	17.3	12
R3	**81.5**	27.2	19.1	19
R4	**58.0**	24.8	17.4	12
R5	**59.2**	24.9	17.5	13
R6	**60.3**	25.1	17.6	13
R7	**61.0**	25.1	17.6	13
R8	**77.6**	28.0	19.5	21
R9	**65.2**	25.6	17.8	14
R10	**49.6**	23.2	16.3	9
R11	**54.4**	24.2	17.0	11
R12	**50.5**	23.7	16.7	10
R13	**61.7**	24.9	17.5	13
R14	**63.6**	25.7	17.9	15
R15	**90.4**	31.1	21.4	32
Air Quality objective value	**40µg/m^3**	**40µg/m^3**	**25µg/m^3**	**35 days**

12.4.15 In the current baseline scenario for 2013, annual mean concentrations of NO_2 are predicted to be above the national air quality objective value at all selected receptors. The highest concentrations are predicted to occur at locations adjacent to busy and congested roads, with high traffic volumes and low speeds. Away from the busier roads, concentrations fall to nearer background levels.

12.4.16 The dominant contribution to the total pollutant concentration values reported in Table 12.6 are those from background sources (such as emissions from energy plant within and beyond the air quality study area and road traffic emissions

from beyond the study area). The contribution from background sources is already above the annual mean objective value for NO_2. A much smaller additional contribution is made by emissions from traffic on the local road network within the study area.

12.4.17 Where annual mean concentrations of NO_2 are predicted to be greater than 60µg/m^3, research (Laxen and Marner, 2003) has suggested that it is likely that the hourly mean concentrations of NO_2 are also likely to be above the air quality objective (200µg/m^3). The hourly objective value for NO_2 is only at risk of exceedance at receptors located adjacent to the busier roads in the study area (Receptors R3, R6, R7, R8, R9, R13, R14 and R15), and is currently achieved elsewhere.

12.4.18 Annual mean concentrations of PM_{10} and $PM_{2.5}$ are predicted to be below their respective national air quality objective values at all selected receptors, and the number of days when the 24 hour PM_{10} objective value is exceeded is also below than the permitted level of 35 days at all receptor locations.

12.4.19 Predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$, and the number of days when the 24 hour PM_{10} objective value is predicted to be exceeded, at the selected receptors during the future baseline scenario (2017 – selected as it is the construction year with the highest transport movements), are listed in Table 12.6. The location of the selected receptors is provided in Figure 12.1.

12.4.20 In the future baseline scenario for 2017, annual mean concentrations of NO_2 are predicted to have decreased slightly from levels predicted in 2013, but not sufficiently to enable achievement of all the air qualify objectives. For this scenario, the projected background contribution is between 36.5 and 40.2µg/m^3. The highest concentrations are still predicted to occur at locations adjacent to busy and congested roads, with high traffic volumes and low speeds (R3 and R15). Away from the busier roads, concentrations fall to nearer background levels (R10 and R12).

12.4.21 The annual mean concentration of NO_2 is predicted to be nearly double the national air quality objective value for that pollutant in 2017, at the receptor location close to Upper Thames Street (R15), and only slightly lower adjacent to Cannon Street (R3). Predicted concentrations for the 2017 baseline scenario are such that it seems likely that annual mean concentrations of NO_2 will continue to be above the national air quality objective value for a number of years beyond 2017.

12.4.22 Where annual mean concentrations of NO_2 are predicted to be greater than 60µg/m^3, research (Laxen and Marner, 2003) has suggested that it is likely that the hourly mean concentrations of NO_2 are also likely to be above the air quality objective (200µg/m^3). The hourly objective value for NO_2 is only at risk

of exceedance at receptors located adjacent to the busier roads in the study area (Receptors R3 and R15), and is predicted to be achieved elsewhere.

