

A1 – Introduction

A1.1 – EIA Scoping Report

A1.2 – EIA Scoping Responses

A1.3 – EIA Scoping Opinion Comments Summary

A1.1 – EIA Scoping Report

A graphic featuring three London Underground roundels on a grey pole against a blue sky. The top roundel is labeled 'BANK STATION CAPACITY UPGRADE', the middle one 'BETTER ACCESS', and the bottom one 'STEP FREE'. The background is a stylized illustration of a city street with various buildings, a red double-decker bus, and pedestrians.

BANK STATION CAPACITY UPGRADE

Bank Station Capacity Upgrade Project

Bank Station Capacity Upgrade Works
EIA Scoping Report

September 2013

BETTER ACCESS

STEP FREE





Bank Station Capacity Upgrade Project

**Bank Station Capacity Upgrade Works EIA Scoping Report
Document Reference URS-8798-RPT-G-000051 BSCU**

30th September 2013

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List of Abbreviations

Abbreviation	Definition
ADMS	Atmospheric Dispersion Modelling System
AEP	Annual Exceedance Probability
aOD	Above Ordnance Datum
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
ATD	Above Tunnel Datum
BAP	Biodiversity Action Plan
bgl	Below Ground Level
BSCU	Bank Station Capacity Upgrade
CEEQUAL	Civil Engineering Environmental Quality (assessment and award scheme)
CLEA	Contaminated Land Exposure Assessment
CLG	Department of Communities and Local Government
CoCP	Code of Construction Practice
CRTN	Calculation of Road Traffic Noise
DAS	Design and Access Statement
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of the Environment, Transport and Regions
DLR	Docklands Light Railway
DMRB	Design Manual for Roads and Bridges
DoE	Department of the Environment
EC	European Commission
EH	English Heritage
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EPAQS	Expert Panel on Air Quality Standard
EPUK	Environmental Protection UK
ES	Environmental Statement
FRA	Flood Risk Assessment
GARDIT	General Aquifer Research, Development and Investigation Team
GIGL	Greenspace Information for Greater London
GHG	Green House Gas
GLA	Greater London Authority
HA	Highways Agency

Abbreviation	Definition
HER	Heritage Environment Record
HGV	Heavy Goods Vehicle
Hz	Hertz
IAQM	Institute of Air Quality Management
IEMA	Institute of Environmental Management and Assessment
IfA	Institute for Archaeologists
ISO	International Standards Agency
JNCC	Joint Nature Conservation Committee
km	Kilometres
L _{A90}	The A weighted noise level exceeded for 90% of the specified measurement period. In BS4142: 1990 it is used to define background noise level
L _{Aeq} (L _{Aeq,1h} ; L _{Aeq,T})	Equivalent continuous sound level. Another index for assessment for overall noise exposure is the equivalent continuous sound level, Leq. This is a notional steady level, which would, over a given period of time, deliver the same sound energy as the actual time varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level
L _{Ar,Tr}	Rating level
L _{Amax}	Maximum value that the A-weighted averaged sound pressure level reached during a measurement period. L _{AmaxF} , or Fast, indicates that the sound pressure level is averaged in 0.125 second slices.
L _w	Sound Power Level
LAQM	Local Air Quality Management
LEL	Lower Explosive Limit
LU	London Underground
LUL	London Underground Limited
LVMF	London View Management Framework
m	Metres
MAGIC	Multi-Agency Geographic Information for the Countryside
NBN	National Biodiversity Network
NO ₂	Nitrogen Dioxide
NPPF	National Planning Policy Framework
O ₃	Ozone
ONS	Office of National Statistics
OSD	Over Site Development
PM _{2.5}	Fine Particulate Matter
PM ₁₀	Particulate Matter
PPE	Personal Protective Equipment

Abbreviation	Definition
PPV	Peak Particle Velocity
PTAL	Public Transport Accessibility Level
RTD	River Terrace Deposits
SAC	Special Area of Conservation
SFRA	Strategic Flood Risk Assessment
SINC	Site of Importance for Nature Conservation
SO ₂	Sulphur Dioxide
SPA	Special Protection Area
SPL	Significant Pollutant Linkages
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
TSP	Total Suspended Particulate
TWAO	Transport and Works Act Order
UDP	Unitary Development Plan
VDV	Vibration Dose Value
WebTAG	Web-based Transport Analysis Guidance
WFD	Water Framework Directive
ZVI	Zone of Visual Influence

1 Introduction

1.1 Background

1.1.1 This EIA Scoping Report has been prepared by URS on behalf of London Underground Limited (LUL) and the project design and build contractor Dragados.

1.1.2 The Bank Station Capacity Upgrade Project seeks to deal with serious existing and anticipated shortfalls in the passenger capacity of the existing station and has four key objectives:

- increase the capacity of Bank station, with the aim of reducing journey times and congestion for passengers while ensuring resilience to surges in demand and train service interruption;
- provide step-free route(s) to the Northern Line platforms from street and DLR levels, an accepted means of escape for Persons with Reduced Mobility (PRMs) and ability to provide assistance for PRMs;
- improve the emergency fire and evacuation protection measures for Northern line and DLR passengers; and
- positively contribute to the objectives of the Mayor's Transport Strategy.

1.1.3 The Bank Station Capacity Upgrade Project consists of two parts: the Bank Station Capacity Upgrade (BSCU) Works and the Over Site Development (OSD). This EIA Scoping Report, as described below, relates to the BSCU Transport and Works Act Order (TWAo) application. Construction of the BSCU Works would be via two locations (as shown in Figure 2.1 in Section 2):

- a new shaft within a work site taking the block bounded by King William Street, Nicholas Lane, Cannon Street and Abchurch Lane (the Whole Block Site); and
- a work site including a second shaft located in Arthur Street (the Arthur Street Work Site), which is approximately 130m to the south of the Whole Block Site.

1.1.4 Powers to undertake the BSCU Works and planning permission will be sought via a TWAo application submitted to the Secretary of State for Transport (the Secretary of State) and an application for planning permission under Section 90(2A) of the Town and Country Planning Act 1990 for the operational works (a 'deemed' planning application). To inform the TWAo application, an Environmental Impact Assessment (EIA) will be carried out and an Environmental Statement (ES) submitted with the application.

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- 1.1.5 Construction of the BSCU Works requires demolition of existing buildings, which would need to be replaced on project completion. A TWAO (with deemed planning permission) can deliver planning consent to construct and operate a railway and ancillary works, however it cannot provide consent for the commercial redevelopment of surplus land. Therefore, permission demolition and a replacement OSD located over and around the new station infrastructure will be sought via an application to the City of London Corporation under the Town and Country Planning Act 1990. The OSD application will also include an ES so as to fully consider the potential effects of the whole project.
- 1.1.6 This scoping report considers the scope of the EIA required to inform the BSCU Works TWAO application and supports the seeking of a scoping opinion from the Secretary of State, other statutory consultees and stakeholders.
- ## 1.2 The Need for Environmental Impact Assessment and the Purpose of this Scoping Report
- 1.2.1 Applications for TWA Orders must follow the Transport and Works (Applications and Objections Procedure)(England and Wales) Rules 2006 (the TWA Rules). Under Rule 7, when making an application, the TWA Rules require submission of 'environmental information' (typically considered an ES) for works which constitute a project which is of a type mentioned in Annex I or Annex II to the EIA Directive (European Council Directive 85/337/EEC as amended)(the Directive).
- 1.2.2 The BSCU Works fall within the description of projects which require environmental impact assessment listed in Annex II to the Directive. Paragraph 10 Infrastructure Projects includes *(g) Tramways, elevated and underground railways, suspended lines or similar lines of a particular type, used exclusively or mainly for passenger transport.*
- 1.2.3 Given the dense urban location of the BSCU Works, and the potential for environmental effects, LUL have elected to carry out an EIA to accompany the TWAO application without seeking a screening opinion.
- 1.2.4 The EIA will be prepared in accordance with Rule 4(1), 11 and Schedule 1 of the TWA Rules.
- 1.2.5 Government Circular 2/99 defines EIA as *a means of drawing together, in a systematic way, an assessment of the project's likely significant environmental effects. This helps to ensure that the importance of the predicted effects and the scope for reducing them, are properly understood by the public and the relevant competent authority before it makes its decision.*
- 1.2.6 The purpose of this EIA Scoping Report is to provide sufficient information to the Secretary of State and consultees as listed in Rule 8(4) of the TWA Rules

in order that they may provide an opinion on the scope and methods of environmental assessment work that it is proposed to undertake in relation to the development. The scoping report will also be utilised to support consultation with other stakeholders as appropriate.

1.2.7 Rule 10 of the TWA Rules specifies the documents which must be submitted as part of an application and the ES will form part of the application package.

1.3 Structure of the Scoping Report

1.3.1 Section 2 of this report provides an overview of the Whole Block and Arthur Street Sites and surrounding area, with Section 3 providing an outline description of the BSCU Works. Section 4 considers the need for the development and alternatives with Section 5 describing how the scope of the assessment has been determined and the methodology that will be applied to assessment. Sections 6 to 20 provide details of the 'technical' assessment topics and issues to be scoped in or scoped out of the EIA. Details of the rationale for scoping the topic into or out of the assessment are provided, as well as details of the scope of any proposed assessment.

1.3.2 A summary table of topics scoped into and out of the assessment with a brief summary explanation is provided in Section 21.

1.3.3 Section 22 outlines the proposed structure of the ES.

1.4 Programme

1.4.1 The outline programme relating to the BSCU Works is as follows:

- TWAO application submitted to the Secretary of State, mid 2014;
- TWAO determination assumed in 2016;
- anticipated demolition of existing buildings at the Whole Block Site and set-up of the Arthur Street Work Site in 2016/17;
- construction of the BSCU Works, 2016 – 2021;
- BSCU Works upgrades and Station Entrance operational in 2021; and
- OSD construction approximately 2021/22 – 2023/25.

2 The TWA Order Area and Surroundings

2.1 Introduction

2.1.1 TWAOs powers are sought to enable above ground works as well as below ground tunnelling in order to construct the Bank Station Capacity Upgrades. Figure A1 in Appendix 1 illustrates the anticipated below ground tunnelling works and the 1mm ground settlement contour which indicates the area potentially affected by the below ground works.

2.2 The Above Ground Work Sites

2.2.1 Above ground, construction is proposed at two sites within the City of London:

- the 'Whole Block Site' located between the London Underground stations of Bank and Monument, centred at grid reference 532791, 180912. The Whole Block Site is located approximately 180m south-east of the Bank LU station and approximately 130m north-west of the Monument Station. The Whole Block Site is bound to the north by King William Street, to the east by Nicholas Lane, to the south by Cannon Street and to the west by Abchurch Lane. The Whole Block Site is approximately 0.2 hectares (ha) in size; and
- Arthur Street Work Site, approximately 130m to the south of the Whole Block Site, centred at grid reference 532796, 180775.

2.2.2 Permanent development in the form of the above ground Station Entrance would be located at the Whole Block Site and further details are provided in Section 3. The Arthur Street Work Site is a temporary worksite required throughout the BSCU Works. The locations of the sites are shown in Figure 2.1.

The Whole Block Site

2.2.3 The Whole Block Site currently comprises six blocks up to seven storeys high, ranging in height from 18 to 24m.

2.2.4 The existing site uses comprise approximately 3,000 square metres of commercial property, primarily offices, but including restaurants at ground level.

2.2.5 The Whole Block Site is located within the Bank Conservation Area. The southern half of the site falls within the London View Management Framework (LVMF) Protected View 5A.2 from Greenwich Park (wider setting) and the southern edge of the site falls within the Protected View 4A.1 from Primrose Hill to St Paul's Cathedral (background).

Figure 2.1: The BSCU Work Sites



The Arthur Street Work Site

- 2.2.6 It is anticipated that the Arthur Street Work Site will occupy the majority of the carriageway between Upper Thames Street and King William Street. Pedestrian access to buildings would be maintained, with vehicular access to two service bays located on Arthur Street integrated into worksite management procedures.

2.3 Surroundings

The Whole Block Site

- 2.3.2 The Whole Block Site lies within an area where the predominant land uses are commercial and retail. The closest residential properties lie approximately 25m to the west of the Whole Block Site boundary on Abchurch Yard and 70m to the south-east of the site on Martin Lane and Laurence Pountney Lane. There are a total of approximately 74 dwellings within 250m of the Whole Block Site boundary, the majority of which are believed to be short term lets. In addition to the nearby Bank and Monument Stations, the Cannon Street Station is located approximately 440m to the west of the Whole Block Site.
- 2.3.3 There are a number of places of worship in the vicinity of the Whole Block Site, including the neighbouring Grade I St Mary Abchurch directly to the west of Abchurch Lane, St Clements Church to the south-east off Clement's Lane, and St Mary Woolnoth Church of England to the north-west off Lombard Street.
- 2.3.4 In addition to the Grade I St Mary Abchurch, the Grade I listed Mansion House (official residence of the Lord Mayor of London) is located approximately 110m north-west of the Whole Block Site.
- 2.3.5 There are 92 listed buildings within 250m of the Whole Block Site of which 11 are Grade I listed, 11 Grade II* listed, and 70 are Grade II listed. There are also seven Scheduled Monuments, six of which are also designated as listed buildings. There are seven listed buildings within 50m of the site, including Grade I listed St Mary Abchurch and Grade II listed 15 Abchurch Lane which both lie directly to the west of the site and have the potential to experience direct impacts to their setting.
- 2.3.6 A Scheduled Monument, the site of Roman Governor's Palace is located off Cannon Street, approximately 25m to the south-west of the Whole Block Site. In addition, the Skinners' Hall Scheduled Monument is located approximately 200m to the south-west of the Whole Block Site. Approximately 200m to the south-east of the Whole Block Site, Grade I listed The Monument is also a Scheduled Monument.
- 2.3.7 The River Thames and London Bridge are located just over 300m to the south of the centre of the Whole Block Site.

- 2.3.8 King William Street, along the northern Whole Block Site boundary, is a busy local distributor road and provides a key route for buses. It also forms part of the London Cycle Network.
- 2.3.9 Cannon Street, along the southern Whole Block Site boundary, is a wider street with a retail presence at ground floor level. It also provides bus routes and is part of the Strategic Road Network.

The Arthur Street Work Site

- 2.3.10 As for the Whole Block Site, the Arthur Street Work Site also lies within an area where the predominant land uses are commercial and retail. The closest residential property lies approximately 25m to the north-west of the site on Martin Lane.
- 2.3.11 Within a 150m study area centred on Arthur Street, there are ten listed buildings, two at Grade I, one at Grade II*, and seven Grade II. The Grade I listed Monument is also a Scheduled Monument. The Grade II listed 'Old Wine Shades' lies approximately 25m to the north-west of the site on Martin Lane. The Fishmongers' Hall Grade II* listed building and Scheduled Monument is located approximately 80m south of the Arthur Street Work Site. The Grade I listed The Monument (Scheduled Monument), lies approximately 80m to the east of the Arthur Street Work Site.
- 2.3.12 The River Thames and London Bridge are located approximately 120m to the south of the Arthur Street Work Site.

3 The Proposed Development (BSCU Works)

3.1 Introduction

3.1.1 The restricted widths of the Bank Station Northern Line platforms and passenger access routes restrict the number of passengers that can pass through the station. The BSCU Works will create additional passenger access capacity to the Northern Line at Bank Station, as well as additional capacity for interchange between the Northern and Central Lines, and between/to other Underground Lines at Bank Station. The BSCU Works will also provide step-free route(s) to the Northern Line platforms from street and DLR levels and will improve the emergency fire and evacuation protection measures.

3.2 Permanent Components of the BSCU Works

3.2.1 The BSCU Works are likely to include the following improvements and additions to the existing Bank Station facilities:

Above Ground

- a new street level Station Entrance onto Cannon Street;
- ancillary facilities; and
- street level plant.

Below Ground

- a new southbound platform and running tunnel for the Northern Line;
- conversion of the existing Northern Line southbound platform into a new concourse with four new dedicated cross passages between the two platforms which each link to a dedicated passenger route;
- a set of triple escalators leading down from the new Whole Block Site Station Entrance to an intermediate level followed by a set of triple escalators within an inclined tunnel barrel landing at the Northern Line platform level;
- basement plant areas housed below the Station Entrance level and the lower levels of the escalator box and street level plant areas;
- a main shaft housing two 17 person capacity lifts (one of which serves street, Northern Line and DLR levels and one of which serves street and Northern Line levels) and an escape/fire fighting staircase and duct work risers;
- DLR platform level works including a triple escalator up to the Northern Line level, including relocation of a number of rooms;

-
- a Central Line Link Tunnel connecting the Northern Line to the Central Line and including a pair of moving walkways. A new high voltage switchroom would be located off the proposed link passage; and
 - Central Line platform level works to include a set of escalators leading down to the Central Line Link and Northern Line. In addition, a number of electrical rooms will be housed within an existing adit between the two platforms.
- 3.2.2 The Station Entrance will occupy the eastern side of the Whole Block Site, spanning from King William Street to Cannon Street at ground level. The public entrance will be located on Cannon Street on the corner of Nicholas Lane.
- ### 3.3 Temporary Road Traffic Movements and Access
- 3.3.1 Preliminary calculations indicate that over 75 per cent of construction vehicle movements will service the Arthur Street Work Site, which lies outside the Bank Conservation Area. Vehicle access to the Whole Block Site during construction will be from Cannon Street. During construction, the additional site on Arthur Street, will enable optimised sequencing of works and reduced local disruption. All construction vehicles will use the Arthur Street Work Site as a holding area.
- ### 3.4 Temporary Northern Line Blockade During Construction
- 3.4.1 During the BSCU Works, a period of closure of the Northern Line running tunnels at Bank Station will be required (a blockade). At present, detailed proposals of how this will be implemented operationally is still under development, but is anticipated to include a 16 week blockade of the Northern Line at Bank Station (March – August 2020). Impacts on the operational network are currently under investigation and the potential to run services through Bank Station without stopping during part of the blockade period will also be considered with the overall aim of minimising disruption to services.

4 Need for the Development and Consideration of Alternatives

4.1 Need for the Development

- 4.1.1 As outlined in the introduction to this scoping report, the Bank Station Capacity Upgrade Project seeks to deal with serious shortfalls in the passenger capacity of the existing Bank/Monument Station Complex.
- 4.1.2 Bank Station is located in the heart of the City of London financial district. It is of strategic importance to the UK economy, being one of the major gateways to the City for employees and visitors. Bank Station is also a strategic network interchange served by six lines (Northern, Central, Waterloo & City, and the District & Circle at Monument, part of the same Station Complex), and the DLR, for which Bank Station is the main central London terminus.
- 4.1.3 Bank Station is the fourth busiest on the Underground Network, with 96,000 passengers boarding, alighting and interchanging during the AM peak period. Demand has increased significantly since 2003 with the Station experiencing a 25 per cent increase in entry, 29 per cent in exit and 41 per cent growth in interchange demand (to 2010).
- 4.1.4 As Bank Station becomes busier, congestion will increasingly become a problem. The Northern Line platforms suffer the worst crowding particularly in the peak periods. Passageways to the DLR, Central Line and station exits also experience congestion with queues forming for stairs and escalators.
- 4.1.5 Staff at the Station have previously needed to put controls in place to prevent overcrowding and in 2011 there were over 100 incidents (non-stopping trains at Bank Station or ticket hall closures) directly due to overcrowding. Using these disruptive control measures at Bank Station has a wider impact on the Underground Network as it causes crowding to occur at related interchange stations. Future forecasts show demand for the Station is growing and crowding will become worse unless the Station is upgraded.
- 4.1.6 Due to the growth in passengers using Bank Station, similar controls would need to be used again in the future to prevent overcrowding. To avoid the disruption and impact of using control measures at Bank Station, and to realise the benefit of Northern Line signalling upgrades, capacity at Bank Station must be increased.

4.2 Consideration of Alternatives

- 4.2.1 An assessment of alternative site options was undertaken as part of the Bank Station Capacity Upgrade Project initial design development by Mott MacDonald on behalf of LUL. Alternatives were also considered as an integral part of the tender process which included consideration of the environmental impacts of design and site options as part of bid assessment criteria.
- 4.2.2 The BSCU Works TWAO application will include an 'Assessment of Options' technical report describing the alternative sites and design options that have been studied by the project team, including designs proposed within alternative bids submitted to LUL.
- 4.2.3 The BSCU Works EIA will include consideration of alternatives as required by the EIA Regulations which will summarise the main alternatives studied as outlined above. Discussion will include details of why the proposed design was brought forward to the detailed design stage, why alternatives were rejected and how potential environmental effects were considered.

5 EIA – Proposed Approach

5.1 General Assessment Approach

- 5.1.1 The ES will be prepared to comply with the requirements of the Transport and Works (Applications and Objections Procedure)(England and Wales) Rules 2006 (the TWA Rules). Where a project requires EIA, the Rules require an assessment in accordance with European Union EIA Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment as amended by Council Directives 97/11/EC, 2003/35/EC and 2009/31/EC (and codified by Directive 2011/92/EU).
- 5.1.2 It is acknowledged that the European Commission are currently discussing and negotiating a new EIA Directive which is expected to be passed in 2014. Should this timing be met, implementation into UK EIA Regulations is likely in 2016. Whilst this timing means that the regulations are unlikely to apply to the Bank Station applications, the project team will nonetheless strive to comply with expected forthcoming regulatory changes, as well as meeting extant requirements.
- 5.1.3 Whilst the exact regulatory changes that will be made are at present unclear, potential key EIA Directive amendments relevant to the Bank Station Capacity Upgrade Project could relate to the consideration of climate change and the monitoring of environmental effects post consent. Such elements are included in the scope of this assessment and the project team routinely engage with the Institute of Environmental Management and Assessment (IEMA) in order to remain informed on legislative developments.
- 5.1.4 Assessment topic specific guidance will be referenced in the relevant specialist chapters of the ES. In preparing the ES, the following general guidance will be considered:
- Department for Transport (DfT), 2006 – A Guide to Transport and Works Act Procedures;
 - TWA Orders Unit, Department for Transport, 2008 – TWA Good Practice Tips for Applicants;
 - Department of the Environment, Transport and Regions (DETR) 1999 – Circular 02/99 – Environmental Impact Assessment;
 - DETR 2000 – Environmental Impact Assessment – A Guide to Procedures;
 - Office of the Deputy Prime Minister 2004 – Note on Environmental Impact Assessment Directive for Local Planning Authorities;

- Department of the Environment (DoE) 1995 – Preparation of Environmental Statements for Planning Projects that require Environmental Assessment – A Good Practice Guide;
- Highways Agency 2008 – Design Manual for Roads and Bridges, Volume 11 (Environmental Assessment), Section 2 (Environmental Impact Assessment), Part 5 (Assessment and Management of Environmental Effects);
- Institute of Environmental Management and Assessment (IEMA) 2004 – Guidelines for Environmental Impact Assessment; and
- Environment Agency 2002 – Scoping Guidance on the Environmental Impact Assessment of Projects.

5.1.5 Although it is acknowledged that they are in draft form, lessons will be drawn from the following documents as appropriate:

- CLG 2006 – Amended Circular on Environmental Impact Assessment. A Consultation Paper; and
- CLG 2006 –EIA: A Guide to Good Practice and Procedures – A Consultation Paper.

5.1.6 The assessment of each topic included in the scope of the EIA will be carried out by specialists with relevant professional expertise and experience. The specialists will be responsible for ensuring that the methods they use are appropriate, reflect best practice and can be defended within the consent process. The assessment process for each topic will adopt a common framework comprising the following steps:

- definition of works to be assessed;
- identification and scoping of issues;
- consultation with relevant stakeholders to identify key concerns and to obtain data;
- confirmation of scope;
- collection of any required baseline environmental data by research and survey;
- evaluation of appropriateness and limitations of assessment methodology (including data constraints);
- identification of resources and receptors;
- prediction of impacts (including modelling where appropriate, consideration of the robustness of predictions and likelihood of occurrence);

- identification of effects;
- evaluation of significance;
- identification of any required mitigation options and evaluation of any impacts associated with the mitigation;
- evaluation of residual effects or risks; and
- any requirements for future monitoring and environmental management systems to verify predictions and fine-tune mitigation.

5.2 Determination of the Scope

5.2.1 Establishing the scope of the assessment in a rigorous and transparent manner is a key step in the assessment process. Consultation with the TWA Orders Unit, local planning authority, relevant statutory organisations and other stakeholders is an essential element of this process and this EIA scoping report is designed to provide stakeholders with sufficient information to form an opinion over the adequacy of the proposed scope of assessment and to ensure that issues potentially giving rise to 'likely significant effects' will be addressed by the EIA.

5.2.2 LUL commenced Stakeholder consultation during the course of the design development, including during the bid process and since contract award. Key stakeholders already consulted on the Bank Station Capacity Upgrade Project include the City of London Corporation, the Church of England and other parts of Transport for London such as surface transport. Initial consultation with other consultees including the Environment Agency and English Heritage has also been undertaken. Information in this scoping report supports the request for a scoping opinion and provides a basis for further engagement with stakeholders.

5.2.3 Schedule 1 of the TWA Rules requires the ES to include (*inter alia*) a description of the *likely significant effects of the development on the environment*. This should cover the *direct effects and any indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects of the project* as well as a description of the forecasting methods used to assess the effects on the environment. Schedule 1 also identifies a number of aspects of the environment that should be considered, namely *population (human), fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the interrelationship between the above factors*.

5.2.4 A proposal of how these aspects will be considered and assessed in the EIA is included in the following sections, which also include discussion of any aspects which it is proposed to scope out of the assessment.

- 5.2.5 Establishment of the proposed scope of assessment has additionally been guided by the Environment Agency 'Handbook for Scoping Projects (2002)', as well as Government Circular 02/99, the Department for Communities and Local Government EIA: A guide to good practice and procedures (A consultation paper).
- 5.2.6 Based on the information currently available regarding the BSCU Works (as outlined in Section 3), previous studies relating to the Whole Block Site and surroundings undertaken by LUL and their consultants, planning policy and knowledge of the sites and surroundings, a judgement has been made on which topics or particular aspects of them should be 'scoped in' and 'scoped out' of the EIA.
- 5.2.7 Issues that are scoped into the EIA are judged likely, without effective mitigation, to have the potential to cause significant effects. Issues that are scoped out of the EIA are those which it is considered are not likely to lead to significant effects. Where insufficient information is available to make a reasonable judgement at this stage, a precautionary approach has been adopted and that issue scoped in. The decision to scope out issues is based upon factors such as a high degree of development-receptor separation, the lack of impact pathways or the known low value or sensitivity of impacted resources/receptors.
- 5.2.8 It should be noted that as the assessment proceeds, topics will be reviewed and their potential significance may be re-evaluated in response to additional information or changes to the project definition.
- 5.2.9 Further information regarding the rationale for inclusion or exclusion of issues is provided in the following specialist sections. For those included within the scope of the EIA, an outline of the assessment method is also provided.

Spatial Scope

- 5.2.10 The following specialist sections describe the rationale for determining the specific area within which each assessment will be focussed. Study areas vary depending on the nature of the impacts and the locations of resources and receptors with the potential to be impacted. Assessments will also interrogate the design of the BSCU Works in order to ensure that an appropriate study area is considered – for example by examining the extent to which the design could be visible as part of the Townscape assessment or by including areas where major utilities works will be required. Where there is uncertainty in relation to design parameters, maximum/minimum limits of deviation in line with a 'Rochdale Envelope' type approach to consider the worst case will be identified and considered for assessment purposes. The approach known as the Rochdale Envelope has developed based on case law in which design parameters or limits of deviation for environmental assessment are established.

- 5.2.11 The description of the development will include a description and assessment of any major utilities works that will be needed to enable the development, regardless of whether these will be included as part of the application, or undertaken under other consents.

Temporal Scope: Baseline and Assessment Years

- 5.2.12 The approach to assessment will be to assess the environmental impacts of the BSCU Works at key stages in its construction and operation/use and, if relevant, decommissioning. These are, where appropriate, then compared to the situation prevailing before the construction of the BSCU Works has commenced (i.e. the current baseline), and if relevant to the situation that would prevail in the future without the BSCU Works (i.e. the projected future baseline).
- 5.2.13 The 'current baseline year' is taken as 2013 since this is the period in which the majority of baseline work will be undertaken. In some cases other current baseline years may be used and this will be explained (e.g. where a particular baseline survey occurs in 2014 or where data from the public record is utilised which may only be available for previous years). Assessment years that are considered generally include:
- Current baseline (2013);
 - As relevant, the future baselines in the absence of development (2016 and 2021);
 - At commencement of operation of the BSCU upgrades (2021).
- 5.2.14 The future baseline is the theoretical situation that would exist in the absence of the development. It is typically based upon extrapolating the current baseline forward using technical knowledge of changes to predict this (e.g. traffic growth over time, etc.).
- 5.2.15 Consideration will also be given to any end of life impacts that will occur due to decommissioning of the development.

5.3 Structure of Assessment Chapters

- 5.3.1 For ease of reference, the assessment of each topic in the ES will be presented within a common chapter structure as follows:
- introduction;
 - legislative and planning policy context;
 - assessment methodology;
 - baseline conditions;

- prevention/reduction of impacts through design;
- assessment of effects;
- mitigation;
- residual effects;
- inter-relationships and cumulative effects;
- limitations; and
- conclusions.

5.3.2 If applicable, the way that environmental effects have been prevented or reduced through design or through standard working practices (during construction or operation) will be described within the 'Prevention/Reduction of Impacts Through Design' section.

5.3.3 However, it is important that mitigation or enhancement measures are dealt with transparently in the assessment process. Therefore, rather than a detailed discussion, the effects of designed in or standard working practices will be summarised in a tabular format wherever possible.

5.4 Assessment of Effects and Defining Significance

5.4.1 EIA assesses environmental effects on resources and receptors, which for this assessment are defined as follows:

- Resources are defined as bio-physical features or items of 'environmental capital'; examples include species and their habitats, aquifers, access routes, and community facilities.
- Receptors comprise human beings, either individually or collectively, and the socio-economic systems on which they depend; for example, residents, employees, communities and economies.

5.4.2 For consistency and in an attempt to allow comparison between topics, the methodology described in this section will be applied where appropriate. Notable amongst the exceptions to this are the assessment of air quality which is assessed in terms of the predicted concentrations of key emissions to air, noise and vibration impacts which are assessed according to British Standards and transport which utilises criteria established for similar schemes. Assessment of ground contamination additionally integrates consideration of risk (likelihood of impacts).

5.4.3 It should be noted that in the context of this assessment and the general methodology utilised, the terms impact and effect are distinctly different. The EIA Directive, by its name, suggests that an assessment of project environmental impacts is required; however, the impacts of the BSCU Works

may or may not result in significant effects on the environment, depending upon the presence and sensitivity of receptors. It is therefore an assessment of *effects* that is required by Rule 11 and Schedule 1 of The TWA Rules.

- 5.4.4 The methodology followed by most assessment chapters is designed to consider whether impacts of the project will have an effect on any resources or receptors. Assessments broadly consider the magnitude of impacts and sensitivity of resources/receptors that could be affected in order to classify effects according to the categories shown in Table 5.1, but the methodology considers a number of factors as illustrated in Figure 5.1.
- 5.4.5 For each topic area of assessment which fully or in part utilise the methodology, the categories of resource/receptor sensitivity (low to very high) and magnitude of impact (very low to high) will be appropriately described and defined.

Table 5.1: Classification of Effects

Sensitivity of Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

- 5.4.6 Where appropriate, the definition of resultant effect categories as shown in Table 5.1 – from negligible to major will also be defined on a topic by topic basis. Where this is not practical or sensible for a particular topic, the generic definitions as shown in Table 5.2 will be used to guide assessment.

Table 5.2: Effect Definitions

Effect	Criteria
Major	These effects may represent key factors in the decision making process. Potentially associated with sites and features of national importance or likely to be important considerations at a regional or district scale. Major effects may relate to resources or features which are unique and which, if lost, cannot be replaced or relocated.
Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision making issues. Nevertheless, the cumulative effects of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.
Minor	These effects may be raised as local issues but are unlikely to be of importance in the decision making process. Nevertheless, they are of relevance in the detailed design of the project.
Negligible	Effects which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

5.4.7 Following the classification of effects using this methodology, further consideration of whether an effect is significant and requires mitigation is carried out using professional judgement, but taking account of:

- the positive or negative nature of the effect;
- whether the effect is permanent or temporary;
- the duration/frequency or likelihood of the effect;
- whether the effect is direct or indirect (for example an indirect effect could be that of a visual change on tourism); and,
- any secondary effects (for example visual impacts could result from any implementation of noise barriers).

5.4.8 If mitigation is proposed, the residual effect following mitigation is categorised using the same system. The final stage of the assessment is to consider whether residual effects are likely and therefore significant.

5.4.9 This approach is essentially in line with CLG guidance – EIA: A guide to good practice and procedures, a consultation paper, June 2006.

5.5 Mitigating Adverse Effects

5.5.1 Schedule 1 of the TWA Rules states that an EIA should include *a description of the measures envisaged to prevent, reduce and where possible remedy any significant adverse effects on the environment.*

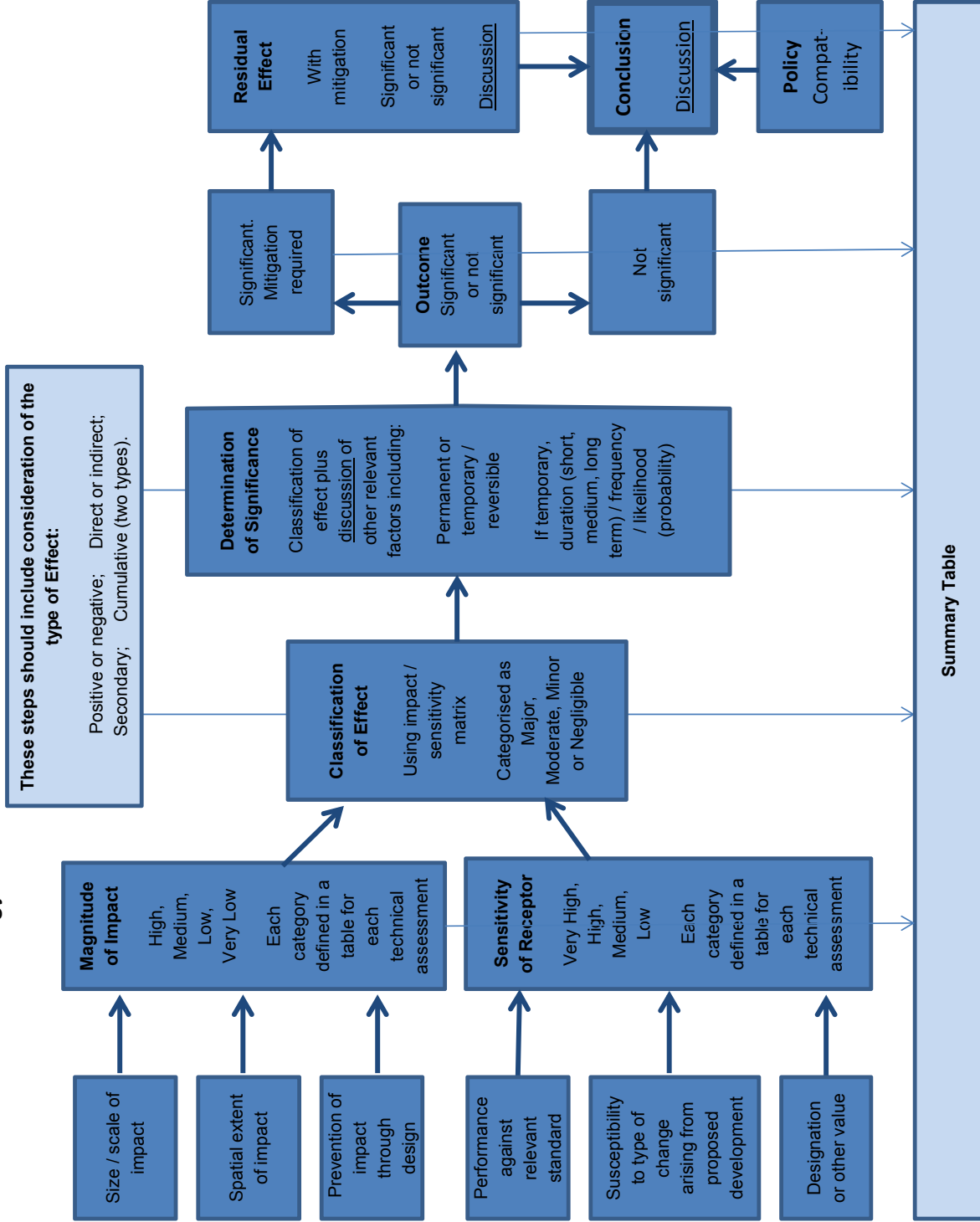
- 5.5.2 The EIA process provides the opportunity for likely significant environmental effects to be determined at an early stage in the formulation of development proposals, for the design to be developed to reduce or eliminate undesirable environmental effects, and where elimination is not possible for mitigation measures to be incorporated to reduce undesirable environmental effects. Mitigation measures can be applied through the consideration of alternatives, physical design, provision of specific control equipment, project management or operation and other means. This process has already begun as part of the design and EIA process (mitigation through design) and will continue as the EIA progresses.
- 5.5.3 The fundamental aim of mitigation is to reduce the significance of the environmental effects. Where mitigation fails to eliminate entirely any (negative) environmental effect, the remaining component of the effect is known as the residual effect.

5.6 Inter-Relationships and Cumulative Effects

- 5.6.1 As required by Schedule 1 of the TWA Rules, the assessment will also have regard to cumulative effects. Whilst the technical chapters will address the environmental effects of the BSCU Works for each environmental discipline, it is also important to consider how these effects may combine with one another (inter-relationships) and with those of other proposed development projects in the vicinity (cumulative effects).
- 5.6.2 To fully define the terms:
- ‘inter-Relationships’ occur between the individual environmental effects of the BSCU Works and have the potential to combine together with one another at receptors and lead to significant effects; and
 - ‘cumulative effects’ arise as a result of the BSCU Works in combination with other large scale developments in the vicinity of the BSCU Works.
- 5.6.3 Inter-relationships will be considered within specialist assessment chapters themselves, but will be summarised in the inter-relationships and cumulative effects chapter.
- 5.6.4 The assessment of cumulative effects requires information regarding other major developments which will be identified through consultation with the local planning authority and other relevant authorities. Developments will be considered as part of the cumulative effects assessments on the basis of those that are:
1. Under construction;
 2. Permitted application(s), but not yet implemented;

3. Submitted application(s), not yet determined;
 4. Identified in the relevant development plan (and emerging development plans – with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited, and
 5. Identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.
- 5.6.5 Information regarding nearby developments will be fed into specialist assessments for consideration on a topic by topic basis. As per the approach to inter-relationships, cumulative effects assessments will be summarised in the inter-relationships and cumulative effects chapter.
- 5.6.6 The BSCU Works will consider cumulative effects of construction and operation of the BSCU Works proposals, with the proposed OSD.
- ## 5.7 Planning Policy
- 5.7.1 Each assessment topic will, as appropriate, include a listing of relevant legislation and identification and assessment of adherence to relevant National, Regional and Local planning policies. Every topic will also be considered (individually and collectively) in the particular and overarching context of the National Planning Policy Framework 2012.
- ## 5.8 Proposed Technical Scope
- 5.8.1 The following Sections 6 to 19 provide details of the ‘technical’ assessment topics and issues to be scoped in or scoped out of the EIA. Details of the rationale for scoping the topic into or out of assessment are provided, as well as details of the scope of proposed assessments.
- 5.8.2 A summary table of topics scoped into and out of the assessment with a brief summary explanation is provided in Section 20 of this scoping report and Section 21 outlines the proposed structure of the ES.

Figure 5.1: EIA Assessment Methodology



6 Townscape and Visual Effects

6.1 Introduction

- 6.1.1 The BSCU Works comprise two work sites occupying two, discrete, urban townscape locations within close proximity to each other, so the general approach for assessing the various impacts will comprise a townscape-led assessment. Townscape is defined as *the landscape within the built-up area, including the buildings and the relationships between them* (Guidelines for Landscape and Visual Impact Assessment, Landscape Institute and Institute of Environmental Management & Assessment, 2013). It is the mix of characteristics and perceptions that make up and contribute to townscape character and create a 'sense of place' or identity.
- 6.1.2 This section provides information on the likely effects of the BSCU Works upon the townscape resources and visual receptors within and around the two sites. A clear distinction is drawn between such impacts:
- **townscape** resources relate to the physical characteristics or components of the environment, which together form the character of that townscape, including buildings, carriageways, paths, vegetation and water areas; and
 - **visual** receptors are individuals whose views of that townscape may change as a result of the BSCU Works, e.g. people working in offices or transport users passing through the area.
- 6.1.3 The Townscape and Visual Effects chapter of the ES will be concerned with the character of the study area as a whole and the perceptions of the townscape for people using the area for whatever purpose. As part of the assessment process, the particular character of conservation areas will be taken into account. Details of listed buildings and potential impacts on those buildings, both direct impacts and impacts on their settings, will be addressed in Chapter 9: Built Heritage. Potential impacts on particular historic features of conservation areas will also be addressed in Chapter 9. Below-ground heritage features will be assessed in Chapter 10: Archaeology. Cross-referencing between the chapters will be included to clarify the text as necessary.
- 6.1.4 The proposed BSCU Works are detailed in Section 3 of this EIA Scoping Report. It is envisaged that OSD will be implemented upon completion of the BSCU Works, the scale and massing of which will be similar to the existing buildings and in context with its surroundings. The BSCU Works also present opportunities for local enhancements through good urban design.

6.2 Description of the Baseline

Policy Context

- 6.2.1 A review of planning policy relevant to the townscape context will be undertaken, in particular the City of London Corporation Core Strategy and 'Saved' Unitary Development Plan (UDP) Policies, and including the London View Management Framework (LVMF, March 2012), which could have potential design implications during the construction phase.

Townscape Character

- 6.2.2 The Sites lie in a densely developed urban area at the heart of the City of London. The Whole Block Site is located on the southern edge of the Bank Conservation Area. Bank is the largest of 26 conservation areas in the City of London, covering an area of over 24 hectares. The southern boundary of the Conservation Area is Cannon Street, and the area immediately to the south of the Whole Block Site is not within a conservation area. The Whole Block Site is also within 500m of the Guildhall, Bow Lane, Queen Street, Laurence Pountney Hill, Leadenhall Market and Eastcheap Conservation Areas. The Arthur Street Work Site is not within a Conservation Area.
- 6.2.3 Much of the street pattern of the area still follows the layout of medieval London, with narrow alleys such as Abchurch Lane, Nicholas Lane and Clement's Lane. Buildings in the area are mainly in office use with shops, cafés, pubs and restaurants at ground level. There is little open space in the area and very few street trees within the immediate vicinity of the Whole Block and Arthur Street Sites. However, there is a small paved square, Abchurch Yard, in front of the entrance to St Mary Abchurch in Abchurch Lane, which links through to King William Street to the west of the church.
- 6.2.4 The area is highly permeable, especially for pedestrians, with its network of alleys and lanes, which provide short-cuts to different areas of the City. Some aspects of legibility are also good, with the landmarks of The Monument and the Bank of England at either end of King William Street, the spire of St Mary Abchurch and the distinctive architecture of the north-west front of St Mary Woolnoth (at the northern end of King William Street). However, being one of the most densely developed areas of the City, the streets are busy and often crowded, and some of the narrower streets do not cope with the high footfall, resulting in people walking in the road.
- 6.2.5 The main roads such as King William Street, Cannon Street and Bank Junction where six roads meet are busy, noisy and congested with traffic. King William Street itself is heavily used by vehicles, particularly buses, taxis and goods vehicles. The side streets in the area are much quieter and many are closed to vehicular traffic at one end. Priorities set out in the Bank Area Enhancement

Strategy include reducing conflict between modes of transport and improving safety, improving the pedestrian environment, and improving provision for cyclists,

- 6.2.6 There is a small residential population in the City of London, but a high population in the area during working hours; working hours are long due to differing trading hours. The streets tend to be most busy in the rush hour and at lunchtime. City workers mainly arrive in the area by public transport or bicycle (there are cycle lanes on both sides of King William Street) and private car use is relatively low. Tourists and school groups also visit the area to see The Monument, the Bank of England, the 17th century churches and the Mansion House. At the weekend the area is quieter, though pubs and clubs are often busy in the evenings, but overall, the area is not tranquil for much of the time.
- 6.2.7 The study area has a distinctive townscape character which derives from its notable buildings and institutions, its location in the City of London and the area's historical and cultural importance. Although King William Street and Cannon Street are wide in comparison to other surrounding streets, their substantial buildings, which range from six to eight storeys, have a strong influence on the proportions of the space, although it tends to be dominated by the volume of traffic, particularly buses.
- 6.2.8 There are several architecturally notable buildings close to the Whole Block and Arthur Street Sites and many are listed, including:
- Church of St Mary Woolnoth, Lombard Street (1716-1727, Hawksmoor) – Grade I;
 - Church of St Mary Abchurch, Abchurch Lane (1681-1687, Wren) – Grade I;
 - Church of St Clement, Clement's Lane (1683-1687, Wren) – Grade I;
 - 1 King William Street (1921, Architects: Campbell & Jones) – Grade II;
 - Phoenix House, 3-7 King William Street (1915, by HL Anderson with additions by Campbell & Jones) – Grade II;
 - Mansion House, Mansion House Street (1739-53, by G. Dance the elder) – Grade I;
 - Bank of England, Threadneedle Street, Prince's Street, Lothbury and Bartholomew Lane (various elements including remnants of the 1788-1808 building by J Soane, largely rebuilt 1921-37 by Herbert Baker) Grade I; and
 - The Monument, Monument Street (1671-77, by Wren) – Grade I; also a Scheduled Monument.

Visual Amenity

- 6.2.9 Three of the Protected Vistas described in the LVMF could potentially be affected by the BSCU Works, as follows:
- the Whole Block Site is partly within and the Arthur Street Work Site entirely within the Background Wider Setting Consultation Area of the Protected Vista from Assessment Point 4A.1 from Primrose Hill to St Paul's Cathedral;
 - the Whole Block Site is partly within the Wider Setting Consultation Area and the Arthur Street Work Site entirely within the Viewing Corridor of the Protected Vista from Assessment Point 5A.2 from Greenwich Park to St Paul's Cathedral; and
 - the Arthur Street Work Site is partly within the Wider Setting Consultation Area of the Protected Vista from Assessment Point 6A.1 from Blackheath Point to St Paul's Cathedral.
- 6.2.10 The Whole Block Site is also visible from the viewing platform of The Monument and in the view from the northern end of King William Street towards The Monument. There are direct views into Arthur Street from The Monument looking along Monument Street, across King William Street.
- 6.2.11 The following key visual receptors have been identified:
- pedestrians, including tourists and visitors, on King William Street and Cannon Street both in the immediate vicinity of the Whole Block Site and also looking towards the site on the approaches from either end of each road;
 - pedestrians, including tourists and visitors, on King William Street and Upper Thames Street in the immediate vicinity of Arthur Street;
 - people looking along King William Street from the north and south;
 - people looking along Cannon Street from east and west;
 - visitors to the viewing platform of The Monument;
 - drivers and passengers of private vehicles and public transport on King William Street, Cannon Street and Upper Thames Street;
 - office workers and other occupants of buildings on King William Street and Cannon Street;
 - occupants of buildings fronting both sides of Arthur Street and buildings on King William Street and Upper Thames Street with windows facing Arthur Street; and
 - people in tall office buildings in the wider study area.

- 6.2.12 Nine representative viewpoint locations were requested by the City of London during the early stages of consultation on the OSD (Nos. 1 to 9), and two additional locations were requested more recently at a subsequent meeting (Nos. 10 and 11), as listed in Table 6.1. Wireline photomontages will be produced for all of these, which will assist in determining the six most appropriate to develop as fully rendered photomontages.
- 6.2.13 To date the viewpoints have been recommended by the City of London Corporation in relation to the OSD only. One or two additional representative viewpoints will also be included to show views of the Arthur Street Work Site, the locations to be agreed with the City of London Corporation along with a possible requirement for a further photomontage.

Table 6.1: Proposed Representative Views

No.	Viewpoint Location
1	Looking east from 78-80 Cannon Street (west of Cannon Street Station)
2	Looking north-east from pedestrianised section of Laurence Pountney Hill
3	Looking north-west from junction of Cannon Street and Martin Lane
4	Looking north-west from junction of London Bridge and Cannon Street (Monument Junction)
5	Looking north-west from junction of King William Street and Cannon Street (approx. 68 King William St)
6	Looking south-west from Nicholas Lane (approx. from No.7)
7	Looking south from Abchurch Lane and King William Street (approx. 85 King William St)
8	Looking south-east from Abchurch Yard (between Sherborne House and St Mary Abchurch)
9	Looking south-east from junction of Lombard Street and King William Street
10	The Monument viewing platform
11	20 Fenchurch Street – a 37-storey building under construction (known as the 'Walkie Talkie')

6.3 Potential impacts

6.3.1 A number of townscape resources and visual receptors could potentially be affected by the construction of the development. These include:

- townscape character (the combination of townscape elements and the way in which they are perceived);
- designated townscape including conservation areas, key views and vistas;

- townscape/streetscape elements such as listed and other historic buildings, distinctive street facades, gateways, spaces, key pedestrian and vehicle movement corridors; and
 - recreational users, people at work, pedestrians, people in vehicles and, to a lesser extent, local residents.
- 6.3.2 However, due to the densely developed urban nature of the area, the zone of visual influence (ZVI) of the development will be relatively limited, with distant views only possible from high buildings and The Monument.
- 6.3.3 Impacts on townscape and visual amenity resulting from the construction of the development are likely to be adverse, however, they will be temporary. Ultimately the operational BSCU Works combined with the completed OSD in place of the existing, generally poor quality buildings, are likely to offer beneficial impacts attributable to the presence of good quality new built elements and the influence on existing townscape character, scale, pattern and permeability, in addition to improvements to the public realm streetscape.
- 6.3.4 The construction phase is likely to result in a number of potential impacts on townscape character and visual receptors, due to changes to the existing townscape resources and/or views, including impacts of temporary features such as construction plant and construction activity.
- 6.3.5 Construction of the BSCU Works has the potential to result in temporary impacts on the local townscape through:
- loss of existing townscape features and interruption to the continuity of street facades;
 - reduction in townscape quality due to the presence of construction traffic, plant and equipment and the introduction of built fabric (buildings, frontages etc);
 - further reduction of tranquillity due to elevated noise and vibration levels; and
 - loss of street space due to temporary and permanent land take.
- 6.3.6 The extent of potential impacts on visual amenity during construction will be minimised by the limited height of the BSCU Works, however, taller elements such as cranes will be more prominent. Features impacting on views will include:
- presence of construction traffic, plant and equipment;
 - introduction of new built form; and
 - floodlighting.

6.4 Assessment Methodology

6.4.1 Desk-based studies will be undertaken, which will review planning policy relevant to townscape and views, including policy relating to conservation areas in addition to non-designated areas of townscape, and strategic or locally important view corridors. Geographical data sets will be created to test the theoretical visibility of the BSCU Works, which will inform the visual assessment and field surveys. Field surveys will be undertaken to verify the desk-based study and refine the ZVI of the sites.

6.4.2 The method of Townscape and Visual Impact Assessment (TVIA) which will be adopted for the BSCU Works has been devised to address the specific impacts likely to result from a development of the scale and nature of the project. The methodology draws upon the following established best practice guidance:

- Guidelines for Landscape and Visual Impact Assessment (Landscape Institute and Institute of Environmental Management and Assessment, Third Edition, 2013);
- Landscape Character Assessment: Guidance for England and Scotland (Countryside Agency and Scottish Natural Heritage, 2002).

6.4.3 Photomontages of the construction phase will be agreed with the City of London and will be produced in accordance with:

- Appendix C of the London View Management Framework (LVMF): Accurate Visual Representations; in conjunction with
- Landscape Institute Advice Note 01/11: Photography and photomontage in landscape and visual impact assessment.

6.4.4 The extent of the study area for the assessment will be determined through desktop study and site work to assess townscape character and views of the two sites. A detailed study of the existing townscape components and character and views of the application sites and the study area will be carried out in consideration of the following:

- site context;
- topography;
- buildings and pattern of built form;
- vegetation and open spaces;
- carriageways and pedestrian access;
- townscape character; and
- representative views.

- 6.4.5 This will be supported by tables, drawings and photographs as appropriate. The planning context with respect to townscape character and visual amenity will also be assessed, taking into account relevant European, national, London and local planning policies. The baseline study will form the basis of the assessment of the predicted impacts of the BSCU Works.