Table 12.6: Air Quality Statistics Predicted at Receptors for the Future Baseline Scenario (2017)

Receptor	Annual Mean NO_2 Conc. ($\mu g/m^3$)	Annual Mean PM_{10} Conc. ($\mu g/m^3$)	Annual Mean $PM_{2.5}$ Conc. ($\mu g/m^3$)	Exceedances of the 24-hr PM_{10} Objective (Days)
R1	**47.8**	23.1	15.8	9
R2	**50.5**	23.4	16.0	9
R3	**70.3**	25.6	17.5	14
R4	**50.1**	23.5	16.1	10
R5	**51.1**	23.5	16.1	10
R6	**52.0**	23.7	16.2	10
R7	**52.6**	23.7	16.3	10
R8	**66.3**	26.4	17.8	16
R9	**55.2**	24.2	16.4	11
R10	**42.4**	22.1	15.1	7
R11	**47.2**	23.0	15.8	9
R12	**43.8**	22.5	15.5	8
R13	**53.3**	23.5	16.1	10
R14	**54.7**	24.3	16.5	11
R15	**76.9**	29.1	19.5	25
Air Quality objective value	**40µg/m^3**	**40µg/m^3**	**25µg/m^3**	**35 days**

12.4.23 Where annual mean concentrations of NO_2 are predicted to be greater than 60µg/m^3, research (Laxen and Marner, 2003) has suggested that it is likely that the hourly mean concentrations of NO_2 are also likely to be above the air quality objective (200µg/m^3). The hourly objective value for NO_2 is only at risk of exceedance at receptors located adjacent to the busier roads in the study area (Receptors R3 and R15), and is predicted to be achieved elsewhere.

12.4.24 Annual mean concentrations of PM_{10} and $PM_{2.5}$, and the number of exceedances of the 24 hour PM_{10} objective are still predicted to be below their respective national air quality objective values at all selected receptors.

Baseline Dust Climate

12.4.25 Dust conditions in the vicinity of the BSCU Work Sites will be typical of the background level of dust that exists in all urban locations in the UK. Receptors currently experience dust deposition at a rate that is determined by the

contributions of local and distant sources. This baseline rate of soiling is considered normal and varies dependent on prevailing climatic conditions. The tolerance of individuals to deposited dust is therefore shaped by their experience of baseline conditions.

12.5 Incorporated Mitigation

Construction

12.5.1 During the BSCU, construction activity will be undertaken in line with the requirements of the CoCP. The draft CoCP includes an extensive list of dust and emissions controls that will be implemented throughout the BSCU, based on measures described within current and emerging Mayor of London guidance (The Mayor of London, 2006; Mayor of London, 2013) and the City of London Corporation's *Code of Practice for Deconstruction and Construction Sites* (City of London Corporation, 2013).

12.5.2 Such measures are standard practice on well-managed construction sites across London and the UK, and where implemented correctly, are sufficient to adequately control dust and emissions from construction activities and NRMM.

12.5.3 Incorporated mitigation measures described within the draft CoCP (Appendix A4.1) include, but are not limited to the following:

- erection of solid barriers around the entire boundary of each main work site;
- plan site layout so that materials with the potential to produce dust, as well as machinery and dust causing activities, are located away from sensitive receptors where reasonably practicable;
- provide hard surfaced site haul routes, which should be regularly inspected for integrity and repaired if required;
- put in place real-time dust monitors across the work sites;
- undertake visual inspections for dust and maintain a log book;
- maintain all dust control equipment in good condition and record maintenance activities;
- keep site fencing, barriers and scaffolding clean;
- effective vehicle cleaning and wheel washing will be implemented for vehicles leaving site;
- haul routes will be dampened down / swept when necessary;
- routinely clean the public highway using wet sweeping methods;
- all loads entering and leaving site will be covered;

- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery;
- use enclosed chutes and covered skips;
- if practicable, strip and wrap buildings to be demolished to reduce the amount of dust which may be liberated;
- re-surface earthworks and exposed areas at the earliest opportunity;
- ensure slopes on stockpiles are no steeper than the natural angle of repose of the material and maintain smooth profile;
- cover, seal, damp down or fence stockpiles to prevent wind whipping;
- ensure sand and other aggregates are stored in shielded areas and are not allowed to dry out;
- minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate;
- avoid double handling of material wherever reasonably practicable;
- mix large quantities of cement, bentonite, grouts and other similar materials in designated areas which will be enclosed or shielded;
- silos to be provided with dust arrestment (bag or cartridge filters);
- concrete crushers and/or concrete batchers will have all necessary permits to operate;
- sheet or otherwise enclose loaded bins and skips; and
- undertake cutting, grinding and sawing off site where practicable. If not, it should be undertaken in a screened-off area with adequate dust control and/or water suppression available.