Townscape Character Assessment Methodology

- 6.4.6 The assessment of townscape impacts will be structured around the identification of townscape character areas. Within the study area there will be areas where development would take place resulting in direct effects, or where there is a degree of intervisibility between the development sites and the surrounding townscape causing indirect effects, or where no change would be perceptible.
- 6.4.7 The townscape assessment will address the impacts of the project on townscape resources and character. It will also address direct and indirect impacts on the setting and character of conservation areas. The assessment of impacts on any cultural heritage resources will be covered in the Built Heritage chapter; however, this will be cross-referred to the Townscape and Visual Effects chapter where relevant, and the townscape assessment process will involve close liaison between the built heritage and townscape specialist consultants.
- 6.4.8 Townscape impacts could arise from the addition of, or changes to, physical features in the townscape. These could affect the physical character of the townscape and/or views within it, including people's enjoyment of historic features such as listed buildings. Potential impacts on the settings of listed buildings specifically, are addressed in Section 9: Built Heritage. Any significant impacts will be identified taking into account the sensitivity of the townscape and the magnitude of impact that they are likely to experience.
- 6.4.9 Each townscape character area will be assigned a sensitivity based on the character and quality of the existing townscape and its ability to accommodate change of the type envisaged due to the project. Sensitivity will be classified as set out in Table 6.2 below.

Table 6.2: Criteria for the Classification of Sensitivity of Townscape Areas

Classification	Sensitivity of Townscape Area
Very High/ High	Townscape of relatively distinctive components and characteristics, sensitive to small changes.
Medium	Townscape of relatively common components and characteristics, reasonably tolerant of changes.
Low	Townscape of relatively inconsequential components and characteristics, the nature of which is potentially tolerant of substantial change.

6.4.10 These classifications will be informed by the criteria set out in Table 6.3 below.

Table 6.3: Criteria for the Classification of Sensitivity of Townscape Resources

Resource	Sensitivity		
	High	Medium	Low
Townscape quality/ condition	High or moderate quality/ good condition and largely intact	Moderate or low quality/ moderate condition demonstrating some intactness	Low quality/ poor condition and disparate elements
Sense of place/ legibility	Strong sense of place/ identity	Moderate sense of place/ identity	No sense of place
Unspoilt character	Demonstrates unspoilt characteristics	Demonstrates a degree of change but with some unspoilt characteristics	Demonstrates high degree of change
Scarcity of the resource	Particularly scarce or fragile townscape	Mainly common features, but occasional interesting features	Common features found in many cities/ towns
Conservation interests	Historic or ecological interests which contribute significantly to townscape character	Some historic or ecological interests which contribute to townscape character	Limited to no historic or ecological interests
Tranquillity	Provides tranquil/ reflective locations	High use townscape with some quiet areas	High use townscape

6.4.11 Magnitude of impact will be determined through a combination of the scale of the development, the type of development and the level of integration of new features with existing elements. Magnitude of impact will be classified set out in Table 6.4 below.

Table 6.4: Criteria for the Magnitude of Townscape Impact

Classification	Magnitude of Impact
High	Ranging from a limited change in landscape characteristics over an extensive area, to an intensive change over a more limited area.
Medium	Moderate change in a localised area.
Low	Minor change in a localised area.
Very Low	Virtually imperceptible change in any component.
Neutral	No change discernible in any component.

Visual Assessment Methodology

- 6.4.12 It is widely accepted by those experienced in environmental assessment that visual effects tend to decrease with distance. The initial site assessment has identified the influence of buildings and urban form on potential views of the BSCU Works. Further studies will be undertaken to establish the extent of potential views to inform an appropriate radius for the study area. The resulting ZVI will be reviewed against the following criteria in order to determine a selection of representative views which will form the basis of the visual assessment:
- receptor function/activity;
 - distance from the application site;
 - topography and elevation;
 - degree and period of exposure;
 - designation of the viewing place; and
 - distribution of receptors.
- 6.4.13 Representative viewpoints will cover a range of receptor groups and locations from close, middle and long distance and will be selected to adequately illustrate the impact of the BSCU Works. Visual receptors (based on representative views) will be assigned a category of sensitivity based on a combination of the activity and expectations of the predominant receptor type (e.g. tourists, people at work etc.) and the location, context and importance of the existing view in relation to the type of development proposed. Sensitivity of receptors will be classified as very high, high, medium or low, as in Table 6.5.

Table 6.5: Criteria for the Classification of Sensitivity of Visual Receptors

Classification	Sensitivity of Receptor
Very High/ High	Views for receptors with proprietary interest and/or prolonged viewing opportunities, or engaged in activity resulting in a high interest or appreciation of the view (e.g. residents or visitors engaged in recreation or tourism whose attention is focussed on the townscape) and/or a high value of existing view (e.g. conservation area).
Medium	Activity resulting in a medium interest or appreciation of the view (e.g. people engaged in outdoor activity that does not focus on an appreciation of the townscape, such as walking or cycling to work) and/or a medium value of existing view (e.g. urban area with no particular historic or aesthetic value). Views for receptors with moderate interest in their environment, such as people in offices, pedestrians, and people in restaurants and bars.
Low	Activity resulting in a low interest or appreciation of the view, or passing or momentary interest in everyday surroundings (e.g. people at work or people in vehicles travelling through the area) and/or low value of existing view (e.g. mundane urban area).

- 6.4.14 Magnitude of visual impact results from a combination of the degree of change to the view resulting from the BSCU Works, including the extent of the area over which the changes would be visible, the period of exposure to the view and reversibility. Magnitude of impact will be classified as high, medium, low, very low or neutral, as in Table 6.6.

Table 6.6: Criteria for the Magnitude of Visual Impact

Classification	Magnitude of Impact
High	High degree of change to existing view (e.g. loss of characteristic features) and/or high degree of exposure to view (e.g. close or open views).
Medium	Medium degree of change to existing view (e.g. partial loss of characteristic features) and/or medium degree of exposure to view (e.g. middle-distance or partial views).
Low	Low degree of change to existing view (e.g. limited loss of characteristic features) and/or low degree of exposure to view (e.g. long-distance, interrupted or glimpsed views).
Very Low	Barely perceptible change to existing view and/or very brief exposure to view.
Neutral	No change discernible in existing view.

Classification of Impacts

- 6.4.15 The potential impacts of the BSCU Works upon the existing (baseline) townscape character and receptors' views of that townscape, will be identified and assessed for the construction phase. Distinctions will be drawn between temporary, permanent and residual impacts. Townscape and visual impacts will

be further categorised as being either direct (e.g. introduction of built form), or indirect (e.g. off-site visual impact of construction traffic) and permanent or temporary.

Assessment of Effects

- 6.4.16 Whilst there will be a degree of professional judgement involved in determining the significance of townscape and visual effects, they can broadly be determined by the interaction of the sensitivity of receptor and magnitude of impact. This interaction results in categorisation of effects as shown in Table 6.7.

Table 6.7: Classification of Townscape and Visual Effects

Sensitivity of Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

- 6.4.17 Environmental effects will also be identified as being beneficial, neutral or adverse. A textual description of townscape and visual effects is given in Table 6.8.

Table 6.8: Classification of Townscape and Visual Effects

Effect	Townscape and Visual Criteria	
Major	<ul style="list-style-type: none"> Potentially associated with sites and features of national importance or likely to be important considerations at a regional or district scale. Major effects may relate to resources or features which are unique and which, if lost, cannot be replaced or relocated. Effects which even in isolation, are likely to be key factors in the decision making process. 	
	<p>Townscape: where the proposed changes would be sufficiently large to substantially alter important townscape features/ valued aspects of townscape.</p>	<p>Visual: where the proposed changes would be sufficient to substantially alter a nationally important view, or view of high scenic quality.</p>
Moderate	<ul style="list-style-type: none"> These effects, if adverse, are likely to be important at a local scale and the cumulative effects of such issues may lead to an increase in the overall effects on a particular area or on a particular resource or receptor. Effects which on their own, could have a material influence on decision making and particularly so when combined with other similar effects. 	
	<p>Townscape: where the proposed changes would be out of scale with the underlying character of an area or noticeably alter a townscape feature or aspect of townscape.</p>	<p>Visual: where the proposed changes to views would be out of scale with the existing view or noticeably alter a view</p>
Minor	<ul style="list-style-type: none"> These effects may be raised as local issues and may be of relevance in the detailed design of the project. In isolation, these factors are unlikely to not likely to be critical in the decision making process, however when combined with other effects, may be relevant, particularly if they lead to a cumulative adverse effect on a particular resource or receptor. 	
	<p>Townscape: where proposed changes would be intermittent and at slight variance with the underlying character of an area and townscape features.</p>	<p>Visual: where proposed changes to views would be intermittent and at slight variance with the existing view.</p>
Negligible	<ul style="list-style-type: none"> Effects which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error. Effects which are unlikely to influence decision making, irrespective of other effects. 	
	<p>Townscape: where proposed changes would have an indiscernible effect on the character of an area and townscape features.</p>	<p>Visual: where proposed changes would have an indiscernible effect on views / visual amenity.</p>
Neutral	No effect.	No effect.

6.4.18 Following the classification of effects using this methodology, further consideration of whether an effect is significant and requires mitigation will be carried-out using professional judgement, taking account of:

- the positive or negative nature of the effect;

- whether the effect is permanent or temporary;
- the duration/frequency or likelihood of the effect;
- whether the effect is direct or indirect (for example an indirect effect could be that of a visual change on tourism); and
- any secondary effects (for example the townscape value could be affected by a loss of trees).

6.4.19 If mitigation is proposed, the residual effect following mitigation will be categorised using the same system. The final stage of the assessment will be to consider whether residual effects are likely and therefore significant.

Mitigation of Impacts

6.4.20 As far as practicable, the construction method of working will be responsive to the physical context in which the works would be located. Construction methodologies and programming of works will be progressed to a level that is sufficient to enable adverse townscape impacts to be defined and appropriate mitigation identified.

6.4.21 Opportunities to avoid, reduce and, if possible, remedy or compensate for significant adverse impacts on townscape resources during the construction phase, will be identified where practicable and appropriate. Mitigation measures could take the form of changes in working methods, use of materials and plant sensitive to the local setting, etc.

6.4.22 Mitigation measures will be specified to ensure that contractors use good practice during construction to prevent or minimise adverse impacts on townscape, for example hoardings will be used to screen construction plant and activity from sensitive receptors. The assessment will assume that such measures would be implemented.

6.4.23 Residual effects, effects remaining once mitigation is in place, will be identified and classified as non-significant or significant, albeit reduced, as appropriate.

7 Transport and Movement

7.1 Introduction

- 7.1.1 The construction events associated with the BSCU Works are such that it is anticipated that the majority of adverse environmental effects will occur during the construction phases, including works associated with utility diversions. These works will create a number of temporary traffic and transport effects to existing transport users, including pedestrians, bus passengers, rail passengers, taxi users, cyclists and general traffic.
- 7.1.2 While every effort to reduce the scale of any impacts will be made to minimise disruption throughout the BSCU Works there is a need for a partial closure of the Northern Line for a time towards the end of the construction period to link the new underground works with the operational network to complete the upgrade. This Blockade is currently anticipated to last for a period of some 16 weeks, with potential for wider implications on the overall transport network that will form an important part of the assessment.
- 7.1.3 Permanent operational effects anticipated to be primarily beneficial, will also be reported as part of the assessment.

7.2 Description of Baseline

- 7.2.1 In recent times the number of interchange journeys made at Bank has risen by over 40% and the number of passengers entering and leaving the station has increased by 25 – 30%. The Northern Line platforms suffer the worst crowding particularly in the peak periods. Passageways to the DLR, Central Line and station exits also experience congestion with queues forming for stairs and escalators. Future forecasts show demand growing. Crowding will become worse unless the station is upgraded to provide more capacity.
- 7.2.2 Abchurch Lane is currently one way in the northbound direction, which enables traffic to connect between Cannon Street and King William Street.
- 7.2.3 Nicholas Lane is effectively a two-way carriageway, although it currently displays signs that denote a 'Prohibition of Driving- Except For Access' restriction for vehicles entering from King William Street; this is not however repeated at the Cannon Street entrance to the road. In practice this means that drivers entering from King William Street are only able to do so in the event that they have legitimate reason to access premises alongside Nicholas Lane, while in the opposite direction the absence of signing suggests that any vehicle can use the route.
- 7.2.4 Both Abchurch and Nicholas Lanes provide a convenient conduit for pedestrians and where permitted, cyclists. Abchurch Lane in particular, is

- potentially more attractive of the two through the appeal of Abchurch Yard at its southern end, although the one-way restriction along the road does impose a control on unrestricted access for cyclists.
- 7.2.5 Cannon Street, Bank and Monument Stations are all within reasonable walking distance of the Whole Block Site. Cannon Street offers a railway terminus with access to Southeastern services and a connected Underground Station for access to the Circle and District Line, while Bank and Monument Stations are interlinked to offer access to the Underground for Northern, Circle and District, Central, Waterloo and City Line services and DLR.
- 7.2.6 Regular bus services both day and night are available from King William Street and Cannon Street supplemented by others from bus stops surrounding the neighbouring Cannon Street/ King William Street/Eastcheap junction.
- 7.2.7 The availability of public transport facilities registers the Whole Block Site with a Public Transport Accessibility Level (PTAL) rating of 6a, which denotes a location that is highly accessible.
- 7.2.8 No waiting 'At Any Time' restrictions cover the carriageway frontage surrounding the Whole Block Site with further conditions imposed on Cannon and King William Streets through No-loading restrictions 07:00-19:00hrs in selected areas. Loading and unloading is however permitted for a reasonable period, as long as the activity is undertaken as a continuous procedure.
- 7.2.9 An existing service entrance for 10 King William Street is provided adjacent to No. 20 Abchurch Lane, which includes a compact vehicle turn-table for servicing vehicles flanked by separately marked areas to accommodate parking provision for around six cycles and four motorcycles. A gated service entrance on the opposite side of the road next to No. 5 Abchurch Lane is also apparent, although in this case a turn-table is not necessary as the opening serves an internal through-route that connects with Sherborne Lane to the west.
- 7.2.10 Vehicles using this facility can therefore enter from either Cannon Street or Sherborne Lane but are obliged to exit via King William Street due to Sherborne presenting as a cul-de-sac in combination with the one-way Order conditioning vehicular movement along Abchurch Lane.
- 7.2.11 Nicholas Lane also contains a relatively wide vehicular service entrance to serve Phoenix House, and forms part of a wider network as a quiet carriageway recommended for cyclists by TfL.
- 7.2.12 A worksite is also proposed at Arthur Street to support an access shaft that will provide access to the main tunnelling works during construction. Located to the north of London Bridge and west of the A3 King William Street, directly opposite Fish Hill Street, Arthur Street is currently accessed from the A3 northbound carriageway travelling from London Bridge and also through a

traffic signal controlled crossroads junction with A3211 Upper Thames Street/ Swan Lane. This junction permits all movements, although notably only buses are able to turn from the westbound carriageway of the A3211 into Arthur Street. A bus lane at the A3 King William Street end of Arthur Street, which is used by London Bus Route 344 for northbound travel, also conditions general traffic movement along the carriageway.

7.3 Assessment Scenarios

7.3.1 It is assumed that the BSCU Works works will be fully operational by 2021 and that construction will commence in 2016.

7.3.2 The assessment will consider the environment both 'With' development (Do-Something) and 'Without' (Do Minimum) the proposed BSCU Works in terms of three scenarios:

1. the current baseline position projected forward to provide future baseline 'Do Nothing' Scenarios for key construction periods and at completion;
2. adding the key construction and operational impacts of BSCU Works to provide a 'Do Something' Scenario that will then be compared with Scenario 1; and finally
3. building on the 'Do-Something' Scenario to add cumulative impacts (i.e. to include additional impacts with other developments proposed in the area) that will be identified through comparison with Scenario 2.

7.4 Assessment Framework

7.4.1 A comprehensive Transport Assessment (TA) will be undertaken in accordance with Transport for London's guidelines and will include:

- an assessment of the impact of the BSCU Works on the surrounding area;
- consideration of the estimated increase in the journeys made to and from the Whole Block and Arthur Street Sites during construction and once the BSCU Works are operational;
- consideration of the BSCU Works vehicular access, servicing arrangements, pedestrian and cycle routes and construction traffic impacts; and
- an assessment of residual and cumulative impacts.

7.4.2 The outputs from this work will inform a Transport Assessment Report (TAR) that will be produced as a stand-alone document and submitted in support of the TWAO application and incorporated as an Appendix to the ES.

7.4.3 The EIA for the BSCU Works will be focussed to address the following issues in relation to transport and movement during both construction and operation:

-
- impacts on traffic flow and the local road network, including any proposed modifications to the adjacent highway layout around the completed BSCU Works;
 - impacts on public transport and on walking and cycling accessibility through the development area and on the public highway in the adjacent area;
 - alterations to road layout/closures/diversions/widening/alterations/junction improvements/diversion of rights of way;
 - changed access to properties and places of work;
 - changes to journey times and journey distances for private and commercial vehicle occupants;
 - changes in accessibility, journey times, distances or frequencies for stations, interchanges and public transport; and
 - changes to interchange, parking, taxi parking/operation, and delivery and servicing.
- 7.4.4 Transport impacts will be assessed using established methodologies and the EIA will concentrate on examining the capability of relevant local transport infrastructure to accommodate the BSCU Works.
- 7.4.5 The principal transport related environmental effects, namely noise and air quality, will be addressed under their respective topics elsewhere within the ES.
- 7.4.6 Accordingly this section of the environmental scoping report identifies the transport and movement related issues of potential significance to be included in the ES, for both the construction and operational phases.
- ## 7.5 Scope of Assessment
- ### **Spatial scope**
- 7.5.1 The spatial scope of the traffic and transport assessment will be different for the construction and operational impacts being assessed.
- ### **Spatial scope - Construction**
- 7.5.2 For the construction phase the assessment will focus on traffic and transport issues resulting from land taken for worksites, the presence of construction heavy goods vehicles (HGV) traffic on the local road network and effects on local access and movement.
- 7.5.3 It is considered that the construction phase may give rise to impacts:

- arising from closures and diversions of highway and public rights of way/other access routes due to construction activities which affect pedestrians, cyclists, buses, taxis, servicing and disabled people etc;
 - on access to public transport due to construction works;
 - of increases in traffic levels/congestion on nearby carriageways and junctions during construction;
 - on parking and loading during construction; and
 - on pedestrian and cycle routes during construction.
- 7.5.4 In addition, the requirement for the blockade of the Northern Line towards the end of the construction period will mean that there will be disruption to journey times and the implications will be assessed.

Spatial Scope - Operation

- 7.5.5 For the operational phase the scope will include the transport routes where there is a significant change in the usage though people accessing the BSCU Works.
- 7.5.6 Potential impacts that could arise from the operational phase are impacts on:
- pedestrians and cyclists;
 - public transport, with particular reference to underground rail passenger movement; and
 - traffic.
- 7.5.7 Preliminary assessment has indicated that the scope for impacts at surface level needs to extend to cover the areas shown on Figure 7.1 and this has been agreed with TfL as reasonable, however, the operational scope will be expanded to consider impacts associated with the proposed Northern Line blockade.

forecast to bring considerable benefits to the travelling public in terms of congestion relief, step-free access and improved journey times; to include the amount of time it takes travel between the Northern Line platforms and street level at Bank Station.

7.7 Baseline

Traffic Data

- 7.7.1 Baseline traffic data will be compiled for the construction and operational phases. The data will compile the annual average day time traffic flows, traffic composition and speeds on the relevant road links for scenarios without the BSCU Works. Traffic data will be collated from models and TfL with supplementary information collected by specialist survey firms where any essential gaps are identified. The assessment process will be informed by:
1. Manual Classified Surveys to determine turning movements and traffic composition at key junctions;
 2. Automatic Traffic Count data to confirm link flows and monthly/weekly/daily/hourly variations in traffic movements; and
 3. Traffic signal junction data sheets to confirm staging and phasing.
- 7.7.2 Transport data collection, traffic surveys and modelling where appropriate will be undertaken at agreed locations to determine the baseline assessment for the transport and movement assessment within the ES. The future baseline will include consideration of the growth in travel demand, including the changes arising from other developments and proposed transport network improvements.
- 7.7.3 All data collected will follow the requirements embodied within TfL Modelling guidance.

Accident Data

- 7.7.4 Baseline accident data will be obtained from TfL Street Management for the study area for the last three year period. A review of current accident statistics by severity and type will be undertaken including a breakdown of those accidents involving pedestrians and cyclists.

Pedestrian and Cycle Movement

- 7.7.5 A review of existing data setting out pedestrian and cyclist journey patterns will be undertaken and further surveys will be undertaken within the study area if required to inform assessment of existing and potential future demand.

Public Transport Users

- 7.7.6 A review of existing public transport user and service data will be included in the form of:
1. bus patronage and journey time data; and
 2. current and forecast patronage data for London Underground, DLR and Rail.
- 7.7.7 The assessment will include a review of workplace population travel to work statistics derived from census data. Although a census was taken in 2011, the required Workplace Travel Statistics for this task are unlikely to be available before 2014. As a consequence 2001 census data will be used with a logic check to ensure that these data are still representative.
- 7.7.8 The effects of committed bus and other transport network improvements will also be included.
- ## 7.8 Assumptions and Limitations
- 7.8.1 The assessment of vehicular transport movements will examine the trend in traffic growth over time to determine the forecast background traffic levels within the study network in future years. Where traffic growth needs to be applied to reflect changes this will be agreed with the highway authority for the roads concerned.
- ## 7.9 Prediction of Effects
- 7.9.1 The methods to be used to predict and evaluate construction effects will take into account the nature and timing of changes to the transport network, the duration of such effects and the potential to reduce or avoid such effects through appropriate mitigation and construction management. The potential effects could include:
- **effects on road users:** relating to any change in journey length arising from temporary diversions required to facilitate construction work or to issues affecting amenity or safety;
 - **effects on pedestrians and cyclists:** changes in pedestrian and cyclist journey patterns, and the provision or obstruction of facilities (footway widths, segregation and protection from traffic, crossing points) that contributes to the perception of safety and journey quality;
 - **effects on vulnerable populations** (children, elderly, mobility impaired and disabled people): whom the proposed construction activities might deter;

- **effects on public transport users** (bus, Underground and DLR users): change to journey time;
- **severance**: increased difficulty of crossing a heavily trafficked carriageway or a physical barrier created by the construction worksites. The nature of alternative route or crossings offered and the additional journey length necessary; and
- **accidents and safety**: a change to accident risks for all road users.

7.10 Evaluation of Effects

- 7.10.1 Various methods and criteria are available for evaluating the effects of changes to traffic and pedestrian movements. It is assumed that many of the junctions in the area are already operating at or close to capacity and that the main effects of the proposed BSCU Works will occur during the construction period.
- 7.10.2 Following the review of a number of assessment methodologies and criteria it is expected that the Bank Station Capacity Upgrade Project will show similar transport and movement effects to Central London stations associated with the Crossrail scheme, during both the operation and construction phases. Appropriate criteria were devised for Crossrail and also for the Victoria Station Upgrade Works. These criteria have previously been reviewed and agreed with a wide number of the key statutory and other consultees. The Crossrail assessment criteria are set out in the Crossrail Environmental Statement Volume 8A, Transport Assessment: Methodology and Principal Findings.
- 7.10.3 With the BSCU Works likely to attract similar types of impacts it is considered appropriate to apply these robust Crossrail criteria to the Bank Station Capacity Upgrade Project and for consistency also use relevant elements to cover the assessment of impacts associated with the OSD. The detailed criteria to be used for the identification and assessment of potentially significant effects are provided below.
- 7.10.4 The magnitude of each impact and its significance will be predicted by a variety of mechanisms, including computer modelling and professional judgement. The assessment will then consider the potential to revise the construction methodology, programme or design to mitigate the potential impact and/or make alterations to the highway network or traffic arrangements.
- 7.10.5 The assessment criteria will not be the sole basis for judging significance used in the assessment. Professional judgement will also be applied to more qualitatively consider effects that are raised by the assessment criteria.

Construction Impacts

- 7.10.6 The criteria outlined below will be used to assess the traffic and transport impacts during construction.

Traffic Levels and Delays to Vehicle Occupants

- 7.10.7 A significant increase in traffic levels and driver and vehicle passenger delay (including delays to bus and coach passengers) is defined as:

BSCU Reference	Criteria
CT1a	A 30 per cent increase in traffic (lorries or all vehicles) over future baseline two-way flows (or one-way flows where either the link or the lorry route is one-way) for links affected for more than four weeks in any 12-month period and where the total increase in traffic is more than 40 vehicles per day; subject to the increase leading to delay. Individual temporary increases of up to five days do not count towards the four-week period.
Or CT1b	A 100 per cent increase in traffic (lorries or all vehicles) over future baseline two-way flows (or one-way flows where either the link or the lorry route is one-way) for links affected for more than five days in any 12-month period and where the total increase in traffic is more than 40 vehicles per day; subject to the increase leading to delay. Individual temporary increases of up to five days do not count towards the four-week period.
Or CT1c	A temporary diversion, for more than four weeks in any 12-month period that leads to a maximum increase in length of journey of more than 2.5km on a route carrying more than 100 vehicles a day, 5km on a route carrying more than 50 vehicles a day, or 10km on any other route.
Or CT1d	A significant delay problem is forecast, such as at a specific junction or associated with access.

Public Transport Delay

7.10.8 A significant effect on journeys by bus, Underground and Rail is defined as:

BSCU Reference	Criteria
CT2a	Changes in a majority of representative journey times by Underground or rail of more than 20 per cent lasting for more than four weeks in any 12-month period.
Or CT2b	Temporary changes in journey distances by bus for more than four weeks in any 12-month period of more than 400m where diversions apply.
Or CT2c	A temporary new increase of more than 30 per cent, for more than four weeks in any 12-month period, in lorries or total traffic on a route running along a bus route, or a net increase of more than 30 per cent in total traffic on a route intersecting a bus route.
Or CT2d	A significant delay, disruption, overcrowding or other impact affecting the public transport network over a wide area for a period of more than five days.

Disruption to Interchange

7.10.9 A significant effect on interchange is defined as:

BSCU Reference	Criteria
CT3	<p>A material change in the vicinity of stations and worksites for over four weeks in any 12-month period to public transport interchange such as:</p> <ul style="list-style-type: none"> • bus facilities and operation (e.g. material loss of or relocation of bus stops, passenger waiting facilities, bus stands or operator facilities); or • taxi facilities and operations (e.g. material loss of or relocation of taxi stands, passenger waiting facilities or operator facilities); or • 'kiss-and-ride' facilities or operation (e.g. material loss or relocation of dropping-off areas).

Parking and Loading

7.10.10 A significant effect on parking and loading is defined as:

BSCU Reference	Criteria
CT4a	<p>On-Street facilities: Loss for more than four weeks in any 12-month period of:</p> <ul style="list-style-type: none"> • one or more on-street parking bays for a specific user or vehicle, including disabled persons, buses, taxis, doctors, ambulance and police vehicles; or • five or more on-street bays for residents and business; or • five or more on-street pedal or motor cycle spaces; or • 20 or more general parking bays or the equivalent length of unrestricted kerbside space; and • the bays or spaces are reasonably well used.
Or CT4b	<p>Private Parking A material traffic or transport impact due to loss of private off-street parking or loading facilities for more than four-weeks in any 12-month period.</p>

Vulnerable Road User Delay and Loss of Amenity

7.10.11 A significant effect on vulnerable road users (pedestrians, cyclists, mobility impaired persons and equestrians) is defined as:

BSCU Reference	Criteria
CT5a	<p>There will be a temporary increase of more than 30 per cent in the total traffic flow, or the number of lorries, for more than four weeks in any 12-month period; and</p> <p>The increase is more than 40 movements a day; and</p> <p>There will be over 100 two-way movements of cyclists or pedestrians per 12-hour average weekday.</p> <p>Note: the vulnerability of the users is 'high' (e.g. there are no physically segregated facilities for cyclists, or there is no footway or an inadequate footway or crossing facilities for pedestrians).</p>
Or CT5b	<p>A temporary maximum increase, for four weeks in any 12-month period of:</p> <ul style="list-style-type: none"> • 250m on a route carrying more than 200 pedestrians a day; or • 500m on a route carrying more than 100 pedestrians a day; or • 1km on a route carrying more than 50 pedestrians a day; or • 2km on any other route.
Or CT5c	<p>A temporary maximum increase in journey length, for cyclists along a carriageway or other public right of way, for more than four weeks in any 12-month period, of more than:</p> <ul style="list-style-type: none"> • 1.5km on a route carrying more than 100 cyclists a day; or • 3.0km on a route carrying more than 50 cyclists a day; or • 6.0km on any other route.
Or CT5d	<p>A significant problem is forecast such as at a specific crossing, associated with footway overcrowding or with access to or between stations or bus stops, or to premises.</p>

Accidents and Safety

7.10.12 Significant effect on accidents and safety is defined as:

BSCU Reference	Criteria
CT6	Those junctions that have experienced more than ten personal injury accidents in a three year period for which data is available: or Links for which data is available that have experienced on average more than ten personal injury accidents per 100-metre length in a three-year period: and The junctions or links would be subject to a net increase of 10 per cent or more in total traffic flow during construction for a period exceeding four weeks in any 12-month period.

Criteria for Permanent Assessment (Operation)

7.10.13 The criteria outlined below will be used to assess the significance of permanent traffic and transport impacts during operation.

Traffic levels and delays to vehicle occupants

7.10.14 A significant impact in traffic levels and driver and vehicle passenger delay is defined as:

BSCU Reference	Criteria
OT1a	A 10 per cent increase in morning peak hour two-way traffic levels on the adjoining highway and exceeding the highway capacity on non-congested links.
Or OT1b	Traffic to or from the station development exceeds 5 per cent of the morning peak hour two-way traffic flow on the adjoining highway where traffic congestion exists or will exist, or in another sensitive area (defined as schools, hospitals or other community facilities).
Or OT1c	Increased traffic levels that exceed 30 per cent of the off-peak-hour two-way traffic on the adjoining highway in congested or non-congested conditions.
Or OT1d	A 5 per cent decrease in morning peak-hour modelled traffic link speeds (over future baseline flows) for congested areas (defined as junction approaches running at an average of 85 per cent of capacity during the peak hour) on an individual highway link.
Or OT1e	A 10 per cent decrease in morning peak-hour modelled traffic link speeds in non-congested areas.
Or OT1f	A 30 per cent decrease in off-peak modelled traffic link speeds in congested or non-congested areas.
Or OT1g	There will be a permanent increase in journey length of 1250 m.

Public transport

7.10.15 A significant impact on journeys by bus is defined as:

BSCU Reference	Criteria
OT2a	A 20 per cent change in journey times (an increase or decrease) on bus links.
Or OT2b	A permanent change in journey distance of more than 400 m.
OT2c	A comparison of public transport journey times without BSCU (by any or all modes) with the proposed BSCU journey time has been assessed. A significant impact is defined as: A change (an increase or decrease) in representative journey times of more than 10 per cent.

Pedestrian delay and loss of amenity

7.10.16 A significant impact is defined as:

BSCU Reference	Criteria
OT3a	<p>A predicted permanent increase of more than 10 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> • the increase will be more than 40 vehicle movements a day; and • there will be over 100 two-way movements of pedestrians per 12-hour average weekday; and • the vulnerability of the pedestrian is 'high'.
Or OT3b	<p>A predicted permanent increase of more than 30 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> • the increase is more than 40 vehicle movements a day; and • there will be between 50 and 100 two-way movements of pedestrians per 12-hour average weekday; and • the vulnerability of the pedestrian is 'high'.
Or OT3c	<p>A predicted permanent increase of more than 30 per cent in the 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> • the increase will be more than 40 vehicle movements a day; and • there will be over 100 two-way movements of pedestrians per 12-hour average weekday; and • the vulnerability of the pedestrian is 'moderate'.
Or OT3d	<p>A predicted permanent increase in journey length of more than 250 m for pedestrians; and</p> <ul style="list-style-type: none"> • there will be over 100 two-way movements of pedestrians per 12-hour average weekday.
Or OT3e	<p>A predicted permanent increase in journey length of more than 500 m for pedestrians; and</p> <ul style="list-style-type: none"> • there will be between 50 and 100 two-way movements of pedestrians per 12-hour average weekday.
Or OT3f	<p>A predicted permanent increase in journey length of more than 1000 m for pedestrians; and</p> <ul style="list-style-type: none"> • there will be less than 50 two-way movements of pedestrians per 12-hour average weekday. <p>Note: high vulnerability is, for example, no or inadequate footway or crossing facilities for pedestrians.</p>

Cyclist delay and loss of amenity

7.10.17 A significant impact is defined as:

BSCU Reference	Criteria
OT4a	<p>a predicted permanent increase of more than 10 per cent in 12-hour weekday twoway traffic flow; and</p> <ul style="list-style-type: none"> • the increase will be more than 40 vehicle movements a day; and • there will be over 100 two-way movements of cyclists per 12-hour average weekday; and • the vulnerability of the cyclist is 'high'.
Or OT4b	<p>predicted permanent increase of more than 30 per cent in 12-hour weekday twoway traffic flow; and</p> <ul style="list-style-type: none"> • the increase is more than 40 vehicle movements a day; and • there will be between 50 and 100 two-way movements of cyclists per 12-hour average weekday; and • the vulnerability of the cyclist is 'high'.
Or OT4c	<p>A predicted permanent increase of more than 30 per cent in 12-hour weekday two-way traffic flow; and</p> <ul style="list-style-type: none"> • the increase will be more than 40 vehicle movements a day; and • there will be over 100 two-way movements of cyclists per 12-hour average weekday; and • the vulnerability of the cyclist is 'moderate'. <p>Note: moderate vulnerability is, for example, limited physically segregated facilities for cyclists.</p>
Or OT4d	<p>A predicted permanent increase in journey length of more than 750 m; and</p> <ul style="list-style-type: none"> • there will be over 100 two-way movements of cyclists per 12-hour average weekday.
Or OT4e	<p>A predicted permanent increase in journey length of more than 1250 m for cyclists; and</p> <ul style="list-style-type: none"> • there will be less than 100 two-way movements of cyclists per 12-hour average weekday. <p>Note: high vulnerability is, for example, no physically segregated facilities for cyclists.</p>

Station and interchange impacts

7.10.18 A significant impact on station interchange is defined as:

BSCU Reference	Criteria
OT5	<p>using professional judgement, to assess impacts that may be caused by passengers arriving and departing at alternative stations as a result of the BSCU work taking account of:</p> <ul style="list-style-type: none"> • local transport conditions at each station; or • the resulting increases in passengers arriving and departing on foot, by bicycle, by car and by bus and taxi. <p>Impacts that it is considered will not be able to be mitigated by local improvement measures will be reported as significant impacts.</p>

Parking and loading

7.10.19 A significant impact on parking and loading is defined as:

BSCU Reference	Criteria
OT6a	A loss of special-use on-street or off-street spaces, including spaces for disabled persons, buses, taxis, doctors, ambulances, police vehicles and car club bays;
Or OT6b	Any predicted increase in on-street parking demand
Or OT6c	A loss of private car parking.

Accidents and safety

7.10.20 A significant impact on accidents and safety is defined as:

BSCU Reference	Criteria
OT7	<p>Those junctions that have experienced more than ten personal injury accidents in a three year period: or</p> <ul style="list-style-type: none"> • links for which data is available that have experienced an average of more than ten personal injury accidents per 100-metre length in a three-year period; and • the junctions or links would be subject to an increase of 10 per cent or more in the total 12-hour weekday traffic flow.

7.11 Mitigation and Identification of Significant Residual Effects

- 7.11.1 A number of traffic management options have already been identified early in the design process. These options will be presented at Stakeholder meetings and examined via detailed traffic modelling.
- 7.11.2 The construction methodology adopted for the capacity upgrade of the station will also seek to minimise the effect on pedestrians, public transport, services and traffic. The delivery of materials and the removal of spoil will aim to be sequenced to minimise, as far as reasonably practicable the effect on both local traffic flows and the wider area where impacts are identified.
- 7.11.3 At those locations where the assessment shows that the significance criteria have been exceeded measures will be investigated that could be implemented to either reduce the effect so that the change falls below the significance criteria or to reduce it as much as is practically and reasonably possible.
- 7.11.4 A table would be prepared that identifies all instances of the significance criteria being exceeded. The scale of the excess will be described in the text. This table will also include a brief description of changes that had the potential for a significance criterion to be exceeded but where analysis has shown that the change was not deemed to be significant.
- 7.11.5 The impact of proposed mitigation measures will also be analysed including those that have already been identified. The results will be presented in a table with a description of the measures and the residual impact.

8 Noise and Vibration

8.1 Introduction

- 8.1.1 The BSCU Works (as described in Section 3) has the potential to result in noise and/or vibration impacts during construction and operation on the receptor locations closest to the BSCU Works sites.
- 8.1.2 The noise and vibration assessment will quantify these impacts and determine their significance, in accordance with the appropriate guidance documents.
- 8.1.3 Subject to agreement with City of London Corporation EHOs, the study area is within 100m of all fixed works and along road traffic links potentially affected by significant changes in traffic flows. This area is considered sufficient to allow for a comprehensive assessment of all potential noise and vibration impacts associated with the BSCU Works.

8.2 Description of the Baseline

- 8.2.1 The existing noise climate at and around the Whole Block and Arthur Street Sites is expected to be dominated by road traffic noise.
- 8.2.2 This assertion is confirmed, and an indication of level provided, by considering noise maps produced by The Department for the Environment, Food and Rural Affairs (DEFRA) in order to meet the requirements of the Environmental Noise (England) Regulations 2006. These maps provide an overview of the contribution to the ambient noise environment in large urban areas from major transport sources in England. The maps indicate ambient noise contours, the sources of noise (i.e. road, rail, air or industry) and the location of those affected.
- 8.2.3 The ambient noise contours on these maps indicate relatively high noise levels along the major roads in the area, and in the vicinity of King William Street, between 70 and 75dB(A) during the daytime and 60 to 65dB(A) during the night-time.
- 8.2.4 Side streets off King William Street (such as St Swithins Lane, Sherborne Lane, Abchurch Lane, Nicholas Lane and Arthur Street) are reasonably expected to experience noise levels approximately 5-10dB lower than this.
- 8.2.5 Sample noise measurements undertaken by Mott MacDonald and reported in August 2011 (Baseline Report – Noise and Vibration N133-BCR-MMD-00-Z-DC-N-0012-S0-0.1) would suggest these (daytime) noise levels from the DEFRA ambient noise contours as reasonably accurate and typical.

8.3 Potential Impacts

- 8.3.1 Potential noise and vibration impacts can be associated with both the construction and operational phases of the development.
- 8.3.2 Table 8.1 summarises these impacts, sources of noise and/or vibration, and states whether they are scoped in or out of the assessment.

Table 8.1: Potential Noise and Vibration Impacts

Development Phase	Source	Scoped 'in' or 'out'
Construction (Noise)	Construction activities and associated plant, including HGV traffic on surrounding public roads.	In
Construction (Vibration)	Construction activities and associated plant.	In
Operational (Noise)	Proposed fixed plant e.g. station air handling units. No significant traffic flow changes are anticipated as a result of the BSCU Works.	In Out
Operational (Vibration and groundborne noise)	Vibration produced by new southbound running tunnel.	In

8.4 Assessment Methodology

- 8.4.1 Reference will be given to the Transport for London, London Underground Guidance Document G1323 (TfL 2012) with regard to the noise and vibration assessment methodologies and assessment criteria.

Baseline Noise Measurements

- 8.4.2 To quantify the prevailing baseline noise climate, noise measurements will be undertaken at locations representative of surrounding sensitive receptors and of the BSCU Works. All noise monitoring shall be undertaken by suitably qualified persons and in accordance with good acoustical practice, care being taken to avoid or note the effects of local acoustic screening and acoustic reflections, and comply with the requirements of British Standard BS 7445: 1991/2003 'Description and Measurement of Environmental Noise'.
- 8.4.3 Parameters logged will include 5 minute L_{Aeq} and L_{A90} levels in third octave/octave bands as well as overall A-Weighted levels including L_{Amax} . Where secure sites can be located, noise monitoring will continue over a period of at least five days to include several weekdays and a weekend. Where secure sites cannot be located, attended measurements will be undertaken for sufficient daytime and night-time periods to adequately characterise the

existing noise climate (minimum 1 hour periods proposed) during daytime, night-time and weekend periods as appropriate.

8.4.4 The monitoring locations and monitoring protocol will be confirmed in advance with the Local Authority Environmental Health Officers but are anticipated to include:

- the Whole Block Site
 - Closest office accommodation (Nicholas Lane);
 - Closest office accommodation (Abchurch Lane);
 - St Mary Abchurch Church of England (Abchurch Lane);
 - St Clement Eastcheap Church of England (Candlewick Ward);
 - Abchurch Yard (residential);
- Arthur Street Work Site
 - 33 King William Street; and
 - Martin Lane.

Baseline Vibration Measurements

8.4.5 Vibration baseline will be measured in terms of the Vibration Dose Value (VDV) and the peak particle velocity (PPV). The VDV will be measured in accordance with the requirements of BS 6472-1:2008 and PPV will be measured in accordance with BS ISO 4866:2010. Vibration measurements will be carried out over a time period of sufficient duration to obtain a representative sample of data. Since the main source of environmental vibration affecting sensitive receptors is likely to be the existing London Underground railway lines, it is expected that a survey of three hours duration at each location should provide a representative sample of train pass-by data.

8.4.6 By undertaking attended measurements, localised vibration levels as a result of footfall and carriageway traffic can be excluded from analysis and assessment.

8.4.7 Due to potential for clashes between the new running tunnel and piles of existing buildings, vibration surveys are initially proposed at a number of locations including but not limited to:

- 33 King William Street (Arthur Street);
- 1-10 St Swithin's Lane (known as New Court);
- 8-10 Mansion House Place; and
- 6-8 Princes Street.

- 8.4.8 In addition, it is anticipated that vibration measurements will also be carried out on selected historic or listed buildings with the greatest potential to be affected by construction works. The baseline vibration measurements will also feed into the prediction model assessing operational groundborne noise and vibration levels.
- 8.4.9 In March 2012, Mott MacDonald produced a report detailing the results of groundborne noise and vibration monitoring undertaken at street level locations above the existing Northern Line tunnel (Ground Borne Noise & Vibration Monitoring – Initial Results N133-BCR-MMD-00-Z-DC-N-13-S0-1.0). This report has highlighted the necessity to undertake internal measurements in order to obtain a more robust data set and therefore, this is what is proposed.

Construction Noise

Prediction Methodology

- 8.4.10 The noise levels generated by construction activities and experienced by any nearby sensitive receptors, such as residential properties, depend upon a number of variables, the most significant of which are:
- the noise generated by plant or equipment used on site, generally expressed as sound power levels (L_w);
 - the periods of operation of the plant on the site, known as its 'on-time';
 - the distance between the noise source and the receptor; and
 - the attenuation provided by ground absorption and any intervening barriers.
- 8.4.11 Construction noise predictions will be carried out based on the methodology outlined in BS 5228-1: 2009 'Code of practice for noise and vibration control on construction and open sites. Part 1: Noise'. BS 5228 predicts noise as an equivalent continuous noise level averaged over a period such as 1 hour ($L_{Aeq,1h}$).
- 8.4.12 BS 5228 contains a database of the noise emissions from individual items of equipment, activities and routines to predict noise from construction activities at identified receptors. The prediction method gives guidance on the effects of different types of ground, barrier attenuation and how to assess the impact of fixed and mobile plant.
- 8.4.13 Specific details pertaining to construction schedule and plant roster will be sourced from Dragados for employment in the construction noise assessment.
- 8.4.14 A Code of Construction Practice is to be developed, anticipated to give due reference to City of London Corporation's Code of Practice for Deconstruction and Construction Sites – May 2013 – intended as a guide to 'Best Practicable Means'.

Significance Criteria

- 8.4.15 The approach to the calculation and assessment of construction noise will be agreed in advance with the City of London Corporation Environmental Health Officers. Any specific requirements pertaining to construction noise limits will be incorporated in the assessment methodology and due reference will be given to the City of London Corporation Code of Practice for Deconstruction and Construction sites and British Standard BS 5228: 2009.
- 8.4.16 In the absence of any local requirements, the assessment of the significance of construction noise effects will be undertaken based on 'example method 1' as defined in BS 5228-1: 2009, Annex E (see Table 8.2).

Table 8.2: Construction Noise Assessment

Assessment Category and Threshold Value Period	Threshold Value dB(A)		
	Category A (a)	Category B (b)	Category C (c)
Night-time (23:00 – 07:00)	45	50	55
Evenings and Weekends (d)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
<p>NOTE 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level including construction, exceeds the threshold value for the category appropriate to the ambient noise level.</p> <p>NOTE 2: If the ambient noise level exceeds the threshold values given in the table, then a significant effect is deemed to occur if the total noise level for the period increases by more than 3 dB due to construction activity.</p> <p>NOTE 3: Applies to residential receptors only.</p>			
<p>(a) Category A: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.</p> <p>(b) Category B: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as Category A values.</p> <p>(c) Category C: Threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than Category A values.</p> <p>(d) 19:00 – 23:00 weekdays, 13:00 – 23:00 Saturdays, 07:00 – 23:00 Sundays.</p>			

- 8.4.17 With reference to Table 8.2, it is noted that the BS 5228 technical committee are in agreement that just 'construction noise' and not 'total noise' should exceed the threshold to determine potential significance (and that a revision to the Standard is expected in the autumn of 2013).

- 8.4.18 In consultation with the City of London Corporation, and given the dense, primarily commercial urban location, it may be preferable to undertake some works during evening and night-time periods to reduce potential impacts on surrounding office buildings during the day.
- 8.4.19 Consequently, and with particular reference to offices (see NOTE 3 in Table 8.2), further consideration of whether an effect is significant and requires mitigation will be undertaken using professional judgement, but taking account of:
- the duration/frequency or likelihood of the effect; and
 - City of London Corporation recommendations for internal noise levels within office spaces.
- 8.4.20 While BS 5228 specifies the prediction of noise levels 1m from a façade, City of London Corporation recommend particular internal noise levels in offices to avoid 'annoyance and interference'. This will be considered in the assessment of potential significance of construction noise.

Construction Vibration

Prediction Methodology

- 8.4.21 The effects of human response to whole body vibration in buildings is defined in BS 6472-1:2008. This gives effects in terms of VDV. However, for construction related vibration, it is considered more appropriate to use the PPV, as suggested in BS 5228-2:2009.
- 8.4.22 The limit of human perception to vibration is in the order of 0.15mms^{-1} to 0.3mms^{-1} peak particle velocity (PPV) and a frequency range from 1 Hz to 80 Hz is often considered appropriate. The human body is not equally sensitive to all frequencies of vibration and weighting curves to reflect the frequency dependency of the body have been developed and are contained within ISO Standards. The weighting gives a good correlation between the measured vibration level and the subjective feeling or impact produced by the vibration.
- 8.4.23 The vibration PPV due to specific construction works will be estimated at sensitive receptors using example measured source data and the appropriate propagation relationship taken from BS 5228-2: 2009 'Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration'.

Significance Criteria – Whole Body Vibration

- 8.4.24 Guidance on the nuisance effects of vibration is provided in BS 5228-2:2009 Annex B, adapted below as Table 8.3.

Table 8.3: Guidance on Effects of Vibration Levels

Vibration Level mms^{-1}	Effect	Significance
<0.3	Vibration is unlikely to be perceptible in even the most sensitive situations for most vibration frequencies associated with construction.	Negligible
0.3 to 1	Increasing likelihood of perceptible vibration in residential environments.	Minor
1 to 10	Increasing likelihood of complaint in residential environments, but can be tolerated at the lower end of the scale if prior warning and explanation has been given to residents.	Moderate
>10	Vibration is likely to be intolerable for any more than a very brief exposure to a level of 10mm^{-1} .	Major

8.4.25 The estimated PPV values due to construction works on site are compared to the target limits specified in Table 8.3 to determine the significance of the vibration effects in terms of nuisance.

8.4.26 With regard to offices environments, BS 6472-1:2008 indicates that approximately double the vibration levels are required to equate to the same level of effect identified in Table 8.3.

Significance Criteria – Building Damage

8.4.27 BS 7385-2: 1993 'Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration' provides guidance on vibration levels likely to result in cosmetic damage, and is referenced in BS 5228-2. Limits for transient vibration, above which cosmetic damage could occur, are given in Table 8.4.

Table 8.4: Transient Vibration Guide Values for Cosmetic Damage

Type of building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
	4Hz to 15Hz	15Hz and above
Reinforced or framed structures	50mms^{-1} at 4Hz and above	
Industrial and heavy commercial buildings	15mms^{-1} at 4Hz increasing to 20mms^{-1} at 15Hz	20mms^{-1} at 15Hz increasing to 50mms^{-1} at 40Hz and above
Note 1: Values referred to are at the base of the building. Note 2: For un-reinforced or light framed structures and residential or light commercial buildings, a maximum displacement of 0.6mm (zero to peak) is not to be exceeded.		

8.4.28 BS 7385-2:1993 states that the probability of building damage tends to zero for vibration levels of 12.5mms^{-1} PPV.

- 8.4.29 The guide values relate predominantly to transient vibration which does not give rise to resonant responses in structures. Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 8.4 may need to be reduced by up to 50 per cent.
- 8.4.30 It should also be noted that these values refer to the likelihood of cosmetic damage. BS ISO 4866:2010 defines three different categories of building damage:
- cosmetic – formation of hairline cracks in plaster or drywall surfaces and in mortar joints of brick/concrete block constructions;
 - minor – formation of large cracks or loosening and falling of plaster or drywall surfaces or cracks through brick/block; and
 - major – damage to structural elements, cracks in support columns, loosening of joints, spalling of masonry cracks.
- 8.4.31 BS 7385-2:1993 defines that minor damage occurs at a vibration level twice that of cosmetic damage and major damage occurs at a vibration twice that of minor damage. Therefore, this guidance can be used to define the magnitude of impact identified in Table 8.5.

Table 8.5: Magnitude of Impact for Building Vibration

Continuous Vibration Level, PPV mms^{-1}	Damage Risk	Magnitude of Impact
6	Tends to zero	Very Low
7.5	Cosmetic	Low
15	Minor	Medium
30	Major	High

- 8.4.32 To determine the significance of these vibration effects, the sensitivity of the receptor should also be considered. Since this project has the potential to affect heritage buildings, the sensitivity of the receptor will be defined incorporating the sensitivity defined by the built heritage assessment. However, where a building is classed as low sensitivity by the heritage assessment, it will nonetheless be classified as high sensitivity in the vibration assessment if it is a residential building. See Table 8.6.

Table 8.6: Classification of Effect

Sensitivity of Resource / Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

- 8.4.33 It should also be noted that these guideline values refer to buildings and above ground structures. The effects of vibration on buried services is defined in section B4.4 of BS 5228-2:2009 and recommends that a limit value of 15mms^{-1} PPV should be applied to buried services for continuous vibration in the absence of specific criteria from the undertakers.

Operational Plant Noise

Prediction Methodology

- 8.4.34 3D modelling software will be employed that implements the ISO 9613 prediction methodology for industrial noise sources e.g. soundPLAN or Cadna-A. Input data for the model will include:

- ground elevation data for the sites and surroundings;
- proposed site layout plans and elevation drawings; and
- sound power level data for all plant items (third octaves/octaves).

- 8.4.35 The model will consist of a detailed three dimensional representation of the BSCU Works and associated fixed plant and will predict the propagation of noise towards the closest noise sensitive receptor locations.

- 8.4.36 Should detailed information not be available to construct an accurate model, appropriate noise level criteria confirmed as acceptable by City of London Corporation shall be applied to produce noise limits at the closest noise sensitive receptors.

Significance Criteria

- 8.4.37 BS 4142: 1997, 'Method for rating industrial noise affecting mixed residential and industrial areas' is commonly used for the assessment of operational fixed plant noise.