12.5.4 Measures contained within the draft CoCP concerning emissions associated with NRMM are standard practice on well-managed construction sites across London and the UK, and where implemented correctly, should be sufficient to adequately control emissions from NRMM.

12.5.5 Incorporated mitigation measures to limit emissions from onsite plant equipment and vehicles will include:

- ensuring that the engines of all vehicles and plant on site are not left running unnecessarily;
- using low emission vehicles;

- using ultra low sulphur fuels in plant and vehicles;
- use of diesel particulate filters where appropriate and practicable;
- should any emissions of dark smoke occur (except during start up) then the relevant machinery should be stopped and any problem rectified before being used;
- requiring that plant will be well maintained, with routine servicing of plant and vehicles to be completed in accordance with the manufacturer's recommendations and records maintained for the work undertaken;
- siting fixed plant away from potential sensitive receptors;
- minimising the use of diesel or petrol powered generators and instead using mains electricity or battery powered equipment; and
- maximising energy efficiency (this may include maximising vehicle utilisation by ensuring full loading and efficient routing).

12.5.6 NRMM and site plant will also adhere to the following standards, as described within the draft CoCP, where practicable:

- all NRMM will meet at least Stage 3B emission criteria where it is available. If Stage 3B equipment is not available, NRMM will, where possible, be fitted with particle traps and / or catalytic exhaust treatment. An inventory of all NRMM, alongside proof of emission limits for all equipment, will be kept on site. All machinery will be regularly serviced and service logs kept on site for inspection; and
- European Emission Standards for Non-Road Diesel Engines depending on when the vehicle is introduced into the fleet.

12.5.7 All commercial on-road vehicles used in construction must meet European certified CO_2 limits and the European Emission Standards pursuant to the European Commission (EC) Directive 98/69/EC (commonly known as Euro Standards), for the year in which it is introduced into the fleet, as described within the CoCP.

Operation

12.5.8 The BSCU does not include any car parking facility. Therefore its operation is not expected to cause a significant change in vehicle movements or their emissions on the local road network.

12.5.9 The operational BSCU does not include energy plant with onsite combustion. Therefore there will not be any onsite combustion emissions associated with the BSCU energy plant.

12.5.10 The BSCU also includes for the ventilation of air from internal areas, which may include particulate matter from tunnel and platform areas. Implementation of LU standards, guidance and good practice measures, as implemented at other London Underground stations would reduce potential emissions of particulate so that a significant effect would not occur. Such measures include, but are not limited to:

- regular cleaning of tunnels;
- use of trains with regenerative braking to reduce the potential for generation of particulate;
- partitioning of station platforms from the main tunnels;
- appropriate design of the flues to ensure adequate dispersion of pollutants;
- use of equipment regarded as Best Available Technology;
- regular inspection of the machinery;
- operation of all machinery to the manufacturer's instructions; and
- ensuring that equipment is well maintained during operation.

12.5.11 The air quality of the London Underground Network is monitored regularly in order to ensure that no hazardous levels of gases and particulates occur. As long as this remains the case, it is considered that the concentration of these pollutants will be greatly diluted within a short distance of above ground vents.

12.6 Assessment of Effects

Construction Dust Emissions

12.6.1 The potential construction phase impacts considered at the sensitive receptors around the BSCU Work Sites are:

- effects on amenity and property including changes to the rate of deposition of particulate matter onto glossy surfaces (such as glass, UPVC and car bodywork) and other property; and
- changes in 24-hr mean concentrations that might increase the risk of exposure to PM_{10} at levels that could exceed the 24-hr mean air quality objective.

12.6.2 The assessment has assumed that mitigation measures will be applied on site, in accordance with the CoCP.

12.6.3 The predicted impacts at the nearest sensitive receptors as a result of the proposed utilities works, the demolition of the Whole Block Site and the BSCU construction works have been considered for each of the following activities, as per current guidance (Mayor of London, 2013):

- demolition works;
- earthworks;
- construction works; and
- track-out.

Demolition of the Whole Block Site

12.6.4 Dust from demolition of the Whole Block Site has the potential to affect the medium sensitivity residential receptors on Abchurch Yard, Laurence Pountney Lane and St. Swithin's Lane, and the commercial receptors on King William Street and Cannon Street, which are considered to be of low sensitivity.

12.6.5 Standard mitigation measures, as described with the CoCP, will be applied to control the release of emissions during the demolition. With the implementation of good site practice and the stringent use of dust control measures throughout this element of works, it is anticipated that the demolition of buildings associated with the Whole Block Site would have a minor adverse impact on amenity and a negligible impact on short-term PM_{10} concentrations at the nearest sensitive receptors. Such an impact would not constitute a significant effect.

BSCU Construction

Earthworks

12.6.6 The main earthworks will be associated with excavation of material for the shafts, tunnels, and new Station Entrance Hall.

12.6.7 With the implementation of good site practice and the stringent use of the incorporated dust control measures, as described with the CoCP, it is anticipated that the earthworks associated with the BSCU will have a minor adverse effect on amenity and a negligible effect on short-term PM_{10} concentrations at the nearest sensitive receptors; neither of which is considered would constitute a significant effect.

Construction works

12.6.8 The activities to be undertaken for construction of the main surface structures are potential sources of dust and PM_{10} emissions; particularly the cutting of materials and the presence of an onsite concrete batching facility. The

structural construction works have a relatively low risk of generating dust emissions, as much of the material used for construction will be precast.

12.6.9 With the implementation of good site practice and the stringent use of the incorporated dust control measures, as described with the CoCP, it is anticipated that the construction element of the BSCU will have a negligible effect on amenity and a negligible effect on short-term PM_{10} concentrations at the nearest sensitive receptors; neither of which are deemed to be significant.

Track-out

12.6.10 As per the IAQM and GLA guidance, there is the potential for dust generated by vehicle movements (track-out) to impact upon sensitive receptors located within 100m of roads that extend up to 500m from the work site entrances. Receptors adjacent to these roads generally consist of commercial office property, with occasional commercial food outlets and some residential property located within 20m of the construction vehicle routes.

12.6.11 With the implementation of good site practice and the stringent use of the incorporated dust control measures, as described with the CoCP, it is anticipated that transport of materials will have a minor adverse effect on amenity and a negligible effect on short-term PM_{10} concentrations at the nearest sensitive receptors; neither of which would constitute significant effects.

Summary

12.6.12 The predicted effects on amenity and health of the BSCU demolition and construction works on nearby receptors are summarised in Table 12.7. An effect that is minor adverse or negligible is not considered to be significant.

Table 12.7: Summary of Construction Phase Dust Effects

Source	Effects on amenity and property	Exposure to PM_{10} at levels that could exceed the 24hr air quality objective
Demolition	Minor Adverse	Negligible
Earthworks	Minor Adverse	Negligible
Construction	Negligible	Negligible
Track-out	Minor Adverse	Negligible
Overall Effect	**Minor Adverse / Negligible**	

Utilities Works

12.6.13 The utilities works, and potential compensation grout works, associated with the BSCU have the potential to generate fugitive dust emissions, emissions from site plant and to transfer material onto the surrounding roads.

12.6.14 All utilities works associated with the BSCU will be undertaken in line with the CoCP – which includes an extensive list of dust and emissions controls, based on measures described within current and emerging best practice. Such measures are standard practice on well-managed construction sites across London and the UK, and are sufficient to adequately control dust and emissions from construction activities and plant.

12.6.15 The utilities works, individually or in combination with the main BSCU construction activities, are considered likely to result in occasional temporary, minor adverse effects at the nearest surrounding receptors during the construction phase, which is not considered to be significant.

Site Plant Emissions

12.6.16 Any potentially adverse effects of NRMM (vehicles and site plant) emissions will be controlled following the measures described within the CoCP.

12.6.17 The implementation of such control measures will be sufficient to reduce emissions associated with NRMM (vehicles and site plant) to a negligible and therefore non-significant effect level.

Construction Phase Vehicle Emissions

12.6.18 The impact of vehicle emissions on local air quality has been considered for the combined impact of construction-related vehicle movements on the public road network, along with proposed temporary changes to the vehicle flow and composition on local roads.