- 8.4.38 The basis of the standard is a comparison between the background noise level in the vicinity of residential locations and the rating level of the noise source under consideration. The relevant parameters in this instance are as follows:

-
- Background Noise Level – $L_{A90,T}$ – defined in the Standard as ‘the ‘A’ weighted sound pressure level of the residual noise at the assessment position which is exceeded for 90 per cent of the given time interval, T, measured using time weighting F (fast);
 - Specific Noise Level – $L_{Aeq,Tr}$ – the equivalent continuous ‘A’ weighted sound pressure level of the source in question over a given time interval; and
 - Rating Level – $L_{Ar,Tr}$ – the specific noise level plus any adjustment made for the characteristic features of the noise.
- 8.4.39 A correction of +5dB is made to the specific noise level if one or more of the features noted below is considered to be present (only one +5dB correction is made regardless of the specific noise level containing one or more of the following characteristics):
- the noise contains a distinguishable, discrete, continuous note (whine, hiss, screech, hum, etc.);
 - the noise contains distinct impulses (bangs, clatters or thumps); or
 - the noise is irregular enough to attract attention.
- 8.4.40 Once any adjustments have been made, the background and the rating noise levels are compared. The standard states that the greater this difference is, the greater is the likelihood of complaints, as follows:
- A difference of around +10dB or more indicates that complaints are likely;
 - A difference of around +5dB is of marginal significance; and
 - If the rating level is more than 10dB below the measured background level, this is a positive indication that complaints are unlikely.
- 8.4.41 The standard specifies a one hour assessment period during the day and a five minute assessment period during the night.
- 8.4.42 While the approach to the calculation and assessment of operational noise levels will be agreed in advance with the Local Authority EHO, Table 8.7 illustrates the proposed scale of significance.

Table 8.7 Operational Plant Noise Significance

Rating level – background noise level (dBA)	Significance
<-10	Negligible
-10 to +5	Minor
+5 to +10	Moderate
>+10	Major

- 8.4.43 The relative sensitivity of offices as opposed to residential properties will be discussed with the City of London Corporation EHOs, but for initial assessment purposes it is anticipated to be equivalent for daytime periods.

Operational Vibration

- 8.4.44 The BSCU Works will introduce a new southbound running tunnel which has the potential to provide new groundborne noise and vibration impacts. The assessment will focus on properties close to the alignment of the new running tunnel. However, any identified noise and vibration sensitive locations within 50m of the alignment of the tunnel will also be included in the study.

Prediction Methodology

- 8.4.45 The assessment will use best practice to determine the operational groundborne noise and vibration levels that occur in buildings affected by the new running tunnel.
- 8.4.46 The prediction of vibration will consist of the measurement of vibration levels that occur inside buildings affected by the existing LUL Northern Line. This will allow the determination of the existing vibration levels. These levels will form the basis of a prediction model which will include all aspects of the vibration transfer path from the track, through the soil into the buildings and the response of the building to the incoming vibration.
- 8.4.47 Special attention will be paid to the locations where piled foundations will be cut to enable the construction of the new running tunnel.

Significance Criteria

- 8.4.48 The significance criteria that apply for groundborne vibration have been based on the guidance provided in BS 6472-1:2008. This Standard gives guidance on the varying degrees of adverse comment that can be expected due to whole body vibration inside buildings. This provides the following relationship for assessing the magnitude of the impact. See Table 8.8.

Table 8.8: Groundborne Vibration Significance Criteria

Vibration Dose Value, $\text{ms}^{-1.75}$		BS 6472-1:2008 Rating	Magnitude of Impact
Daytime	Night-time		
< 0.2	< 0.1	Adverse comment not expected	Very Low
0.2 – 0.4	0.1 – 0.2	Low probability of adverse comment	Low
0.4 – 0.8	0.2 – 0.4	Adverse comment possible	Medium
0.8 – 1.6	0.4 – 0.8	Adverse comment probable	High

8.4.49 The significance of the effect is considered by combining the magnitude of the impact with the sensitivity of the receptor using Table 8.9.

Table 8.9: Classification of Effect

Sensitivity of Resource / Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

8.4.50 High sensitivity receptors are considered to be residential properties, hotels and places of worship. Medium sensitivity receptors are considered to be commercial premises including offices and shops, subject to professional judgement.

8.4.51 For groundborne noise, the significance criteria have been based on the guidance in LUL Noise and Vibration Asset Design Guidance G1323 and the criteria used in other recent underground railway projects such as the Northern Line Extension to Battersea. Table 8.10 provides the following relationship for the magnitude of impact.

Table 8.10: Groundborne Noise Significance Criteria

Internal Groundborne Noise Level due to Single Train Pass By, $\text{dB L}_{\text{AFmax}}$	Magnitude of Impact
≤ 35	Very low
36 – 40	Low
41 – 45	Medium
≥ 46	High

8.4.52 The significance of the effect is considered by combining the magnitude of the impact with the sensitivity of the receptor using Table 8.11.

Table 8.11: Classification of Effect

Sensitivity of Resource / Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

- 8.4.53 High sensitivity receptors are considered to be residential properties, hotels and places of worship. Medium sensitivity receptors are considered to be commercial premises including offices and shops, subject to professional judgement.

Construction and Operational Road Traffic Noise

Prediction Methodology

- 8.4.54 The BSCU Works has the potential to influence traffic flows on existing roads in the area surrounding the sites both when the development is operational and particularly during its construction. The assessment will focus on the impact at existing sensitive receptors located along surrounding affected roads.
- 8.4.55 The Highways Agency 'Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7-Traffic Noise and Vibration' provides guidance on the appropriate level of assessment to be used when assessing the noise and vibration impacts arising from all road projects, including new construction, improvements and maintenance.
- 8.4.56 The magnitude of the impact of the change in traffic flow generated by the construction and operation of the development will be assessed by calculating the change in the traffic noise levels at a selection of sensitive receptors along affected roads.
- 8.4.57 The calculations will employ the methodology provided in Calculation of Road Traffic Noise (CRTN), which is the standard methodology adopted in the UK for the calculation of noise levels from road traffic.

Significance Criteria

- 8.4.58 The DMRB short-term criteria have been adapted to produce the criteria presented in Table 8.12 which will be used for assessment.

Table 8.12: Criteria for Assessment of Changes in Road Traffic Noise Levels

Change in Noise Level $L_{A10,18h}$ (dB)	Magnitude of Impact
0	No change
≤ 1	Negligible
>1 -3	Low
> 3 – 5	Medium
> 5	High

8.4.59 The significance of the effect will be considered based on the magnitude of the impact and the sensitivity of the receptor, as shown in Table 8.13.

Table 8.13: Classification of Effects for Changes in Road Traffic Noise Levels

Sensitivity of Resource / Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

8.4.60 Residential buildings, hotels and places of worship are classed as high sensitivity; commercial premises and offices are initially classed as medium sensitivity, subject to professional judgement.

9 Built Heritage

9.1 Introduction

- 9.1.1 The aim of the Built Heritage Chapter will be to identify any built heritage assets which may be affected by the BSCU Works and any additional heritage constraints to the development. Recommendations and strategies outlining further work that it is proposed to undertake as part of the EIA and the approach required are described.

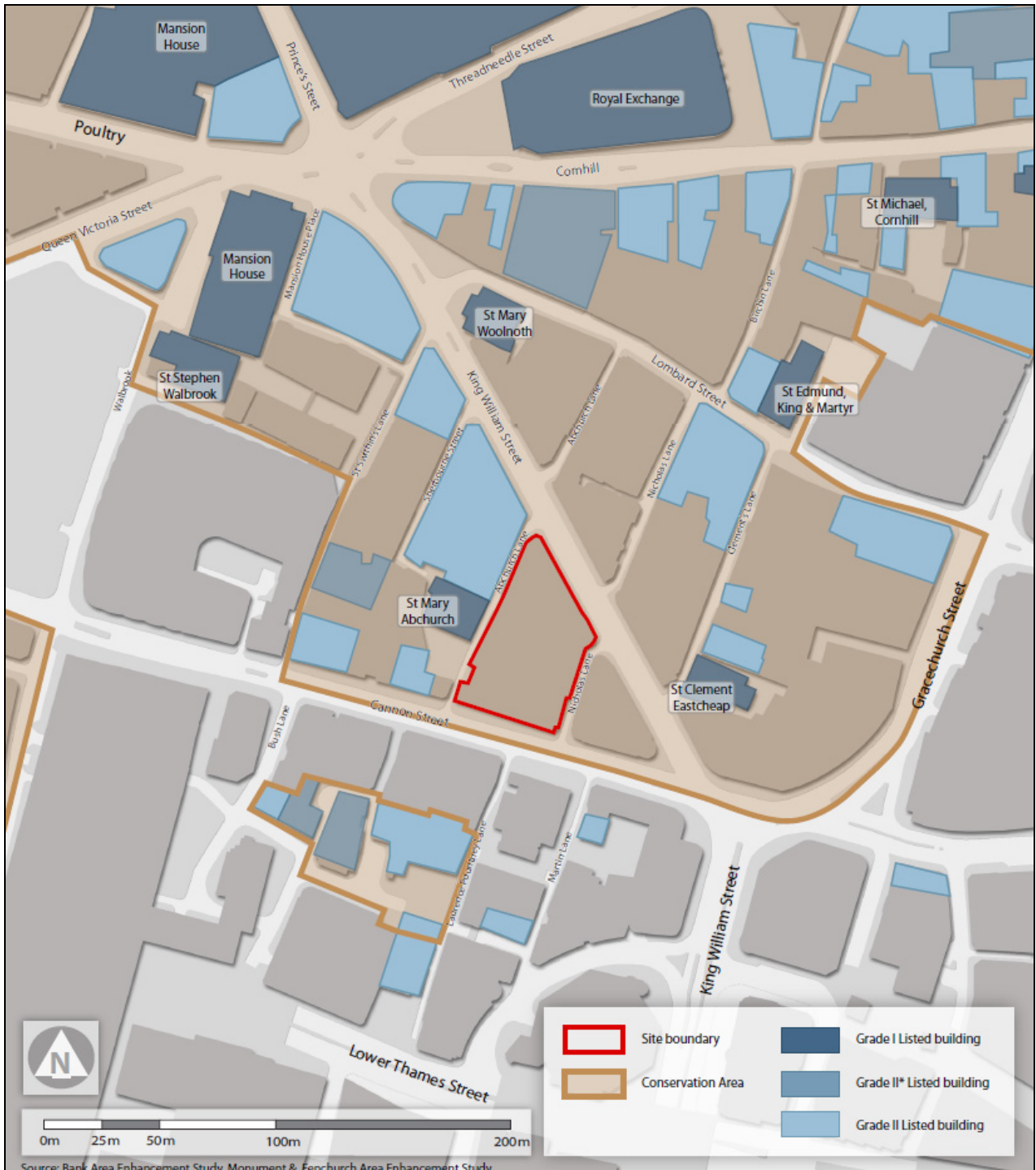
9.2 Description of the Baseline

Designated Assets

- 9.2.1 Baseline information for the built heritage scope was appraised from online and relevant literature sources, including documents relating to the BSCU Works authored by Mott McDonald and Alan Baxter Associates. Due to the nature of the impacts arising from the BSCU Works, which include settlement resulting from tunnelling activity, the study area will correspond with the area assessed as being at risk of ground movements measuring more than 1mm during construction. This area has been defined by greenfield geotechnical damage assessment and has been utilised and approved as a study area for EIA on previous large infrastructure projects involving tunnelling.
- 9.2.2 In addition, a further study area of 150m from the proposed Arthur Street Shaft will also be assessed, due to the above ground activity at this site and the potential for temporary setting impacts to heritage assets. These study area limits are considered to suitably establish both the potential for direct impacts on built heritage assets within close proximity of the BSCU Works, and also to assess potential ground movement and setting impacts on assets in the vicinity. The impacts on the setting of wider townscape and visual amenity, including views, will be examined within the Townscape and Visual Effects chapter as described in Section 6.
- 9.2.3 There are 47 listed buildings within the 1mm settlement contour, of which seven are Grade I listed, two Grade II* listed, and 38 are Grade II listed. There are also two Scheduled Monuments, one of which is also designated as a listed building. Within the 150m study area centred on Arthur Street, there are an additional ten listed buildings; two at Grade I, one at Grade II*, and seven Grade II. The Grade I listed Monument is also a Scheduled Monument. This makes a total of 58 assets to be considered. The assessment will determine the impacts to the significance of buildings with multiple designations both in terms of their listed and their scheduled status. The Whole Block Site location and surroundings are shown in Figure 9.1.

9.2.4 The site of the Roman Governor’s Palace (Scheduled Monument 1001997) is approximately 50m to the south-west of the Arthur Street Work Site. This asset comprises buried archaeological remains, and will therefore be considered in the Archaeology chapter (Section 10).

Figure 9.1: Location Plan of the Whole Block Site including Conservation Area Boundary and Listed Buildings



- 9.2.5 Approximately 50m to the east of the Arthur Street Work Site, Grade I listed The Monument is also a Scheduled Monument (list entry 1193901, SM 1002065). The Monument has a far reaching setting due to its height and form, and this setting may be impacted by construction at the Arthur Street Work Site. The impact of construction on the heritage significance of the asset will be assessed within the Built Heritage chapter.
- 9.2.6 The BSCU Works lie, in part, within the Bank Conservation Area. There is also one other Conservation Area to the south-west of the Whole Block Site, that of Laurence Pountney Hill. This Conservation Area is within 150m of the Arthur Street Work Site. The Bank Conservation Area has the potential to be directly impacted by the BSCU Works due to potential building damage within the conservation area. The Laurence Pountney Hill Conservation Area has the potential to be impacted during construction due to temporary disturbance to setting and from noise of construction activities. The impact of these activities on the setting and context of heritage assets will be assessed within the Built Heritage chapter.

Undesignated Assets

- 9.2.7 The OSD site currently incorporates a retained façade to Abchurch Lane, designed to provide a historic context to the adjoining heritage assets of St Mary Abchurch and 15 Abchurch Lane. Whilst this asset is undesignated, it is seen to be of importance in its role as setting of designated assets by the City of London Corporation and English Heritage. Impacts to the retained façade will be examined within the OSD EIA.

9.3 Potential Impacts

- 9.3.1 The BSCU Works encompass works at the Whole Block Site, the Arthur Street Work Site, and below ground tunnelling and station works.
- 9.3.2 It is recognised that there are potential impacts to all heritage assets within the 1mm settlement contour, however, previous assessment work undertaken by Mott McDonald and Alan Baxter Associates suggests that few buildings will experience damage which would harm their heritage significance.
- 9.3.3 Settlement impacts will be direct, relating to potential damage to assets caused by ground movement, and any mitigation or intrusive monitoring strategy will be designed to protect the assets. Impacts to the built heritage are expected to be greater in close proximity to the BSCU Works.
- 9.3.4 On the basis of the initial scoping appraisal and the initial greenfield damage assessment conducted during the bid process, there are four listed buildings that may potentially experience over 50mm of ground movement during the BSCU Works:

- Grade I listed St Mary Abchurch (list entry 1359119);
- Grade II listed 15 Abchurch Lane (list entry 1064771);
- Grade II listed 3-7 King William Street (list entry 1064622); and
- Grade II listed 1 King William Street (list entry 1252015).

9.3.5 A further two listed buildings may potentially experience over 25mm of ground movement:

- Grade I listed Mansion House (list entry 1064604); and
- Grade II listed 1-6 Lombard Street (list entry 1286139).

9.3.6 Eleven buildings are predicted to experience between 10mm and 25mm of ground movement:

- Grade I listed 27-32 Poultry (list entry 1064598);
- Grade I listed Church of St Clement (list entry 1064699);
- Grade II* listed 20 St Swithen's Lane (list entry 1079092); and
- nine further Grade II listed buildings.

9.3.7 Buildings with potential to experience up to 10mm of ground movement include three Grade I listed buildings, of which the Fishmongers Hall is also a Scheduled Monument, one Grade II* listed building, and 28 Grade II listed buildings.

9.3.8 Built heritage assets close to the Arthur Street Work Site will experience temporary setting impacts during construction, including The Monument. Other temporary impacts of construction such as increased traffic and noise may also affect heritage assets, for instance churches, and will therefore be assessed.

9.4 Assessment Methodology

Overview

9.4.1 For the purposes of the impact assessment, the chapter will cover heritage assets in accordance with the integrated and holistic approach to the historic environment set out in the National Planning Policy Framework (NPPF). The Historic Environment Planning Practice Guide, published by English Heritage prior to the adoption of the NPPF, continues to be relevant as guidance on the heritage aspects of the NPPF.

9.4.2 Paragraphs 126 to 141 contain the heritage specific policies in the NPPF, whilst paragraph 9 considers new development in a heritage context.

9.4.3 The Historic Environmental Impact Assessment will be undertaken in accordance with relevant national, local and emerging policy, guidance and professional standards. These will include, but not be limited to:

- National Planning Policy Framework 2012;
- Policies set out in the City of London Corporation Core Strategy, 2011 Built heritage policy is contained in PS12: Historic Environment;
- Bank Area Enhancement Strategy 2013;
- English Heritage, 2008 Conservation Principles: Policies and Guidance for the Sustainable Management of the Historic Environment;
- English Heritage, 2006. Understanding Historic Buildings;
- English Heritage, 2011 Guidance on Conservation Area Appraisals;
- English Heritage Guidance on The Setting of Heritage Assets, 2011;
- English Heritage, 2011 Seeing History in the View; and
- The Institute for Archaeologists, 2008 Standards and Guidance for Archaeological Desk-Based Assessment.

Spatial Scope

9.4.4 As identified in 9.2.1, for the purposes of the assessment for the BSCU Works with the potential to impact heritage assets, the study area will assess structures within the settlement effects boundary (at the 1mm contour). The assessment will also address the Arthur Street Work Site and surrounding area within a 150m radius.

Baseline Study

9.4.5 The EIA will include a comprehensive desk-based assessment of baseline conditions. The purpose of the heritage baseline study will be to identify known statutorily designated and non-designated heritage assets.

9.4.6 If necessary, a wider study will be incorporated to consider any potential setting impacts of the BSCU Works sites on the heritage significance of designated built heritage. This area for consideration will be consistent with the Zone of Visual Influence (ZVI) chosen for the TVIA. The baseline heritage resource will then be accurately mapped in relation to the BSCU Works sites and surrounding study areas.

9.4.7 Site assessment will be undertaken in order to assess the impact of the BSCU Works on the setting of any identified heritage where relevant to the heritage significance of assets and to seek to identify any previously unrecorded historic

townscape features within the BSCU Works sites which may be impacted by the proposals. Photographs will be taken to illustrate the heritage baseline.

- 9.4.8 Designated and undesignated assets will be identified through searches of both the Greater London Historic Environment Record and National Heritage List for England. The information provided by these datasets will be enhanced by targeted research from existing written, cartographic, photographic and electronic information to identify the likely character, extent and significance of any identified heritage assets and their setting. Identification of assets and documentary sources undertaken during previous work will be examined and reviewed in light of the current proposed BSCU Works, and relevant material incorporated into the baseline.
- 9.4.9 Sources to be consulted will include but are not limited to:
- Greater London Historic Environment Record (HER);
 - National Heritage List for England;
 - City of London Corporation Metropolitan Archives;
 - Documentary and cartographic sources; and
 - Historic and modern aerial photographs.
- 9.4.10 This will enable the likely character, extent, date and significance of any identified heritage assets and their setting to be established.
- 9.4.11 As well as seeking a scoping opinion via a request to which this scoping report relates, further consultation with the City of London Corporation Conservation Officer and English Heritage in order to establish and, if necessary, agree suitable mitigation measures for impacts on built heritage and historic townscape assets will be undertaken as required.

Evaluation of the Heritage Resource

- 9.4.12 Once the baseline conditions for the BSCU Works sites have been established, the potential impacts on identified heritage assets from the BSCU Works will be identified and assessed.
- 9.4.13 The potential impacts of the BSCU Works on the heritage resource are likely to include:
- damage to listed buildings from ground movement, or mitigation of such;
 - impacts on heritage assets due to construction noise and traffic; and
 - impacts on the heritage significance of the setting and context of heritage assets.

Sensitivity of Heritage Assets

- 9.4.14 The sensitivity or importance of identified heritage assets will be determined by professional judgement guided by statutory and non-statutory designations, national, regional and local policies, and the modified criteria for Scheduled Monuments used in England by the Secretary of State for Culture, Media and Sport (DCMS 2010). Guidance provided in the NPPF states that some heritage assets have a level of interest which justifies a statutory designation and therefore particular procedures apply to decisions that involve them. Other heritage assets which are not statutorily designated but which are of heritage interest are also a material planning consideration (NPPF, paragraph 135).
- 9.4.15 A hierarchy is attributed to the value of individual assets on the basis of their designated or non-designated status, established in paragraph 132 of the NPPF. Scheduled Monuments, protected wreck sites, Registered battlefields, Grade I and II* listed buildings and Grade I and II* Registered Parks and Gardens, and World Heritage Sites are accorded the highest significance, whilst Grade II listed buildings and Grade II Registered Parks and Gardens of Special Historic Interest are accorded a slightly lower value. Table 9.1 summarises the factors for assessing the sensitivity of heritage receptors.
- 9.4.16 Potential impacts are defined as a change resulting from the BSCU Works that affects the heritage resource. These impacts are considered in terms of being either adverse or beneficial and in terms of being direct, indirect or cumulative, constructional or operational. The assessment of impact will include consideration of a heritage asset's setting, which will vary from case to case and cannot easily be generically defined.

Table 9.1: Factors Determining the Sensitivity of Heritage Receptors

Factors determining the Sensitivity of Heritage Receptors	
Very High	<p>Remains of inscribed international importance, such as World Heritage Sites</p> <p>Other buildings or sites of recognised international importance</p> <p>Historic landscapes of international sensitivity, whether designated or not</p> <p>Extremely well preserved historic landscapes with exceptional coherence, time-depth or other critical factor(s)</p> <p>Designated historic landscapes of outstanding interest</p>
High	<p>Grade I and Grade II* listed buildings</p> <p>Scheduled Monuments</p> <p>Grade I and Grade II* Registered Parks and Gardens</p> <p>Other assets that can be shown to have exceptional or particularly important qualities in their fabric or historical association</p> <p>Assets that can contribute significantly to acknowledged international or national research objectives</p> <p>Undesignated landscapes of outstanding interest</p> <p>Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factor(s)</p>
Medium	<p>Grade II listed buildings</p> <p>Historic buildings that are of special interest and can be shown to have important qualities in their fabric or historical association</p> <p>Conservation areas</p> <p>Historic Townscapes with historic integrity</p> <p>Undesignated assets that contribute to regional research objectives</p> <p>Undesignated assets not of schedulable quality but with good survival and rare in the region</p> <p>Undesignated landscapes of high quality and importance, and of demonstrable national sensitivity</p> <p>Locally listed buildings as recorded on a local authority list</p> <p>Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor(s)</p>
Low	<p>Undesignated assets of local importance and/ or modest quality</p> <p>Assets compromised by poor preservation and/or survival or contextual associations</p> <p>Assets of limited value, but with the potential to contribute to local research objectives</p> <p>Robust undesignated historic landscapes</p> <p>Historic landscapes with specific and substantial importance to local interest groups, but with limited sensitivity</p> <p>Historic landscapes whose sensitivity is limited by poor preservation and/or survival of contextual associations</p>

Setting

- 9.4.17 Setting is a material consideration in government planning guidance relating to historic buildings and historic landscapes. Furthermore, setting forms a statutory consideration in the assessment of impacts upon listed buildings and conservation areas (Section 66 of the Planning (Listed Building and Conservation Areas) Act 1990). An analysis of setting is necessary so as to appraise the nature and extent of any impact to a heritage asset. Setting cannot be defined as it varies from place to place; however, English Heritage has stated that setting encompasses “*the surroundings in which a place is experienced...local context, embracing present and past relationships to the adjacent landscape*” (English Heritage 2008).
- 9.4.18 Furthermore, elements of a setting may make a positive or negative contribution to the significance of an asset and may affect the ability to appreciate that significance or may be neutral. This is not only expressed by reference to visual considerations, but other environmental issues such as noise, dust and vibration, spatial associations and our understanding of the historic relationship between places will also determine the extent and importance of setting (English Heritage 2011). For the purposes of this assessment, all of these issues will be considered with regard to the potential impacts of the BSCU Works upon heritage assets. Professional judgement will be used to apply the scale shown in Table 9.2 in consideration of the magnitude of any impact the BSCU Works may have on setting.

Magnitude of Impact

- 9.4.19 The magnitude of an impact can be judged on a five-point scale (see Table 9.2). The impact score is arrived at without reference to the value/significance of the feature.
- 9.4.20 The potential impacts of ground movement on built heritage assets will be assessed in a separate Damage Assessment report; a detailed methodology for this assessment will be agreed with stakeholders. The results of this damage assessment will inform the assessment of magnitude of impact, based on the expected level of damage to each building during the BSCU Works, and will be presented as a Technical Appendix to this assessment.

Table 9.2: Factors determining the Magnitude of Heritage Impacts

Factors determining the Magnitude of Impacts	
High	Change such that the significance of the asset is totally altered or destroyed. Comprehensive change to setting effecting significance, resulting in changes in our ability to understand and appreciate the resource and its historical context and setting
Medium	Change such that the significance of the asset is affected. Changes such that the setting of the asset is noticeably different, effecting significance resulting in changes in our ability to understand and appreciate the resource and its historical context and setting
Low	Change such that the significance of the asset is slightly affected. Changes to the setting that have a slight impact on significance resulting in changes in our ability to understand and appreciate the resource and its historical context and setting
Very Low	Changes to the asset that hardly affect significance. Changes to the setting of an asset that have little effect on significance and no real change in our ability to understand and appreciate the resource and its historical context and setting

Assessment of Effects

- 9.4.21 The assessment of effects will be undertaken in two stages. The magnitude of impact will first be assessed without reference to the sensitivity of the receptor. The findings of this assessment will then be cross-referenced with the value of the asset (sensitivity of receptor) to categorise the effect that is likely to result from the BSCU Works (Table 9.3).

Table 9.3: Classification of Heritage Effects

Sensitivity of Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

- 9.4.22 Following the categorisation of effects using this methodology, further consideration of whether an effect is significant and requires mitigation is carried out using professional judgement, taking account of whether effects are considered to be positive or negative, permanent or temporary, direct or indirect, the duration/frequency of the effect and whether any secondary effects are caused. Major and moderate effects are generally considered to be significant.

- 9.4.23 As outlined above, mitigation may be proposed to reduce or compensate any adverse effects or to enhance positive effects. Mitigation could include structural work to alleviate settlement effects, monitoring of heritage structures to control works, or other mitigation relating to noise, vibration and visual effects. The assessment will re-assess impacts after considering any proposed mitigation to determine the residual effect.

10 Archaeology

10.1 Introduction

10.1.1 The aim of the Archaeology Chapter will be to identify any archaeological assets (buried heritage assets) which may be affected by the BSCU Works and any additional archaeological constraints to the development.