12.6.19 The impact of additional bus movements on the local road network as a result of the Northern Line blockade has also been considered.

BSCU Construction Traffic

12.6.20 Predicted annual mean concentrations of NO_2, PM_{10}, $PM_{2.5,}$ and the number of days when the 24 hour PM_{10} objective value are predicted to be exceeded, at the selected air quality sensitive receptors, with the estimated worst case transport impacts overlaid onto the future baseline and BSCU construction in progress in 2017, are listed in Table 12.8.

12.6.21 In both the future baseline scenario and the construction phase scenario, annual mean concentrations of NO_2 are predicted to be above the national air quality objective value at all selected receptors, particularly along busy roads. For the forecast worst case construction phase transport scenario, the highest concentrations are predicted to occur, at locations adjacent to busy and congested roads, with high traffic volumes and low speeds. Away from the busier roads, concentrations fall to nearer background levels, but remain above the objective value.

Table 12.8: Air Quality Statistics Predicted at receptors for the Future Construction Scenario (2017)

Receptor	Annual Mean NO_2 Conc. ($\mu g/m^3$)	Annual Mean PM_{10} Conc. ($\mu g/m^3$)	Annual Mean $PM_{2.5}$ Conc. ($\mu g/m^3$)	Exceedances of the 24-hr PM_{10} Objective (Days)
R1	**48.6**	23.2	15.9	9
R2	**51.9**	23.5	16.1	10
R3	**76.3**	26.3	17.9	16
R4	**51.1**	23.6	16.1	10
R5	**52.3**	23.6	16.2	10
R6	**52.3**	23.7	16.3	10
R7	**53.5**	23.8	16.3	10
R8	**66.9**	26.5	17.9	17
R9	**55.6**	24.3	16.5	11
R10	**42.7**	22.1	15.2	7
R11	**47.5**	23.0	15.8	9
R12	**44.0**	22.5	15.5	8
R13	**53.6**	23.5	16.1	10
R14	**56.4**	24.5	16.7	12
R15	**79.5**	29.6	19.8	27
Air Quality objective value	**40µg/m^3**	**40µg/m^3**	**25µg/m^3**	**35 days**

12.6.22 The magnitude of annual mean concentrations of NO_2 in the forecast worst case construction phase scenario is similar to that reported for the future baseline scenario (Table 12.6) and indicates that the annual mean NO_2 concentration would be above the national air quality objective value by a similar margin with and without the BSCU.

12.6.23 As with the baseline scenario, where annual mean concentrations of NO_2 are predicted to be in greater than 60µg/m^3 (Laxen and Marner, 2003) it is likely that the hourly mean concentrations of NO_2 will be above the objective value. Such concentrations are still predicted to occur at sensitive receptor locations near to Cannon Street (R3), Lower Thames Street (R8), and Upper Thames Street (R15), primarily due to the magnitude of the contribution from background sources.

12.6.24 Annual mean concentrations of PM_{10} and $PM_{2.5}$, and the number of exceedances of the 24 hour PM_{10} objective are predicted to be below their respective national air quality objective values at all selected receptors

considered.The change in pollutant concentrations predicted as a result of the forecast worst case BSCU construction phase is listed in Table 12.9.

12.6.25 The annual mean concentrations of PM_{10} and $PM_{2.5}$ and the 24 hour mean concentrations of PM_{10} are predicted to remain below the respective air quality objective values for the future baseline and construction phase scenarios.

12.6.26 Annual mean concentrations of NO_2 are predicted to remain above the objective value at receptors across the study area. However, the hourly objective value for NO_2 is only at risk of exceedance at receptors located adjacent to the busier roads in the study area (R3, R15), and is achieved elsewhere.

Table 12.9: Magnitude of Change in Predicted Air Quality between the Future Baseline and Future Forecast Worst Case Construction Scenario (2017) and Associated Effects with respect to Objective/Limit Value

Receptor	Annual Mean NO_2 Conc. ($\mu g/m^3$)	Annual Mean PM_{10} Conc. ($\mu g/m^3$)	Annual Mean $PM_{2.5}$ Conc. ($\mu g/m^3$)	Exceedances of the 24-hr PM_{10} Objective (Days)
R1	+ 0.8 (s)(Min.)	+ 0.1 (i)(Neg.)	+ 0.1 (i)(Neg.)	<1 (i)(Neg.)
R2	+ 1.4 (s)(Min.)	+ 0.1 (i)(Neg.)	+ 0.1 (i)(Neg.)	+ 1 (s)(Neg.)
R3	+ 6.0 (l)(Maj.)	+ 0.7 (s)(Neg.)	+ 0.4 (s)(Neg.)	+ 2 (m)(Neg.)
R4	+ 1.0 (s)(Min.)	+ 0.1 (i)(Neg.)	<0.1 (i)(Neg.)	<1 (i)(Neg.)
R5	+ 1.2 (s)(Min.)	+ 0.1 (i)(Neg.)	+ 0.1 (i)(Neg.)	<1 (i)(Neg.)
R6	+ 0.3 (i)(Neg.)	<0.1 (i)(Neg.)	+ 0.1 (i)(Neg.)	<1 (i)(Neg.)
R7	+ 0.9 (s)(Min.)	+ 0.1 (i)(Neg.)	<0.1 (i)(Neg.)	<1 (i)(Neg.)
R8	+ 0.6 (s)(Min.)	+ 0.1 (i)(Neg.)	+ 0.1 (i)(Neg.)	+ 1 (s)(Neg.)
R9	+ 0.4 (s)(Min.)	+ 0.1 (i)(Neg.)	+ 0.1 (i)(Neg.)	<1 (i)(Neg.)
R10	+ 0.3 (i)(Neg.)	<0.1 (i)(Neg.)	+ 0.1 (i)(Neg.)	<1 (i)(Neg.)
R11	+ 0.3 (i)(Neg.)	<0.1 (i)(Neg.)	<0.1 (i)(Neg.)	<1 (i)(Neg.)
R12	+ 0.2 (i)(Neg.)	<0.1 (i)(Neg.)	<0.1 (i)(Neg.)	<1 (i)(Neg.)
R13	+ 0.3 (i)(Neg.)	<0.1 (i)(Neg.)	<0.1 (i)(Neg.)	<1 (i)(Neg.)
R14	+ 1.7 (s)(Min.)	+ 0.2 (i)(Neg.)	+ 0.2 (i)(Neg.)	+ 1 (s)(Neg.)
R15	+ 2.6 (m)(Mod.)	+ 0.5 (s)(Neg.)	+ 0.3 (i)(Neg.)	+ 2 (m)(Neg.)

Magnitude of change descriptor – (i): Imperceptible; (s):Small; (m) Medium; (l): Large
Effect descriptors – Neg.=Negligible, Min.=Minor, Mod.=Moderate, Maj.=Major

12.6.27 The total annual mean concentrations of NO_2 reported for the future construction scenario in 2017 are the result of the contribution of emissions from background sources, the contribution from future baseline traffic sources and the worst case change in road traffic flow and composition due to the proposed works. For example at receptors near to Upper Thames Street (R15)

the total predicted annual mean concentration for the future construction scenario is 79.5 μg/m^3. This is the result of a contribution from background sources of 40.2μg/m^3, a contribution from baseline emissions from local traffic of 36.7μg/m^3 and the worst case change in the contribution from local traffic emissions due to the BSCU of +2.6μg/m^3.

12.6.28 These changes could occur during the construction period and the annual mean concentrations of NO_2 would return to future baseline conditions as the works near completion.

12.6.29 The temporary worst case BSCU transport impacts on local air quality would take the following form:

- at all individual receptors a negligible effect would be experienced due to changes in concentrations of particulate matter (PM_{10} and $PM_{2.5}$);
- based on the magnitude of predicted annual mean concentrations, there will be an increase in the number of exceedances of the hourly mean NO_2 objective value at three locations. Consequently, the objective would not be achieved prior to the works, during the construction phase or on the return to baseline conditions upon completion of the works; and
- the change in the annual mean concentration of NO_2 would be 2.6μg/m^3 at one receptor location near Upper Thames Street (R15) and 6.0μg/m^3 at one receptor location on Cannon Street (R3). At all receptor locations, the objective would not be achieved prior to the works, during the construction phase or on the return to baseline conditions upon completion of the works.