Recommendations and strategies outlining further work proposed as part of the EIA and the suggested approach are described.

10.1.2 In order to support the EIA for the Whole Block and Arthur Street Sites, the historic environment will be considered under two separate topics: Archaeology (buried remains) and Built Heritage (historic buildings, structures and streetscapes). These topics will form separate chapters of the ES.

10.2 Description of the Baseline

10.2.1 The current understanding of baseline conditions used to establish the archaeological scope has been informed by an appraisal of the results of previous archaeological investigations undertaken in the areas surrounding the Whole Block and Arthur Street Sites, relevant documentary and online sources.

10.2.2 A study area comprising two overlapping circles each of 100m radius and extending from the centre of the Whole Block Site between King William Street and Cannon Street and the Arthur Street Work Site was selected for the scoping assessment. Within the urban environment of central London the 100m radius study area is of sufficient size to enable the identification of all archaeological assets that may be impacted by the BSCU works in accordance with NPPF paragraph 128. The study area will also allow the context of and potential for surviving archaeological remains to be assessed.

Designated Assets

10.2.3 A single Scheduled Monument is located within the study area surrounding the Whole Block Site encompassing the buried archaeological remains of the Roman Provincial Governor's Palace (English Heritage National Monuments List No. 1001997).

10.2.4 The designated extent of the buried remains which comprise the Scheduled Monument are located beneath extant buildings, including Cannon Street Station approximately 20m to the southwest on the southern side of Cannon Street beyond the limits of the Whole Block Site. Evidence from archaeological excavation of the site has revealed an extensive complex of buildings across three terraces cut into the hillside overlooking the Walbrook valley and covering approximately 1.2 hectares. The scale and monumental architecture of the buildings, which were laid out symmetrically around a large ornamental garden

court, the centrepiece of which was an elongated central pool, suggest this is the site of a palatial residence or imperial palace known as a *praetorium*. As such it would have been the centre of provincial administration and the official residence of the Roman Governor of the Roman province of Britain. The monument description rightly describes the site as being on a '*wholly exceptional scale*' and '*of significance for the western empire, as well as of outstanding national importance in the Roman province of Britain*' (English Heritage Monument description, accessed 29th July 2013).

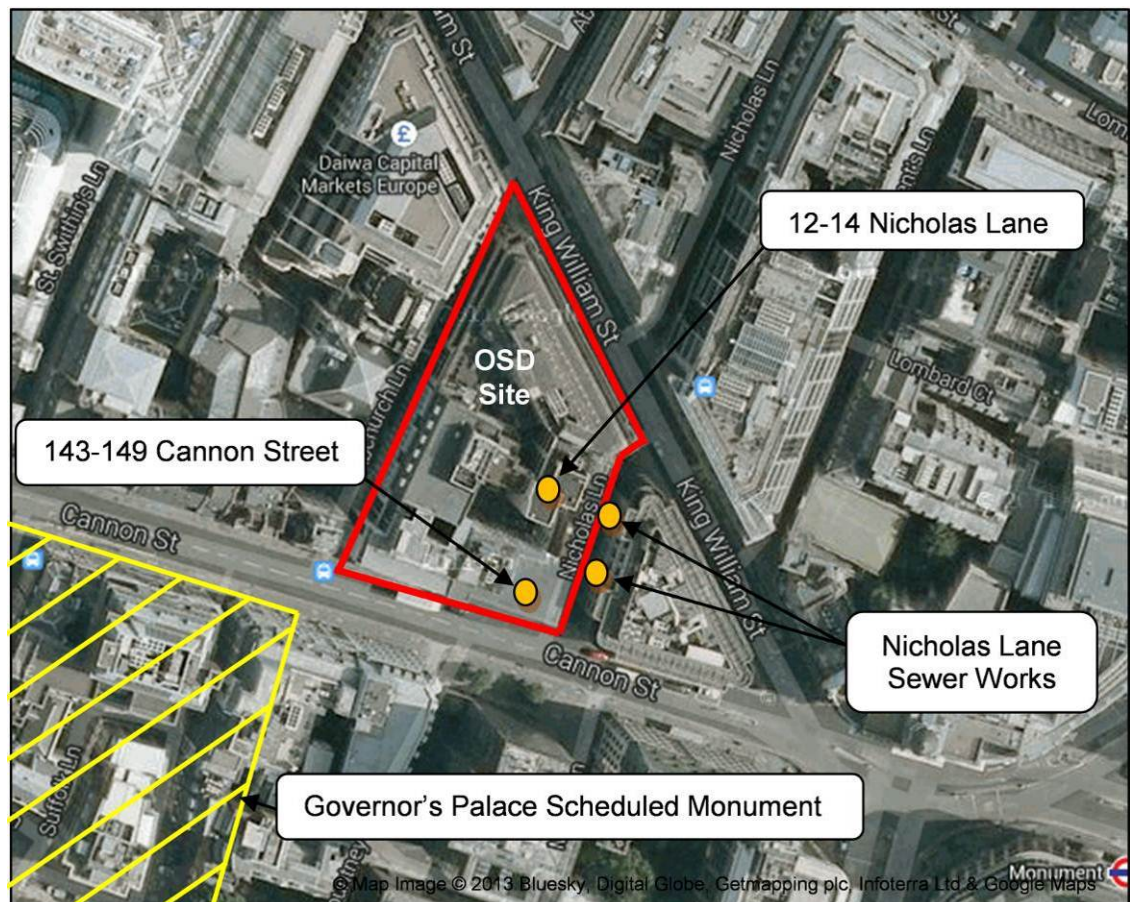
- 10.2.5 Two Scheduled Monuments are located within the 100m radius study area surrounding the proposed Arthur Street Work Site. Both comprise extant above ground structures and both are also statutorily listed buildings:
- The Monument, Scheduled Monument and Grade I listed building (English Heritage National Monuments List Nos.1002065 and 1193901)
 - Fishmongers' Hall Scheduled Monument and Grade II* listed building (English Heritage National Monuments List Nos. 1002058 and 1359203).
- 10.2.6 The impact of the BSCU Works on these two Scheduled Monuments will be limited to their setting and possible settlement effects. These assets will therefore be assessed in Chapter 9, Built Heritage.
- 10.2.7 There are no World Heritage Sites, Registered Parks and Gardens or Registered Battlefields within the combined study areas.
- 10.2.8 Designated heritage assets such as listed buildings, Conservation Areas and their settings are assessed in Chapter 9, Built Heritage.

Non-Designated Assets

- 10.2.9 Both the Whole Block and Arthur Street Sites are situated within the City of London, the area of which is considered to be equivalent to an Archaeological Priority Area. In addition, the Cannon Street and Nicholas Street frontages of the Whole Block and Arthur Street Sites are located within an Area of Archaeological Potential as defined by saved policy ARC1 (Map 11.2) of the Unitary Development Plan 2002. The archaeological potential of the area is derived from its location within the heart of the Roman and medieval City of London.

Whole Block Site

- 10.2.10 Previous archaeological investigations undertaken in the vicinity of the Whole Block Site suggest that there is potential for archaeological deposits to extend between 3m and 5m below the existing ground surface. This area includes that of the Whole Block Site. Based on current ground levels this suggests that archaeological deposits could survive to a depth of c.108-109m ATD.
- 10.2.11 Roman and medieval remains have certainly been recorded within the boundary of the Whole Block Site at 12 and 14 Nicholas Lane (Figure 10.1) where archaeological monitoring in 1980 recorded substantial Roman wall footings and at least two layers of fire destruction deposits. Also within the site at 143-149 Cannon Street, archaeological excavations in the 1960s revealed Roman deposits including gravel dumps associated with construction or metalling of the Roman road that ran approximately east-west along what is now Cannon Street, and ragstone foundations of a building that cut through burnt Flavian (AD 69-96) deposits and a pit containing 'bones'.
- 10.2.12 Further evidence for archaeological remains within the immediate vicinity of the Whole Block Site includes:
- Roman walls and tesserae footways found during the excavation of sewer trenches in various locations around the site during the 19th century;
 - the quoin end of a rag, chalk and flint wall, around 2.13m thick (the top of which lay at approximately 2.74m below the surface) found during 19th century sewer excavations towards the southern end of Nicholas Lane;
 - a Roman dwelling and a red tessellated footway revealed during early 20th century repairs to the sewerage system along St Nicholas Lane; and
 - a Roman votive urn associated with a building in the vicinity found at the northern end of Nicholas Lane. The urn was found at a depth of approximately 4.88m below ground level, illustrating the depth of Roman deposits present in the vicinity of the Whole Block Site.
- 10.2.13 Although known archaeological remains are dominated by Roman discoveries, it is anticipated that the upper parts of the archaeological sequence will comprise medieval and post-medieval remains.

Figure 10.1: Location of Archaeological Remains

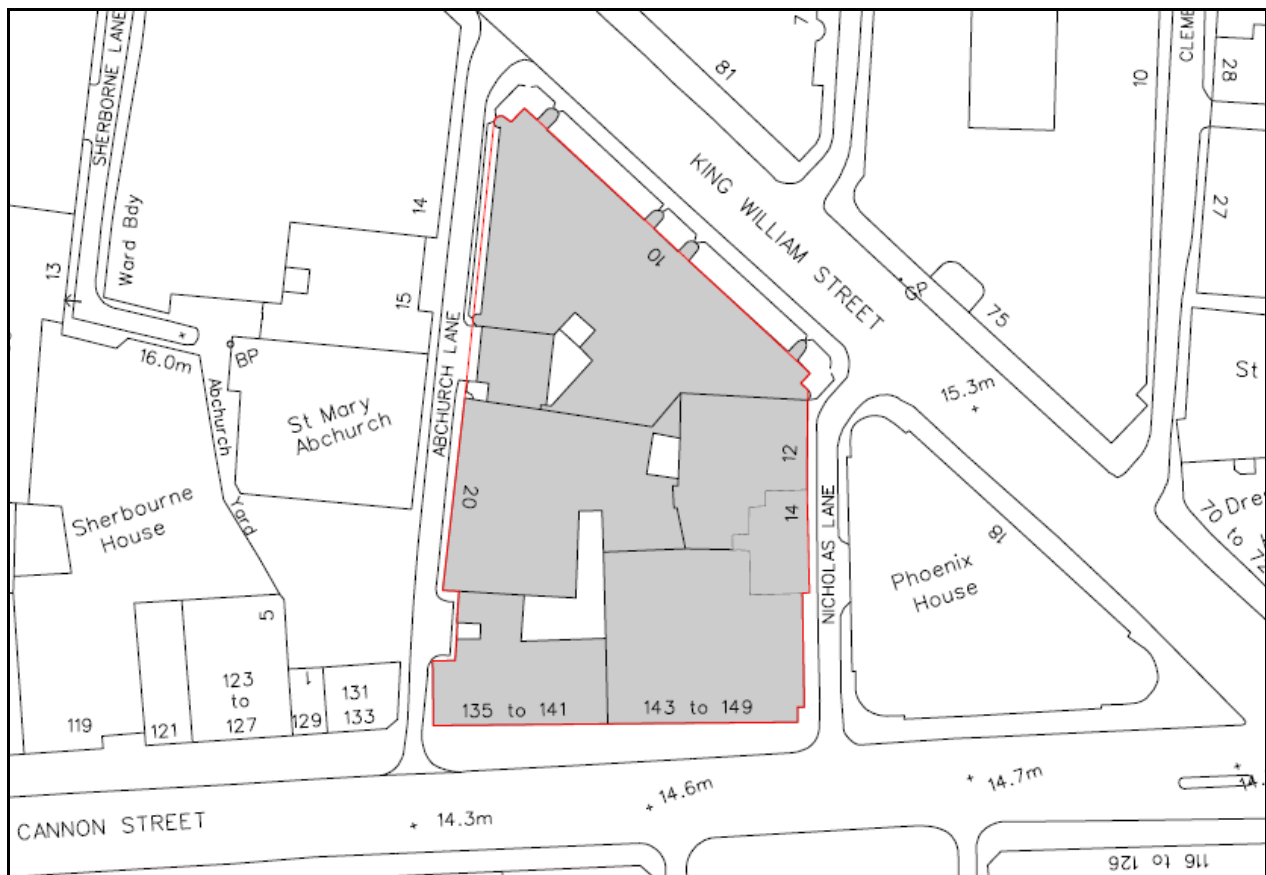
10.2.14 Despite the known archaeological potential of the area, the construction of the existing buildings (as shown in Figure 10.2) will have impacted on the archaeological resource across much of the Whole Block Site as summarised below:

- within the 10 King William Street construction the double storey basement, notably the deepest section of lower basement located in the centre of the building is likely to have removed any surviving archaeological remains. Survey work to date concluded that there is a high potential for remains of Roman and medieval date to survive within the area of the single level basement (in the northern, southern and western edges of the site);
- 12 Nicholas Lane is known to have a single storey basement level which extends to a depth of approximately 109-110m ATD. Although construction of the basement is likely to have removed the majority of the archaeological sequence, early indications suggest that there is potential for up to 1m of archaeological deposits to survive beneath the basement slab;
- 14 Nicholas Lane also has a single storey basement level which extends to a depth of approximately 111-112m ATD. As with 12 Nicholas Lane,

despite previous construction impacts, early indications suggest that there is potential for the survival of up to 3m of archaeological deposits beneath the basement slab;

- 143-149 Cannon Street has a single basement level which extends to a depth of approximately 109-110m ATD. This basement will have removed much of the archaeological sequence, although it is possible that up to 1m of archaeological deposits survive beneath the basement slab; and
- both 135-141 Cannon Street and 20 Abchurch Lane have double storey basements extending to c. 107m and 108m ATD respectively, which are likely to have removed any surviving archaeological remains. 135-141 Cannon Street has also previously been archaeologically excavated.

Figure 10.2: Existing Buildings within the Whole Block Site



Arthur Street Work Site

10.2.15 In the immediate vicinity of the Arthur Street Work Site, known archaeological assets include evidence for the prehistoric 'natural' foreshore of the River Thames and the remains of substantial Roman buildings including waterfront warehouses, the Roman waterfront revetment (to the south of the site), floors, hypocaust, cess pits and dump deposits.

- 10.2.16 Much of the excavated evidence has been recovered from 33 King William Street immediately south of the proposed Arthur Street Work Site which was excavated in the 1920s and in 1979. Of note are the remains of a substantial Roman masonry building which are likely to extend northwards from the 33 King William Street site into the area of the proposed shaft. In addition a sequence of Saxon pits, medieval buildings and cess pits were also recorded overlying Roman horizons.
- 10.2.17 Historic map evidence presented in the 33 King William Street, London EC4, Archaeological Desk-based Assessment (Mills Whipp, 2011), shows that the proposed shaft site was occupied by late medieval and post-medieval housing until the construction of Arthur Street.
- 10.2.18 Construction of the carriageway and the laying of modern services and utilities will have resulted in some truncation of the upper archaeological horizons but it is anticipated that the medieval and Roman remains will survive at depth.
- 10.2.19 Survey evidence for possible below ground disturbance suggests that several existing sewers cross the area surrounding the proposed shaft location. The construction method of the sewers is not currently known and therefore the possible extent to which they may have disturbed buried archaeological remains has yet to be established.
- 10.2.20 Although the proposed Arthur Street Work Site is located on the line of the disused City and South London Railway tunnels it is known that these were the world's first deep level 'tube' tunnels to be excavated using a tunnel shield. Consequently there remains the potential for sub-surface archaeological remains to survive between the existing ground surface and underlying natural geology.

10.3 Potential Impacts

Whole Block Site

- 10.3.1 The design for the Whole Block Site will include a new concourse at the existing basement level linked to new connection tunnels and platform access. A piled box with secant and contiguous pile retaining walls will be constructed to house:
- a new triple escalator – Station Entrance to Northern Line box to an intermediate landing extending southwards across the basements of 12 and 14 Nicholas Lane, and a new triple escalator Station Entrance to Northern Line barrel to platform level ; and
 - two new Station Entrance to Northern Line and DLR passengers lifts excavated from the existing basement slab level in 10 King William Street.

- 10.3.2 The upper secant pile wall will extend at least 1m into the London Clay extending 7-10m below the existing basement levels. Construction of the piled box has the potential to remove buried archaeological remains which may survive within its footprint particularly beneath the basement slab of 14 Nicholas Street.
- 10.3.3 Outside the piled escalator box and access shaft box a raft slab without piles laid over existing basement slabs is the preferred foundation option. Construction impacts outside the piled box will therefore be limited to the use of localised piling; to areas previously disturbed by construction of the existing buildings; or to enabling works such as utility diversions.

Arthur Street Work Site

- 10.3.4 At Arthur Street the current construction methodology requires that an 11m diameter shaft, with a total depth of 36m below ground level will be constructed. The top 15m of the shaft will be secant piled with the remainder being spray concrete lined.
- 10.3.5 Excavation of the Arthur Street Shaft will remove any archaeological remains that survive between existing ground level and the natural Thames Terrace gravels.
- 10.3.6 Further construction impacts at the Arthur Street Work Site will comprise enabling works such as utility diversions.

10.4 Assessment Methodology

Overview

- 10.4.1 In order to support the EIA for the Whole Block and Arthur Street Sites, the historic environment will be considered under two separate topics: Archaeology (buried remains) and Built Heritage (historic buildings, structures and streetscapes). These topics will form separate chapters of the ES.
- 10.4.2 When preparing the archaeological impact assessment the following standards and guidance documents will be taken into consideration:
- National Planning Policy Framework (NPPF) 2012 (Section 12);
 - English Heritage, Historic Environment Planning Practice Guide (EH 2010);
 - English Heritage, Conservation Principles: Policies and Guidance for the Sustainable Management of the Historic Environment (EH 2008);
 - Institute for Archaeologists Standard and Guidance for Historic Environment Desk-based Assessment (IfA 2012);

- Institute for Archaeologists Standard and Guidance for Field Evaluation (IfA 2008);
- Institute for Archaeologists Code of Conduct (IfA 2012);
- Planning Advice Note 3: Archaeology in the City of London; and
- English Heritage, Greater London Archaeology Advisory Service: Standards for Archaeological Work London Region (2009).

Baseline Study

- 10.4.3 The EIA will comply with the requirements of Saved Policy ARC1 of the City of London Corporation Unitary Development Plan 200, Policy CS12 of the Core Strategy (2011) and Section 12 of the NPPF and will be supported by a comprehensive desk-based assessment of baseline conditions. The purpose of the archaeological baseline study will be to identify known statutorily designated and non-designated archaeological assets.
- 10.4.4 The assessment will focus upon the Whole Block and Arthur Street Sites and in accordance with standard archaeological practice a surrounding study area as defined above.
- 10.4.5 The baseline archaeological resource will then be accurately mapped in relation to the Whole Block and Arthur Street Sites and surrounding study areas. The archaeological baseline study will also determine the archaeological potential of the assets and assess their significance.
- 10.4.6 A number of site visits will be undertaken in order to assess the current conditions within the Whole Block and Arthur Street Sites, the extent of previous development impacts and, where appropriate, assess the impact of the BSCU Works on the setting of any identified archaeological assets.
- 10.4.7 Designated and undesignated assets will be identified through searches of both the Greater London Historic Environment Records and English Heritage National Monuments Record. The information provided by these datasets will be enhanced by targeted research from existing written, cartographic, photographic and electronic information to identify the likely character, extent and significance of any identified archaeological assets and their setting.
- 10.4.8 Sources to be consulted to inform the archaeological baseline assessment will include:
- Greater London Historic Environment Record;
 - English Heritage National Monuments List;
 - English Heritage National Monuments Record;
 - the London Metropolitan Archive;

- the Guildhall Library;
 - London Archaeological Archive and Resource Centre (for previous archaeological investigation reports);
 - historic Ordnance Survey and pre-Ordnance Survey mapping;
 - previous archaeological studies undertaken for the Bank Station Capacity Upgrade project;
 - available ground investigation reports or borehole data;
 - information regarding archaeological priority areas obtained from the City of London Corporation; and
 - various internet sources.
- 10.4.9 This will enable the likely character, extent, date and significance of any identified heritage assets and their setting to be established and the archaeological potential of the BSCU Works sites determined.
- 10.4.10 All spatial data and related attribute data shall be managed within a project specific information management system based on a GIS system.
- 10.4.11 As well as seeking a scoping opinion via a request to which this scoping report relates, further consultation with the Archaeological Officer for the City of London Corporation will be undertaken.

Evaluation of the Archaeological Resource

- 10.4.12 Once the baseline conditions for the BSCU Works sites have been established, the potential impacts on identified archaeological assets from the BSCU Works will be identified and assessed.
- 10.4.13 The potential impacts of the BSCU Works on the heritage resource may include the damage or loss of potentially important archaeological remains surviving as below ground deposit sequences currently sealed beneath the existing ground surface and extant buildings.

Sensitivity of Archaeological Assets

- 10.4.14 For the purposes of this impact assessment, the term sensitivity is used to describe the heritage significance or weight given to each asset.
- 10.4.15 The sensitivity of identified archaeological assets will be determined by professional judgement guided by statutory and non-statutory designations, their assessed significance as set out in the NPPF, national, regional and local policies, archaeological research frameworks and the modified criteria for Scheduled Monuments used in England by the Secretary of State for Culture, Media and Sport (CLG 2012).

10.4.16 The criteria used to determine the sensitivity of archaeological assets are presented in accordance with a five point scale as shown in Table 10.1.

Table 10.1: Factors Determining the Sensitivity of Archaeological Assets

Sensitivity (Heritage Significance)	Asset Categories
High	Remains of inscribed international/universal importance, such as World Heritage Sites. Scheduled Monuments. Registered battlefields. Non-designated archaeological assets demonstrably of schedulable quality and significance.
Medium	Sites of moderate archaeological resource value as identified through consultation. Non-designated assets not of schedulable quality but with good survival and rarity within the region.
Low	Locally important historic or archaeological sites, sites with a local value for research, education or cultural appreciation. Assets compromised by poor preservation and/or survival of contextual associations.
Not Significant	Assets identified as being of no historic, evidential, aesthetic or communal interest. Assets with no significant research potential. This may include heavily truncated archaeological remains, chance finds of isolated artefacts that have no archaeological context or remains/structures which are identified as archaeological assets by Local Authority Historic Environment Records but which have been previously destroyed.

Magnitude of Impact

10.4.17 Potential impacts are defined as a change resulting from the BSCU Works that affects the archaeological resource. These impacts are considered in terms of being either adverse or beneficial. The assessment of impact will include consideration of a heritage asset's setting, which will vary from case to case and cannot easily be generically defined.

10.4.18 Professional judgement will be used to apply the scale shown in Table 10.2 in consideration of the magnitude of any impact the BSCU Works may have on the archaeological resource or its setting.

10.4.19 The magnitude of an impact is considered on a five-point scale. The impact score is arrived at without reference to the value/significance of the asset.

Table 10.2: Factors Determining the Magnitude of Archaeological Impacts

Magnitude of Impact	Description of Change
High	Change such that the significance of the asset is totally altered or destroyed. Comprehensive change to setting affecting significance, resulting in changes in our ability to understand and appreciate the resource and its historical context and setting.
Medium	Change such that the significance of the asset is affected. Changes such that the setting of the asset is noticeably different, affecting significance resulting in changes in our ability to understand and appreciate the resource and its historical context and setting.
Low	Change such that the significance of the asset is slightly affected. Changes to the setting that have a slight impact on significance resulting in changes in our ability to understand and appreciate the resource and its historical context and setting.
Very Low	Changes to the asset that hardly affect significance. Changes to the setting of an asset that have little effect on significance and no real change in our ability to understand and appreciate the resource and its historical context and setting.
No Change	The development does not affect the significance of the asset. Changes to setting that do not affect the significance of the asset or our appreciation of it.

Assessment of Effects

- 10.4.20 The assessment of effects will be undertaken in two stages. The magnitude of impact will first be assessed without reference to the sensitivity of the receptor. The findings of this assessment will then be cross-referenced with the heritage significance or value of the asset (sensitivity of receptor) to categorise the effect that is likely to result from the BSCU Works (Table 10.3).

Table 10.3: Classification of Archaeological Effects

Sensitivity of Receptor	Magnitude of Impact				
	High	Medium	Low	Very Low	No Change
High	Major	Major	Moderate	Minor	Negligible
Medium	Major	Moderate	Minor	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible	Negligible
Not Significant	Minor	Minor	Negligible	Negligible	Negligible

- 10.4.21 Following the categorisation of effects using this methodology, further consideration of whether an effect is significant and requires mitigation is carried out using professional judgement, taking account of whether effects are considered to be positive or negative, permanent or temporary, direct or indirect, the duration/frequency of the effect and whether any secondary effects

are caused. Major and Moderate effects are generally considered to be significant.

- 10.4.22 As outlined above, mitigation may be proposed to reduce or compensate any adverse effects or to enhance positive effects. The assessment will re-assess impacts after mitigation to determine the residual effect.
- 10.4.23 The scope of archaeological mitigation assessed as being potentially required during the EIA process will be determined by the extent and significance of surviving archaeological remains but may include detailed excavation, geoarchaeological or palaeoenvironmental sampling or monitoring and recording of archaeological remains (archaeological watching brief) during demolition and construction activities.

11 Air Quality

11.1 Introduction

11.1.1 This Section of the scoping report outlines the proposed approach to the assessment of potential effects on local air quality sensitive receptors.

11.2 Description of the Baseline

11.2.1 An initial review of published air quality baseline information is presented from publicly available sources of information including:

- the Air Quality Archive hosted on the Department of Environment Food and Rural Affairs (DEFRA) website;
- the London air online air quality recourse;
- the London Atmospheric Emissions Inventory;
- Local Authority air quality websites; and
- Local Authority Local Air Quality Management Reports.

11.2.2 A review of aerial photography and mapping has also informed this section.

Local Air Quality Management

11.2.3 Under the requirements of Part IV of the Environment Act (1995), Local Authorities, including the City of London Corporation, must carry out a phased review and assessment of air quality within their administrative areas.

11.2.4 The review and assessment undertaken by the City of London Corporation to date has identified that air quality across much of the Borough is poor, with exceedances of the national air quality objectives for nitrogen dioxide (NO₂) and particulate matter (PM₁₀).

11.2.5 When local authorities identify an area of poor air quality, that may not achieve compliance with a national air quality objective set out in the national Air Quality Strategy (H.M. Government, 2010), they are required to declare an AQMA and develop measures to work towards compliance with the health based objectives. For this reason, the City of London Corporation declared a Borough-wide Air Quality Management Area in 2001 and have published an Air Quality Action Plan (AQAP) (City of London, 2011).

11.2.6 Publicly available information from the City of London Corporation website indicates that they monitor and measure air quality at several locations within the Borough's administrative area. This monitoring and measurement of air quality involves six automatic continuous monitoring stations (monitoring one or more of the pollutants NO₂, PM₁₀, fine particulate matter (PM_{2.5}), sulphur

dioxide (SO₂) and ozone (O₃) and five passive diffusion tubes (measuring NO₂). A summary of the NO₂, PM₁₀ and PM_{2.5} data gathered at these locations is provided in Table 11.1 and Table 11.2. The publically available data currently available from the City of London Corporation website has been supplemented by data published on the London Air Quality Network (<http://www.londonair.org.uk>), which is maintained by Kings College London.

Table 11.1: City of London Monitored Pollutant Concentration Data

Monitoring Station	Grid Ref.	Pollutant	Annual Mean Conc. (µg/m ³)					Air Quality Obj.
			2008	2009	2010	2011	2012	
CT1 Senator House (urban background)	532234, 180894	NO ₂	49	48	51	52	50	40
CT2 Farringdon Street (kerbside)	531625, 181201	PM _{2.5}	-	-	-	24	-	25
CT3 John Cass School (urban background)	533475, 181179	NO ₂	58	56	55	48	47	40
		PM ₁₀	26	27	26	28	26	40
CT4 Beech Street (roadside)	532176, 181862	NO ₂	85	90	81	67	-	40
		PM ₁₀	26	28	30	29 ^a	28 ^a	40
CT6 Walbrook Wharf Foyer (roadside)	532528, 180784	NO ₂	126 ^b	131 ^b	117 ^b	101 ^b	114 ^b	40
CT8 Upper Thames Street (roadside)	532834, 180691	PM ₁₀	34 ^a	36 ^a	37 ^a	37 ^a	34 ^a	40

^a In this year, there was also an exceedance of the 24 hour PM₁₀ air quality objective of 50 µg/m³ exceeded 35 times or more in the year.

^b In this year, there was also an exceedance of the 1 hour NO₂ air quality objective of 200 µg/m³ exceeded 18 times or more in the year.

11.2.7 The data displayed in Tables 11.1 and 11.2 confirms that air quality at locations within the City of London area is poor, with exceedances of the national air quality objective for annual mean NO₂ (40 µg/m³) at roadside and urban background locations (locations set back from the roadside). Exceedances of the hourly mean NO₂ (200 µg/m³ exceeded 18 times or more in a year) and 24 hour mean PM₁₀ (50 µg/m³ exceeded 35 times or more in a year) national air quality objectives have also been recorded at some locations within the Borough.

Table 11.2: City of London Measured NO₂ Pollutant Concentration Data

Diffusion Tube	Grid Ref	Annual Mean Conc. (µg/m ³)				
		2007	2008	2009	2010	2011
CL5 St Bartholomew's Hospital (urban centre)	531901, 181571	50	43	43	42	45
CL38 St Andrew's Church (roadside)	531851, 180962	69	75	67	61	63
CL39 St Dustan's Church (roadside)	531235, 181155	100	82	102	87	98
CL40 Guinness Trust Estate (roadside)	533791, 181027	76	62	67	55	65
CL55 Speed House (urban background)	532482, 181799	41	38	43	37	38
National Air Quality Objective (µg/m ³)		40				

11.2.8 The data gathered by the City of London Corporation provides an overview of the standard of air quality within the Borough. However, none of the monitoring or measurement sites operated within the City of London are in close proximity to the BSCU Works sites. As such, there are no existing sources of monitoring or measurement data that are representative of conditions currently experienced at or in the vicinity of the BSCU Works sites.

Site Specific Data Collection

11.2.9 In the absence of monitored or measured NO₂, PM₁₀ and PM_{2.5} data in the immediate vicinity of the BSCU Works sites, a short term passive NO₂ diffusion tube survey will be undertaken. The survey will involve the locating of diffusion tubes at several locations adjacent to carriageways in the vicinity of the BSCU Works sites and would be undertaken for a duration of at least three months (the minimum length of time usually considered acceptable by Local Authority Environmental Health Officers (EHOs)).

11.2.10 The data obtained from that survey will be annualised following the methodology described in the DEFRA Technical Guidance Note LAQM TG(09) (Defra, 2009). The annualised data will provide a source of baseline pollutant data for the area around the Whole Block and Arthur Street Sites. This data will be used to verify air quality model predictions following the methodology described within LAQM TG(09).

11.2.11 In addition to the baseline NO₂ survey described above, a survey of PM₁₀ and Total Suspended Particulate (TSP) will be undertaken prior to construction of the proposed works. The monitoring will be undertaken using electronic monitoring devices positioned at a location that is representative of conditions experienced at sensitive receptors in the vicinity of the BSCU Works site

boundaries. This monitoring will provide a reference for monitoring undertaken during the demolition and construction works to inform the suitability of dust control measures implemented during the works.

11.3 Potential Impacts

11.3.1 The BSCU Works has the potential to affect air quality through emissions to air, which include:

- road traffic emissions during construction (from construction vehicles associated with the BSCU Works and from the diversion of traffic due to any road closures associated with the BSCU Works construction);
- dust generation and site plant emissions (including non-road mobile machinery) during works;
- road traffic emissions during the operation (if the operation of the BSCU Works would lead to a change in vehicle flow and composition on the local road network); and
- any energy plant emissions associated with the BSCU Works.

11.3.2 All of the above potential impacts will be considered as part of the assessment of impacts. However, some aspects of the BSCU Works may only require a basic or screening assessment, whilst others may require a more detailed assessment.

Spatial Scope

Sensitive Receptor Locations

11.3.3 The spatial extent of the sensitive receptors considered in the air quality assessment will vary dependent on each potential impact.

11.3.4 The impact of dust generated during construction activities will have the potential to affect sensitive receptors located within 100m of the construction works, as defined within LAQM guidance (LAQM, 2012).

11.3.5 The impact of any change to vehicle flow and composition on the local road network and, the resultant change in emissions, during the construction and operational phases, will have the potential to affect receptors located adjacent to the roads that undergo the greatest change as a result of the BSCU Works. The exact location of such receptors will depend on where the greatest change in vehicle flow and composition is likely to occur.

11.3.6 The impact associated with any energy plant emissions has the potential to affect sensitive receptors at locations within a few hundred metres of the source of emission (the energy plant stack). The exact location of such receptors will depend on the where the plume from the stack grounds, which

will depend on the height of the stack release point and local meteorological conditions.

- 11.3.7 The BSCU Works sites are located in the central eastern area of the City of London. A review of the area using aerial photography and mapping data has identified that much of the surrounding land use in the vicinity of the BSCU Works is given over to commercial office space, the nearest of which is within 10m. There is some residential property located amongst the predominantly commercial space, including flats situated off Abchurch Yard, Moorgate, Cheapside, Cannon Street, Bishopsgate, Ludgate Hill, London Wall, Martin Lane and Upper and Lower Thames Street.
- 11.3.8 The nearest ecological sensitive area to the BSCU Works sites are the Walthamstow marshes, approximately 7km to the north of the BSCU Works.
- 11.3.9 Specific receptors will be identified following initial assessment work to identify the key sources of pollutions (e.g. point sources and/or road traffic sources) and the locations most likely to be affected by these sources.

Temporal Scope

- 11.3.10 The air quality assessment will consider the following scenarios:
- current baseline (2012) – used for model verification;
 - future baseline (2016) – future construction year without the BSCU Works;
 - future baseline (2021) – future year of opening without the BSCU Works;
 - construction (2016) – future construction year with the BSCU Works; and
 - operation (2021) – future year of opening with the BSCU Works.
- 11.3.11 The air quality assessment requires a baseline 2012 scenario (rather than 2013) in order to provide an annual mean of measured data as comparison for model verification purposes.
- 11.3.12 The construction year scenarios (both baseline and with development) will demonstrate the impact of construction road vehicle emissions on local air quality. As the construction period is over a number of years, the year considered will represent the worst case year when construction-related vehicle movements are at their peak.
- 11.3.13 The opening year scenarios (both baseline and with development) are to demonstrate the impact of additional vehicle movements and any energy plant emissions associated with the operation of the BSCU Works.

11.4 Assessment Methodology

- 11.4.1 Emissions of dust during the construction phase will be assessed in a qualitative manner. The assessment will be based upon current guidance published by the Institute of Air Quality Management (IAQM) (IAQM, 2012), which considers the risk of significant dust effects occurring based on the scale of the works proposed, the proximity and sensitivity of nearby receptors and the suitability of control measures to reduce dust emissions at source. The assessment will also be in line with current local planning guidance at the time of assessment, including the Mayor of London's emerging Supplementary Planning Guidance on emissions from construction and demolition, which is currently undergoing a period of consultation.
- 11.4.2 The effects of road traffic emissions during the construction phase and operational phase (if required) will be assessed using the Design Manual for Roads and Bridges (DMRB) detailed methodology (HA 207/07) (HA, 2007). Any increases in concentrations of NO₂, PM₁₀ and PM_{2.5} will be quantified at roadside receptors on the carriageways experiencing the greatest increases in traffic flows which exceed DMRB screening criteria. The assessment of road traffic emissions will focus on the three key road traffic pollutants NO₂, PM₁₀ and PM_{2.5}. The modelling of road traffic emissions will be undertaken using the current version of Atmospheric Dispersion Modelling System (ADMS) Roads (at the time of the assessment). The road traffic emissions model will be verified using data gathered from the short term NO₂ diffusion tube survey, following the methodology described in LAQM TG(09).
- 11.4.3 The effect of emissions from any energy plant associated with the BSCU Works on pollutant concentrations will be modelled using the current version of ADMS 5 (at the time of the assessment). The pollutants that the assessment of energy plant emissions will consider will be finalised after the fuel type is confirmed. The air quality assessment will report the combined effect of emissions from road traffic and energy plant on nearby sensitive receptors.
- 11.4.4 The assessment of road traffic and any energy plant emissions will also be in line with current local planning guidance at the time of assessment, including (if relevant) the Mayor of London's emerging Supplementary Planning Guidance on emissions from Combined Heat and Power plant, which is currently undergoing a period of consultation.
- 11.4.5 The assessment criteria against which impacts on sensitive receptors will be considered are derived from:
- EU Limit Values transcribed into UK legislation; and

- Air Quality Objective Values recommended by the Expert Panel on Air Quality Standards (EPAQS) and set in regulation for the purposes of Local Air Quality Management.

11.4.6 The significance of the predicted increase in ground level concentrations of pollutants will be assessed using methods based on criteria devised by the IAQM and Environmental Protection UK (EPUK).

Receptor Sensitivity

11.4.7 All human receptors are considered to be of equivalent, high sensitivity to air quality impacts, as air quality standards set for the protection of human health have already taken full account of receptor sensitivity.

11.4.8 All receptors are considered to be of medium to high sensitivity with respect to dust amenity impacts, based on the criteria described in IAQM guidance.

Magnitude of Impact and Assessment of Significance

11.4.9 The scale of the risk of adverse effects occurring due to construction activities, with mitigation in place will be described using the terms high, medium and low risk. Experience in the UK is that good site practice is capable of mitigating the impact of fugitive emissions of particulate matter effectively (IAQM, 2012). Such measures are described within the GLA's guidance on controlling emissions from construction and demolition activities, and the City of London Corporation's Code of Practice for Deconstruction and Construction Sites. A Code of Construction Practice (as further discussed in Section 19) will be developed in liaison with the City of London Corporation. The use of such measures means that in all but the most exceptional circumstances, effects at receptors can be controlled to ensure effects are of negligible or slight adverse at worst, which is not considered to be significant.

11.4.10 With regard to road traffic and any energy plant emissions, the change in pollutant concentrations with respect to baseline concentrations will be 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 scenarios will also be described and this will be used to consider the risk of the Air Quality Strategy Values / EU Limit Values being exceeded in each scenario.

11.4.11 For a change of a given magnitude, the Institute of Air Quality Management have published recommendations for describing the magnitude of impacts at individual receptors (Table 11.3) and describing the significance (Table 11.4) of such impacts.

Table 11.3: Magnitude of Changes in Ambient Pollutant Concentrations of NO₂, PM₁₀ and PM_{2.5}

Magnitude of Change	Annual Mean Concentrations of NO ₂ (µg/m ³)	Annual Mean Concentrations of PM ₁₀ (µg/m ³)	Annual Mean Concentrations of PM _{2.5} (µg/m ³)	Exceedances of the 24 hour mean objective for PM ₁₀ (days)
Large	+/- > 4	+/- > 4	+/- > 2.5	+/- > 4
Medium	+/- 2 – 4	+/- 2 – 4	+/- > 1.25 – 2.5	+/- 2 to 4
Small	+/- 0.4 – 2	+/- 0.4 – 2	+/- > 1.25 – 0.25	+/- 1 to 2
Imperceptible	+/- < 0.4	+/- < 0.4	+/- > 0.25	+/- < 1

- 11.4.12 A change in predicted annual mean concentrations of NO₂ or PM₁₀ of less than 0.4µg/m³ are 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.
- 11.4.13 The criteria in Table 11.3 relate to air quality statistics that are elevated about 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/m³. It is unusual for works of this type to give rise to a change of more than 0.1µg/m³.
- 11.4.14 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 the DMRB Screening Tool. The magnitude descriptors in the table above are as proposed by Environmental Protection UK (EPUK, 2010).
- 11.4.15 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 is necessary.
- 11.4.16 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 11.4. A small increase in annual mean concentrations, at receptors exposed to baseline concentrations that are just below the objective value (36µg/m³ to 40µg/m³) is considered to have a slight adverse effect as the slight increase in the risk of exceeding the objective value is significant. However, a small increase in annual mean concentration at receptors exposed to baseline concentrations that are below or well below

(< 36µg/m³) is not likely to affect the achievement of the objective value and is therefore not a significant effect (negligible).

Table 11.4: Description of Air Quality Significant Effects for Sensitive Receptors

Absolute Concentration in Relation to Objective/Limit Value	Change in Concentration			
	High	Medium	Low	Very Low
Increase with BSCU Works				
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 Works				
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

Mitigation

- 11.4.17 Mitigation measures will be defined where applicable. The construction dust assessment will assume that standard best practice mitigation will already be in place (see Section 19), as suggested by current assessment guidance. Additional measures will be defined if required.

12 Water Resources and Flood Risk

12.1 Introduction

12.1.1 This chapter provides an assessment of the potential construction and operation impacts on water resources and flood risk associated with the TWAO elements of the Bank Station Capacity Upgrade Project. In the context of this chapter, the term 'water resources' covers the assessment of impacts on:

- surface water and groundwater resources;
- surface water and groundwater quality; and
- flood risk.

12.1.2 The following key legislation, policy and guidance are taken into account in the assessment of water resources and flood risk. Assessment of the BSCU Works and its impacts in relation to the provisions of this legislation and policy is an essential step in the assessment of the significance of effects.

- EU Water Framework Directive; EU Groundwater Directive; EU Floods Directive and associated UK Flood Risk Regulations 2009; EU Habitats Directive;
- Flood and Water Management Act; Water Act and any new provisions brought in through the Water White Paper and Water Bill; the Environmental Protection Act 1990; the Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009; Land Drainage Act;
- Water and flood risk local planning policy;
- Environment Agency Groundwater Protection: Policy and Practice (GP3); and
- Relevant LUL Standards.

Source-pathway-receptor Model

12.1.3 The assessment will be undertaken using the Source-Pathway-Receptor model. This model identifies the potential sources or 'causes' of effect as well as the receptors (water resources) that could potentially be affected. However, the presence of a potential effect source and a potential receptor does not always infer an effect, there needs to be a clear mechanism or 'pathway' via which the source can have an effect on the receptor.

12.1.4 The first stage in utilising the Source-Pathway-Receptor model will be to identify the causes or 'sources' of potential impact. The sources will be identified through a review of the details of the BSCU Works, including the size

and nature of the development, potential construction methodologies and timescales. This will be undertaken in the context of local conditions relative to water resources near the BSCU Works sites, such as topography, geology, climatic conditions and potential sources of contamination.

- 12.1.5 The next stage will be to undertake a review of the potential receptors, that is, the water resources themselves that have the potential to be affected. The identification of potential water resource receptors has been undertaken through a review of baseline data.
- 12.1.6 The last stage will be to determine if there is an exposure pathway or a 'mechanism' allowing an effect to potentially occur between source and receptor.
- 12.1.7 If it is determined that there is no pathway for the potential effect, then that particular impact or source will be scoped out of the assessment. Similarly for the Flood Risk Assessment (FRA), if it is identified that there is no potential for flooding from a particular source (e.g. no possibility of tidal flooding as the site lies inland and away from tidal reaches of watercourses) then that form of flooding will not be considered further.

12.2 Description of the Baseline

- 12.2.1 The hydrological setting for the Whole Block Site was identified in the 'Baseline Report – Water Resources N133-BCR-MMD-00-Z-DC-N-0007-S0-0.1' (August 2011) produced for London Underground. This section largely draws from, and updates, details within the baseline report.

Spatial Scope

- 12.2.2 The description of the baseline focuses on the area within 1km of the Whole Block Site, and the proposed Arthur Street Work Site, which are both TWAO elements of the Bank Station Capacity Upgrade Project. It also considers any key receptors outside of this area that may be hydraulically connected to water resources inside the area e.g. if a groundwater abstraction borehole is located 2km away but has a source protection zone that extends to within 1km of the BSCU Works.

Temporal Scope

- 12.2.3 The baseline study defines the current state of the baseline i.e. 2013.

Topography

The BSCU Works is located on the northern side of the River Thames. The Whole Block Site is bordered by King William Street, Abchurch Lane, Cannon Street and Nicholas Lane where ground elevations are around 14 to

14.5maOD. Further to the south at the proposed Arthur Street Work Site, located in front of 33 King William Street, ground elevations are lower at around 10maOD.

Hydrology and Surface Water Drainage

- 12.2.4 The average annual rainfall is 583.6mm at the Greenwich weather station, located 6km to the south-east of the BSCU Works.
- 12.2.5 The BSCU Works is located on the north side of the River Thames Estuary in the Thames River Basin District. The Thames is at an elevation of around 5maOD in this area and meanders 58km eastwards to the North Sea. The Whole Block Site is located 300m to the north of the Thames and the proposed Arthur Street Work Site is closer at around 120m.
- 12.2.6 The Whole Block Site is also located around 100m east of the buried River Walbrook, which runs along Walbrook Road and is now part of Thames Water's combined sewer system.

Geology

- 12.2.7 The geology in the vicinity of the BSCU Works is expected to comprise made ground (with an average thickness of 2.5m), underlain by Alluvium (1.2m), River Terrace Deposits (6.0m), London Clay Formation (at least 35.0m), Lambeth Group (17.0m), Thanet Sand (9.0m) and the Chalk.

Hydrogeology

Shallow Aquifer

- 12.2.8 The Alluvium and River Terrace Gravels form a shallow secondary aquifer perched on the London Clay Formation. Water levels are expected to be controlled by the balance of urban recharge from rainfall/ soakaways/pipeline leakage and outflows from natural/artificial drains. Water levels may also demonstrate tidal fluctuations associated with the River Thames.
- 12.2.9 Borehole logs (TQ38SW1856 and TQ38SW1770) indicate that the groundwater table in the vicinity of the BSCU Works is at an elevation of between 4 and 6maOD (8 to 10mbgl). However the logs are dated 1975 and 1962 and groundwater levels may have changed owing to subsequent developments in the area.
- 12.2.10 Groundwater flows in the area of the BSCU Works are expected to follow the general topographic gradient towards the River Thames, although they may also be influenced by preferential flow paths e.g. the buried River Walbrook.
- 12.2.11 The made ground that caps the shallow aquifer is predicted to behave as a non-aquifer and therefore confine the shallow aquifer.

Deep Aquifer

- 12.2.12 The Thanet Sand and Chalk form a deep principal aquifer in the study area. This is in partial hydraulic continuity with the Upnor Formation (a secondary aquifer), which is the lower part of the Lambeth Group. The Environment Agency Status Report 2012 for management of the London Basin Chalk Aquifer indicates that groundwater levels in the deep aquifer were between -30 and -40maOD (44 to 54mbgl) in January 2012. Groundwater levels are controlled by the General Aquifer Research, Development and Investigation Team (GARDIT) strategy to maintain the integrity of underground structures and foundations in the London Clay Formation.
- 12.2.13 The 'Baseline Report – Water Resources N133-BCR-MMD-00-Z-DC-N-0007-S0-0.1' (Mott MacDonald, August 2011) also highlighted that there were records for 68 (deep aquifer) water supply boreholes within 250m of the Whole Block Site and that other unrecorded water supply boreholes or dug wells may exist. Seven of the boreholes are associated with licensed abstractions.

Non-aquifer (including London Clay Formation)

- 12.2.14 A non-aquifer, which comprises London Clay Formation and Reading and Woolwich Formations of the Lambeth Group, is expected to hydraulically separate the shallow and deep aquifers. Despite the label of 'non-aquifer', these horizons contain sandier layers or sand lenses that might be encountered during excavations.
- 12.2.15 It is noted that the Mott MacDonald Baseline Report Water Resources (Mott MacDonald, August 2011) does refer to the presence of a depression in the surface of the London Clay Formation in the area of the Whole Block Site, as identified by a geo-technical desk study. Although unlikely, there is a risk this indicates the presence of a fully penetrating pingo that could provide a hydraulic link between the deep and shallow aquifers.

Environmental Designations

- 12.2.16 There are no water dependent environmental sites (e.g. Sites of Special Scientific Interest (SSSI)) within the vicinity of the BSCU Works.

Flood Risk

- 12.2.17 A Strategic Flood Risk Assessment (SFRA) was prepared for the City of London Corporation by Halcrow in 2012. The SFRA includes a review of flood risk across the City of London Corporation administrative area for a range of flood risk sources including fluvial and tidal (from the River Thames), surface water, groundwater and sewers.

- 12.2.18 The SFRA is based on a range of data sources for each flood source, including the outputs of hydraulic modelling of surface water flood risk undertaken as a development of modelling completed for the Drain London project (GLA).

Fluvial and Tidal Flood Risk

- 12.2.19 Environment Agency flood maps, accessed online on the 22nd August 2013, identify that the BSCU Sites lie within Flood Zone 1, defined as land with a less than 0.1 per cent Annual Exceedance Probability (AEP) for flooding from rivers and/or the sea (also referred to as a less than 1 in 1000 chance of flooding in any year).

Surface Water Runoff

- 12.2.20 Hydraulic modelling undertaken as part of the City of London Corporation SFRA has assessed the risk from a range of storm events including the 1 in 100 year (1 per cent AEP) plus allowances for climate change. The City of London Corporation Strategic Flood Risk Assessment Review map 'Flood Depth with Flow direction map 100 year plus climate change return period' (dated 18/04/2012) identifies that the Whole Block and Arthur Street sites do not lie in an area at risk from surface water flooding.

Sewers

- 12.2.21 Surface water runoff hydraulic modelling undertaken as part of the City of London Corporation SFRA included a representation of the sewer network serving the area of the BSCU Works. As a consequence the surface water runoff mapping referred to in paragraph 12.2.20 accounts for the risk posed to the development from local sewers. As a consequence the BSCU Works do not lie in an area at risk from sewer flooding.

Groundwater Flood Risk

- 12.2.22 The BSCU Sites are underlain by a shallow aquifer. The groundwater levels are expected to be approximately 8 to 10mbgl based on two geological borehole logs from 1975 and 1962. The 'Baseline Report – Water Resources N133-BCR-MMD-00-Z-DC-N-0007-S0-0.1' (Mott MacDonald, August 2011) states that the area has been identified to be of moderate to moderately high susceptibility to groundwater flooding. Basements are known to exist in the vicinity of the BSCU Works and these may be at some risk of groundwater flooding.
- 12.2.23 The groundwater levels in the deep aquifer are at significant depth and controlled by GARDIT. Therefore the risk from groundwater flooding caused by the deep aquifer in the vicinity of the BSCU Works is low.

Artificial Flood Sources

- 12.2.24 Artificial flood sources include the risks posed by features such as canals, reservoirs and water mains. Whilst engineered and maintained to a high standard the risk of a failure in containment of canals and reservoirs should be considered. The only surface water feature local to the BSCU Works is the River Thames. There are no canals or reservoirs local to the BSCU Works sites. Environment Agency data identifies that flooding from the Queen Mary and Queen Mother Reservoirs (30km to the west of the sites, upstream) would be contained in the River Thames and would not affect the sites.

Tunnel Flood Risk

- 12.2.25 There is believed to be a potential risk of inflow from the disused City and London running tunnels and from the existing disused LUL heritage asset King William Street Station through which the Arthur Street Shaft will be constructed.
- 12.2.26 The mechanism for leakage from these existing tunnels and the King William Street Station is uncertain but water was observed during a site visit to King William Street Station and the disused City and South London Lines. It is also noted that the Waterloo and City Line to the north is known locally as 'the drain' because of water ingress issues.

12.3 Potential Impacts

Surface Water

- 12.3.1 The key potential surface water receptor is the River Thames estuary, which is a water body under the Water Framework Directive (WFD). The water body is 'THAMES MIDDLE' (GB530603911402) and is classified as a heavily modified water body with a current ecological quality status of 'Moderate Potential'. The current chemical quality status is 'Fail' owing to overall priority hazardous substances and a number of specific determinants.
- 12.3.2 The BSCU Works construction of a shaft and underground structures is deemed unlikely to impact the River Thames receptor.