12.6.30 Applying the adopted approach for the determination of significance, the effect of the predicted changes in particulate matter concentrations represents a negligible effect at each receptor location. The effect of the predicted change in hourly mean concentrations of NO_2 is considered to be minor at worst, due to the small change in the absolute annual mean concentration values. The effect at the receptor location represented by R3 is considered to be major and the effect at R15 is considered to be moderate. At all other receptors, effects will be minor at worst.

12.6.31 Overall, the temporary change to the flow and composition of road traffic on the local road network during the construction phase of the BSCU is considered to have at worst, a moderate temporary adverse effect on local air quality. During this time, the change in the concentration of all pollutants, including NO_2, is unlikely to be large enough to be detectable by local residents and may not be large enough to be identified by trend analysis of data from Local Authority monitoring sites.

12.6.32 This assessment has considered a worst case transport network scenario that could be caused by the BSCU during the construction phase. The worst case scenario assumes that traffic diverted during construction ignores primary diversion signage south of London Bridge (which would route traffic away from the City) and follows secondary diversion signs on a route via Cannon Street. However, it is considered likely that some vehicles will follow the signage south of the river and avoid the London Bridge route and at the secondary signage, some vehicles are likely to turn right onto Eastcheap or proceed north onto the A1213 (Gracechurch Street) and find alternative routes. Given the baseline congestion levels on Cannon Street, once knowledge of diversion routes become established, drivers are considered likely to choose alternative routes that are more suited to their true origins and destinations. Therefore, whilst the route used in the assessment would be signed as a secondary formal diversion, it is anticipated that after a short duration (potentially a matter of days) drivers will find alternative routes that will diffuse the impacts across the wider network.

12.6.33 In the context of IAQM guidance, a moderate effect is considered to be significant. However, the change in the level of exposure that receptors on Cannon Street (R3) and near Upper Thames Street (R15) experience is likely to be for only a very short duration (likely to be a matter of days) at commencement of the BSCU construction. Effects of the project are therefore not likely to be significant.

12.6.34 It is not considered likely that impacts of the BSCU would interfere with other measures being brought forward through policies or Action Plans at the national and local level, to reduce the contribution from background sources or the contribution from existing local road traffic emissions.

Utilities Works

12.6.35 The general utilities works, and potential compensation grouting works, associated with the BSCU will require the temporary total and partial closure of a number of roads over a phased period at an early part of the construction programme (2016-2017). Whereas the total and partial closure of these roads will lead to the diversion of some traffic onto alternative routes, the temporary nature of the closures and the associated traffic management measures relating to the works will promote the free flow of traffic and thereby minimise the potential for excessive emissions to air from congested traffic. Effects due to general utilities works are therefore not considered likely to be significant.

Blockade

12.6.36 It is anticipated that the temporary blockade of a section of the Northern Line (17 weeks) as part of the BSCU will lead to an increase in bus movements on

bus corridors over Waterloo Bridge, Blackfriars Bridge and London Bridge during the period of the blockade. The number of additional bus journeys required on the worst-affected route is as many as 16 two-way movements in the AM peak hour and 10 two-way movements in the PM peak hour. For the other hours of the day, there is sufficient capacity with existing bus numbers to cope with the additional passengers predicted to be displaced as a result of the blockade. The addition of 26 two-way bus movements per day for the duration of the temporary Blockade is unlikely to cause a significant effect on local air quality in itself. The cumulative impact associated with the blockade would, however, contribute to a small extent to the impacts associated with emissions from construction vehicles and diverted traffic.

12.7 Mitigation

Construction Phase Dust and Site Plant Emissions

12.7.1 It is considered that the standard practice dust and emissions control measures listed within the draft CoCP are sufficient to control impacts so that any effect is not significant. As such, no further mitigation measures are considered necessary.

Construction Road Traffic Emissions

12.7.2 The assessment of construction phase transport network impacts has identified that a significant air quality effect could potentially occur at a limited number of sensitive receptor locations on Cannon Street and Upper Thames Street. However, these effects are temporary in nature and are likely to last for only a very short duration at the commencement of the works, before returning to future baseline conditions. No additional mitigation relating to construction phase vehicle emissions are therefore considered necessary or practicable.

12.8 Residual Effects

12.8.1 Residual effects are as described in section 12.6.

12.9 Inter-relationships and Cumulative Effects

12.9.1 During the BSCU, there is the potential for cumulative effects that result from changes caused by other reasonably foreseeable works or developments, to act in combination with those from the BSCU.

12.9.2 The construction of the BSCU may be undertaken in unison with elements of the construction of a replacement over site development (OSD). The BSCU will also occur in unison with the construction of other consented third party schemes in the area. A full list of these third party schemes is provided in Chapter 17: Inter-relationships and Cumulative Effects.

12.9.3 During the construction phase, cumulative effects associated with dust deposition and an increase in short-term concentrations of PM_{10} may occur at sensitive receptors located within 350m of BSCU Work Sites and 350m of committed development work sites, when works are being undertaken simultaneously (GLA, 2013; IAQM 2014).

12.9.4 It is standard practice across London for construction works to be undertaken in accordance with the Mayor of London's guidance on *Controlling Dust and Emissions from Construction and Demolition* (GLA, 2006; 2013). The implementation of control measures described within this guidance has a track record of successfully controlling the effects of dust and PM_{10}. If such control measures are implemented on other construction sites (as they are expected to be) in order to comply with London-wide requirements, and the BSCU adheres to the agreed CoCP, the cumulative effect on dust soiling and short-term concentrations of PM_{10} will be minor adverse, and will not be considered significant.

12.9.5 The assessment of construction phase road traffic emissions described in this chapter has already taken into account committed development in the air quality study area, through the traffic data used in the dispersion modelling exercise. Therefore the cumulative impacts are the same as those listed in Table 12.9 and discussed in Section 12.6.

12.10 Assumptions and Limitations

12.10.1 This assessment is based on information and data available at the time of the assessment.

12.10.2 The assessment has been informed by 24 hour Annual Average Traffic Flow data based on traffic counts undertaken within the study area (see Appendix A8.1: Transport Assessment). Such traffic data has its own inherent uncertainties due to the conversion of peak hour and daily flows into the annual average daily flows required. However, the traffic data has been manipulated using best practice measures to reduce such uncertainty as far as practicable.

12.10.3 The assessment has also been informed by data gathered by an automatic continuous monitoring station (Walbrook Wharf) and a series of NO_2 diffusion tubes. Such monitoring methods also have inherent uncertainties, but are, however, the best available means for gathering and obtaining such data.

12.10.4 The dispersion modelling exercise has been informed by background pollutant concentration data obtained from Defra's background pollutant maps (Defra, 2012). Due to some uncertainty in the rate at which Defra projects future background pollutant concentrations to decrease, a Sensitivity Analysis has been undertaken and is described in Appendix A12.4. The Sensitivity Analysis

assumes that background pollutant concentrations do not improve from the existing baseline year of 2013 to the assessment year of 2017.

12.11 Conclusions

12.11.1 The assessment described within this chapter has considered the potential impact of the BSCU on local air quality. The assessment has included the consideration of impacts associated with construction dust, emissions from site plant and emissions from vehicles during the construction phase.

12.11.2 In general, construction activities, including those associated with the utilities works, have the potential to generate fugitive dust emissions as a result of demolition, construction, earthworks or the transfer of material to surrounding roads. However, the potential emission of any airborne particulate matter will be controlled using on site management practices to the extent that the BSCU will only give rise to minor adverse effects from dust and PM_{10} which are not considered significant.

12.11.3 Baseline and construction phase road traffic emissions have been modelled using ADMS-Roads. The model has been verified using data gathered by a continuous automatic monitoring station and a six month diffusion tube survey undertaken in the study area.

12.11.4 Although modelling has shown that, in the context of IAQM guidance, a significant air quality effect could be triggered at two locations (on Cannon Street and near Upper Thames Street), such an event would likely occur for only a very short duration (likely to be a matter of days) at commencement of the BSCU construction. Road traffic related air quality effects of the project are therefore not considered to be significant.

12.11.5 It is not considered likely that impacts of the BSCU would interfere with other measures being brought forward through policies or Action Plans at the national and local level, to reduce the contribution from background sources or the contribution from existing local road traffic emissions.

12.11.6 No impacts considered to result in significant effects will occur during the operational phase of the project.

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