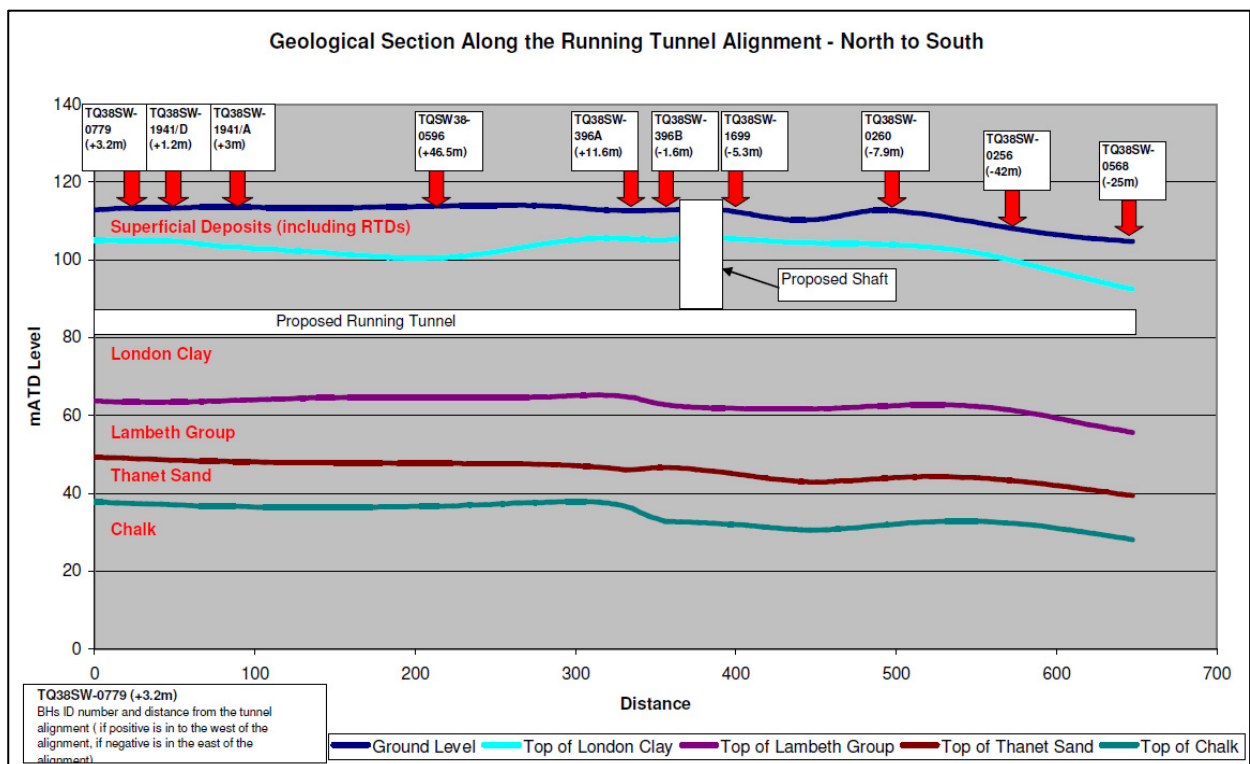
Groundwater

- 12.3.3 With respect to groundwater there are no WFD water bodies mapped in the study area. However the shallow (Alluvium/River Terrace Deposits) and deep (Thanet Sands/Chalk) aquifers are deemed to be potential receptors along with the groundwater abstractions that the deep aquifer supports.
- 12.3.4 The BSCU Works construction involves excavations through the shallow aquifer. This includes the Arthur Street Shaft that will be 40m deep with an earth retention system comprising secant pile wall and contiguous pile wall.

Therefore it is deemed that the shallow aquifer and supported receptor could be impacted by the BSCU Works. Potential impacts associated with construction and operation phases include changes in groundwater flows and levels, which may be significant given that basements exist in the area of the BSCU Works. There is also the potential for pollution incidents during construction works that could lead to contamination of the shallow aquifer.

- 12.3.5 The BSCU Works construction does not involve excavations into the deep aquifer or dewatering of the deep aquifer (see Figure 12.1). Therefore the BSCU Works will not impact the deep aquifer and supported receptors, such as licensed groundwater abstractions.

Figure 12.1: Geological Section along the Running Tunnel Alignment - North to South



Source: Mott MacDonald, 2012, BSCU Geotechnical Desk Study

Flood Risk

- 12.3.6 The assessment of flood risk concludes that the Whole Block and Arthur Street Sites are not at risk of flooding from tidal/fluvial, surface water, sewers or artificial sources (except perhaps water mains). Given the nature of the existing site and BSCU Works, there is unlikely to be any impact on tidal/fluvial or artificial sources that could give rise to a consequential impact to neighbouring property.

- 12.3.7 Given modern drainage standards the BSCU Works are unlikely to have an impact on surface water flooding or flood risk from sewers to neighbouring properties.
- 12.3.8 Current water ingress into King William Street Station requires further assessment. The existing drainage may be defective or it is a pumped system no longer in operation. The source of the water ingress and potential flood risk requires further investigation and assessment and may require control measures put in place prior to construction.
- 12.3.9 From a flood risk perspective, existing basements in the vicinity of the development are a potential receptor for groundwater flooding. The BSCU Works includes excavation of (and construction within) the shallow aquifer. Therefore there is potential for groundwater levels and therefore flood risk to be altered in the near vicinity of the BSCU Works.

Summary of Baseline and Proposed Scope of EIA

- 12.3.10 The BSCU Works are located on the northern side of the River Thames (a WFD water body) and in the near vicinity of the buried River Walbrook, which is part of Thames Water's combined sewer system. There are no environmental designations in the area of the BSCU Works.
- 12.3.11 The hydrogeology of the BSCU Works sites comprise a shallow aquifer (Alluvium/River Terrace Gravels) and a deep aquifer (Chalk/Thanet Sands). The aquifers are hydraulically separated by a non-aquifer comprising the London Clay Formation/Lambeth Group. There are seven licensed groundwater abstractions from the deep aquifer in the vicinity of the BSCU Works.
- 12.3.12 Despite the presence of potential groundwater receptors associated with the deep aquifer, the BSCU Works will not impact these and therefore the deep aquifer can be scoped out of the EIA. However it is possible that the shallow aquifer could be impacted and therefore it is recommended that the shallow aquifer is included in the EIA.
- 12.3.13 The Whole Block and Arthur Street Sites are located in flood zone 1 and are less than 1 hectare in area. In accordance with the NPPF a FRA is not required to support the planning application. However, as there is potentially a risk of flooding from groundwater and perhaps water mains, flood risk is included within the scope of the EIA.

12.4 Assessment Methodology

Water Resources

- 12.4.1 Once potential effects on water resources are identified, as described above by the source-pathway-receptor model, it is necessary to determine how significant the effects are likely to be, to enable the identification of potential mitigation measures that can counteract negative effects. The effect on the receptors depends largely on the sensitivity of the receptor and the magnitude of effect experienced.
- 12.4.2 An assessment of the significance of each effect will be undertaken based on the methodology provided in the Web-based Transport Analysis Guidance; specifically the Water Environment Sub-Objective WebTAG Unit 3.3.11. This provides an appraisal framework for taking the outputs of the EIA process and analysing the key information of relevance to the water environment. WebTAG is based on guidance prepared by the Environment Agency and builds on the water assessment methodology in Design Manual for Roads and Bridges (DMRB) 11:3:10. Although this method was designed primarily for transport projects it is applicable to and widely used for other development types.
- 12.4.3 The methodology provides an assessment of the significance of an effect by firstly considering how important or how sensitive the receptor is and secondly, by considering the likely magnitude or extent of the effect on the receptor. By combining these two elements, the severity of any effects can be categorised. If significant negative effects are thus identified, mitigation measures can be proposed to offset them.

Receptor Sensitivity

- 12.4.4 The sensitivity of each water resource (the receptor) is based on its considered value, for example its value as an ecological habitat, as a source of drinking water or as a recreational resource (see Table 12.1).

Table 12.1: Sensitivity of Water Resource

Importance	Criteria	Examples
Very high	Water resource with an importance and rarity at an international level with limited potential for substitution.	<ul style="list-style-type: none"> - A water resource making up a vital component of a protected Special Area of Conservation (SAC) or Special Protection Area (SPA) under the EC Habitats Directive - A water body achieving a status of 'High' under the Water Framework Directive (WFD) Classification - Principal aquifer providing potable water to a large population
High	Water resource with a high quality and rarity at a national or regional level and limited potential for substitution.	<ul style="list-style-type: none"> - A water resource designated or directly linked to a SSSI. - Principal aquifer providing potable water to a small population - A river designated as being of 'Good Status' or with a target of good status or potential under the Water Framework Directive - A water body used for national sporting events such as regattas or sailing events - A watercourse or waterbody which supports significant or valuable ecology
Medium	Water resource with a high quality and rarity at a local scale; or Water resource with a medium quality and rarity at a regional or national scale.	<ul style="list-style-type: none"> - Secondary aquifer providing potable water to a small population - An aquifer providing abstraction water for agricultural and industrial use
Low	Water resource with a low quality and rarity at a local scale.	<ul style="list-style-type: none"> - A non 'main' river or stream, or waterbody without significant ecological habitat

Magnitude of Impact

12.4.5 The magnitude of a potential impact is then established based on the likely degree of impact relative to the nature and extent of the BSCU Works (see Table 12.2). It is important to consider at this stage that potential impacts can be beneficial as well as adverse and it is the purpose of an EIA to highlight the full spectrum of potential impacts from a proposed development. The derivation of magnitude is carried out independently of the importance of the water resource.

Table 12.2: Magnitude of Water Resource Impact

Magnitude of Impact	Criteria	Examples
High	Impact results in a shift in a water body's potential attributes.	<ul style="list-style-type: none"> - Change in WFD classification of a waterbody. - Compromise employment source - Loss of flood storage/increased flood risk - Pollution of potable source of abstraction
Medium	Results in impact on integrity of attribute or loss of part of attribute.	<ul style="list-style-type: none"> - Contribution / reduction of a significant proportion of the effluent in a receiving river, but insufficient to change its WFD classification - Reduction / increase in the economic value of the feature.
Low	Results in minor impact on water body's attribute.	<ul style="list-style-type: none"> - Measurable changes in attribute, but of limited size and / or proportion.
Very Low	Results in an impact on attribute but of insignificant magnitude to affect the use / integrity.	<ul style="list-style-type: none"> - Physical impact to a water resource, but no significant reduction / increase in quality, productivity or biodiversity. - No significant impact on the economic value of the feature. - No increase in flood risk

Assessment of Effects

- 12.4.6 Once the magnitude of an impact is derived, the potential effect can be categorised by combining the assessments of both the importance of the water resource and the magnitude of the impact in a simple matrix (see Table 12.3).
- 12.4.7 Effects which are assessed to be major or moderate are generally considered to be significant (and in need of mitigation); those that are minor and negligible are generally not considered to be significant, however determination of whether an effect is considered to be significant is also based on professional judgement, taking account of whether effects are considered to be positive or negative, permanent or temporary, direct or indirect, the duration/frequency of the effect and whether any secondary effects are caused.

Table 12.3: Classification of Effects on Water Resources

Sensitivity of Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

12.4.8 Examples of major, moderate, minor and negligible effects in the context of water resources at the BSCU Works sites are given in Table 12.4.

Table 12.4: Definition of Water Resources Effects

Effect	Description of surface water resources effect
Major	Where the proposed changes would be sufficiently large to alter the WFD Classification of a water body or prevent Good status being achieved in the future. Where the proposed changes would cause a measurable change to water quantity, quality or ecology, but of insufficient magnitude to alter the WFD Classification of the water body.
Moderate	Where effects on water resources would be of moderate duration and of insufficient extent to affect the whole water body or where the water body affected is not classified under the WFD. Where effects on water resources would be moderate/minor, of moderate to short duration and limited to the vicinity of the proposed development.
Minor	Where effects on water resources would be minor, of short duration and limited to the immediate vicinity of the proposed development or where the water body affected is not classified under the WFD and or low importance.
Negligible	Where proposed changes would have an indiscernible effect on the water resources.

Flood Risk Assessment Methodology

12.4.9 The specific methodology for defining and assessing flood risk is dictated by the requirements of the National Planning Policy Framework (NPPF) and its Technical Guidance.

12.4.10 FRAs identify potential flood risks both to and from the BSCU Works. Unlike the impact assessment methodology applied for other water resources, the flood risk methodology used in the FRA assumes that the 'receptors' in the Source-Pathway-Receptor model are any areas of land or development potentially at risk both as a result of the development but also within the BSCU Works itself.

- 12.4.11 In a sense, the application of the Source-Pathway-Receptor model can be considered as reversed, in that the water resources themselves are the potential 'sources' of effect.
- 12.4.12 Nevertheless, the principle of the model is the same in that an effect is only considered if all three elements of the model are identified.
- 12.4.13 Using the FRA methodology, sites at risk are not graded by a 'value' as it is assumed that all areas affected by flooding are equally important. NPPF simply requires that proposed development should not increase flood risk elsewhere (i.e. no adverse effect) and should reduce flood risk where possible. In the absence of an assigned 'value' for receptors, the significance of effect will be based on a qualitative assessment of the likely magnitude of the flood risk effects.
- 12.4.14 Tidal/fluvial, surface water, sewers and artificial sources flood risks are scoped out of the EIA and a FRA is not required by NPPF to support the planning application. Groundwater flood risk will therefore be covered in the Water Resource and Flood Risk section of the EIA.

13 Land Contamination

13.1 Introduction

13.1.1 The land contamination assessment, primarily considers the station area footprint within the Whole Block Site, and the Arthur Street Work Site as its study area. However, the assessment will consider both impacts to the sites from off-site contamination sources, and off-site contamination impacts from the BSCU Works. The final extent of off-site assessment will be driven by a source-pathway-receptor assessment methodology.

13.2 Description of the Baseline

13.2.1 To date, baseline information has been obtained from a combination of desk-top study information, and ground investigations undertaken for 3rd party developments in the vicinity of the works. A summary of this information is provided as follows:

- Geotechnical Baseline Report (0011-UA04557-UP31R-02) (October 2012) by Hyder;
- Geotechnical Desk Study (N133-BCR-MMD-00-Z—DC-Z-0047-S0-1.0 (March 2012) by Mott MacDonald;
- Unexploded Ordnance Desk Study Bank Station Capacity Upgrade (3322) (November 2011) by MACC International;
- Redevelopment of 81 King William Street (1982); by Wembley Laboratories Ltd;
- Redevelopment of 10 King William Street (1974); by Wimpey Laboratories Ltd;
- The Walbrook Development (2006) by Fugro Engineering Services Ltd;
- NM Rothschild Bank (2007) by Norwest Holst Soil Engineering Ltd;
- The Walbrook Square Development (2007) by Soiltechnics (Factual report not received only borehole data without absolute levels available); and
- Bank Station Capacity Upgrade – Abstraction and Historic Wells Current Status (April 2012) by London Underground.

Ground Conditions

13.2.2 Site investigations identified the presence of shallow Made Ground in the region, of varying thicknesses and variable composition. Made Ground may be absent beneath the Whole Block Site in areas where basements currently exist. The Made Ground is underlain by successive superficial deposits of Alluvium,

- and Taplow Gravels also known as River Terrace Deposits (RTD) as shown in Figure 12.1.
- 13.2.3 The underlying solid geology at both sites comprises London Clay, which has been shown to be at least 35m thick, and extend beyond the depth of the project. The London Clay is underlain by successive lithologies of Lambeth Group, Thanet Sands and Chalk.
- 13.2.4 The superficial deposits are designated as a 'Secondary A' aquifer, which are described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. Shallow groundwater in the region has been encountered at approximately 10m below ground level.
- 13.2.5 The London Clay is designated as a 'Non-aquifer' and as such is generally considered to act as a barrier to the vertical migration of shallow groundwater and contaminants. The Mott MacDonald March 2012 desk study noted the potential for pathways between the shallow aquifer and deeper aquifers of the Lambeth Group, Thanet Sands and Chalk, where local, deep drift filled hollows may exist, although hollows are not yet known to be present beneath the sites.
- 13.2.6 Seven registered abstraction wells have been identified within 250m of the Whole Block Site. These are likely to have been drilled into the Chalk Aquifer below the London Clay, although wells with abstraction rates below 20m³/day do not require Abstraction Licence applications, and hence it is possible that other wells in the area may be in use that have not been identified.
- 13.2.7 The BSCU Works sites are not located within any groundwater Source Protection Zones (SPZs).
- 13.2.8 The closest surface water body is the River Thames located approximately 120m south of the Arthur Street Work Site and 300m south of the Whole Block Site.
- 13.2.9 As the region has long been developed for primarily commercial purposes (office uses), the likelihood of significant contamination in soils and groundwater beneath the sites is considered to be low. The most likely source of contamination arises from Made Ground in shallow soils expected within the footprint of the Arthur Street Work Site, and potentially beneath the Whole Block Site.
- 13.2.10 Further detail of baseline ground conditions are provided in Section 12.
- Unexploded Ordnance**
- 13.2.11 The Unexploded Ordnance Desk Study by MACC International (2011) concluded an 'Medium to High' risk level, and recommended risk mitigation

measures for intrusive works including boring, piling, tunnelling and shaft construction.

13.3 Potential Impacts

Human Health

- 13.3.1 The primary contamination receptor is construction workers exposed to soils and shallow groundwater, during BSCU Works construction. A potential nuisance risk to site neighbours also exists as a result of the off-site transport of generated spoil materials.
- 13.3.2 Contamination exposure risks to construction workers and site neighbours will be mitigated through the adoption of appropriate personal protective equipment (PPE) and environmental site control measures.
- 13.3.3 Once constructed there will be no direct contact pathways to future site users from soil and groundwater as the station will be an enclosed system, separated from soils and groundwater. Once construction works are completed the Arthur Street Work Site will be decommissioned and hence will not pose an operational risk. Ground-gas inhalation potentially poses a risk if generating materials are located in soils beneath the station, however based on site history information, the likelihood of these materials being present is low. If ground-gas is shown to be present, this would likely be mitigated as a consequence of the ventilation system installed within the station. Additional mitigation measures such as membranes could be incorporated into structure design if necessary, although this would only be required if very high ground-gas concentrations and flow rates were being generated.
- 13.3.4 Ground-gas inhalation is not considered to pose a risk at the Arthur Street Work Site, as the act of shaft construction will result in the removal of any contaminated materials i.e. 'sources' that would potentially give rise to ground-gas.

Controlled Waters

- 13.3.5 The BSCU Works would not be expected to increase contamination risks to Controlled Waters as works will not extend beneath the London Clay Formation.
- 13.3.6 Surface water contamination risks are considered to be low as station works will not present a significant opportunity for surface water run-off to come into contact with soils at the sites. Regardless, environmental controls will be put in place during construction works to manage surface water run-off.

Wastes

- 13.3.7 While not a contaminated land impact as such, a strategy will be required to manage the disposal of any surplus soils and groundwater generated as a result of BSCU Works construction and an assessment of the contamination status of soils and groundwater will be required to assist in formulating this strategy.

Unexploded Ordnance

- 13.3.8 Unexploded ordnance poses a risk to below ground intrusive works and appropriate mitigation measures will be employed as required.

13.4 Assessment Methodology

Overview

- 13.4.1 The Environment Agency provides guidance on the conduct of an EIA with regard to contamination issues (Scoping Guidelines on the Environmental Impact Assessment of Projects 2002), and there is a considerable body of guidance that has been prepared in order to assist both local authorities and practitioners in assessing the degree to which land is contaminated and deciding whether such land is contaminated within the meaning of the Part IIA of the Environmental Protection Act 1990.

- 13.4.2 The Act provides a statutory definition of contaminated land:

“Contaminated Land is any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

Significant harm is being caused or there is a significant possibility of such harm being caused; or

Pollution of controlled waters is being, or is likely to be caused.”

- 13.4.3 In the guidance that accompanies the Act, there is advice on what constitutes significant harm and what constitutes a significant possibility. Further guidance on the risk assessment process is given in Environment Agency documentation on the basis of the Contaminated Land Exposure Assessment (CLEA) model which is intended to be used as the common basis for contamination assessments in the UK.

- 13.4.4 With regard to pollution of controlled waters, the Environment Agency has prepared guidance on methods of assessment. These are contained in their Research and Development Publication No 20 ‘Methodology for the Derivation of Remedial Targets for Soils and Groundwater to protect Groundwaters’.

- 13.4.5 Underpinning all sets of guidance is a hazard-pathway-receptor methodology which is used to identify significant pollutant linkages (SPLs). The following definitions apply:
- Hazard: source of contamination;
 - Receptor: the entity which is vulnerable to harm from the hazard; and
 - Pathway: the means by which the hazardous contamination can come into contact with the receptor.
- 13.4.6 Without a significant pollutant linkage the contamination may be a hazard but does not constitute a risk to human health or the environment.
- 13.4.7 Therefore, in assessing the potential for contamination to cause a significant effect, the extent and nature of the potential source or sources of contamination must be assessed, pathways identified, and sensitive receptors or resources identified and appraised, to determine their value and sensitivity to contamination related impacts.
- 13.4.8 The land contamination assessment will use the above processes to assess risks.

Magnitude of Contamination Sources

13.4.9 The magnitude of sources of land contamination is described qualitatively in Table 13.1.

Table 13.1: Descriptive Scale for Magnitude of Extant and Potential Sources of Existing Contamination

Magnitude	Definition	Previous Land Uses
High	Site investigation data indicating widespread and/or severe localised contamination.	Previous or ongoing activity on or near to site with high potential to cause land contamination (e.g. gasworks, chemical works, landfill).
Medium	Detectable localised soil contamination above threshold limits, identified during ground investigation.	Previous or ongoing activities with some potential to cause moderate contamination (e.g. railways, collieries, scrapyards).
Low	Detectable but minor soil and groundwater contamination concentrations. Soil and groundwater quality standards less than threshold and unlikely to affect most sensitive receptors. Site investigation data detecting no significant contamination.	Previous or ongoing activities with low potential to cause contamination (e.g. residential, retail or offices).
Very Low	No contamination or Made Ground identified from site investigation work on the site.	Greenfield site.

Receptor Sensitivity

13.4.10 The presence and sensitivity of receptors at risk from potential land contamination can be assessed by consideration of the following:

- surrounding land uses, based on mapping and site visits and existing planning designations;
- proposed end-use, based on the nature of the BSCU Works;
- type of construction operations that will be necessary as part of the development; and
- geology, hydrogeology and hydrology of the BSCU Works sites and surrounding area.

13.4.11 The sensitivity of potential receptors can be described qualitatively according to the categories shown in Table 13.2.

Table 13.2: Sensitivity of Contamination Receptors

Sensitivity	Definition	Future Site Users and Surrounding Land Users	Construction Workers	Groundwater	Built Environment
Very High	Environment responds to major change(s) e.g. agricultural land use for food production, allotments.	Residential with plant uptake, and allotments	Extensive earthworks, and demolition of buildings	Principal Aquifers	Buildings, including services and foundations of historic significance
High	Environment clearly responds to effect(s) in quantifiable and / or qualifiable manner e.g. low grade agricultural land, recreational ground.	Residential without plant uptake	Limited earthworks	Secondary A Aquifers	Buildings, including services and foundations
Medium	Environment responds in a minimal way such that only minor changes are detectable e.g. landscaped areas.	Commercial landscaping or open space areas	Minimal disturbance of ground	Secondary B Aquifers	Infrastructure (roads, bridges, railways)
Low	Environment is insensitive to impact, no discernible changes e.g. soils are not in use, the land has an industrial / commercial land use and / or mainly covered by hard standing.	Industrial land covered by hard standing	No disturbance to ground	Unproductive Strata (Non-Aquifers)	Minor industrial development without subsurface services

Significance Criteria

- 13.4.12 If a hazard has been identified and potential sensitive receptors are present, then the potential effects can be determined by considering the pathways whereby the hazard may impact upon the receptors. Table 13.3 indicates the most feasible potential effects that may generally occur in relation to development sites for different classes of receptor. During the assessment it will be assumed that there is (or will be during or after construction) a pathway

present between the source and the receptor, unless there is a clear indication that this will not be the case.

Table 13.3: Potential Effects of Contamination on Receptors

Receptor / Resource	Potential Impact
Future Site Users (workers / visitors)	Direct or indirect ingestion of contaminated soil, inhalation, dermal contact (operational)
Surrounding Land Users	Concentration of flammable or asphyxiating in-ground gases in enclosed spaces (operational) Inhalation of harmful in-ground vapours indoors and outdoors (operational)
Construction Workers	Direct or indirect ingestion of contaminated soil and groundwater, inhalation, dermal contact (construction stage) Concentration of flammable or asphyxiating gases in confined spaces (construction stage) Inhalation of asbestos during building demolition (construction stage)
Groundwater	Contamination of Principal and Secondary Aquifers
Built Environment	Chemical attack of buried concrete structures (operational) Permeation of water supply pipelines (operational) Concentration of explosive gases above Lower Explosive Limit (LEL) (operational)

- 13.4.13 The strength of pathway between a source and receptor is a function of the distance between the two and the ease or otherwise of the migration pathway.
- 13.4.14 A combination of the source and receptor rankings will provide an indication of the level of contamination on the sites and the nature and severity of possible effects. It should be noted that both rankings may vary in the different scenarios being considered (i.e. baseline, construction and operation).
- 13.4.15 For sites where there is no (or very limited) site investigation data, this stage consists of comparing the magnitude of the hazard and the sensitivity of the receptor for each potential impact, using the qualitative descriptions outlined in Tables 13.1 and 13.2 above.
- 13.4.16 Where site investigation data are available, the assessment of the magnitude of impact can be assisted by an assessment of the testing results that exceed relevant contaminant screening levels for each particular type of impact. Appropriate screening levels are selected based on the nature of the hazard-pathway-receptor linkage and with reference to current published guidelines.

Assessment of Effects

- 13.4.17 The effects (before any mitigation) can be assessed on the basis of the matrix as shown in Table 13.4 in conjunction with professional judgement of the site-specific geological, hydrogeological and contamination ground conditions.

These include contamination types, concentrations and distribution, groundwater flow direction and presence and thickness of any impermeable geological strata.

Table 13.4: Classification of Effects

Sensitivity of Resource / Receptor	Magnitude of Impact			
	High	Medium	Low	Very Low
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

- 13.4.18 Generally, major and moderate effects are considered to be significant (and in need of mitigation) and minor and negligible effects are considered insignificant and not requiring any mitigation with respect to the BSCU Works. Determination of whether an effect is considered to be significant is also based on professional judgement, taking account of whether effects are considered to be positive or negative, permanent or temporary, direct or indirect, the duration/frequency of the effect and whether any secondary effects are caused.

Risk Assessment

- 13.4.19 The classification of potential significance (determined using the above matrix), and consideration of likelihood of an event occurring, can then be incorporated into a final risk based assessment. Likelihood will take into account both the presence and distribution of a particular hazard within the site as well as the integrity (strength) of the pathway between the hazard and receptor. This approach is adopted from guidance within Section 6.3 of CIRIA C552: Contaminated Land Risk Assessment - A guide to Good Practice (2001).
- 13.4.20 Table 13.5 demonstrates the perceived likelihood of an event occurring and Table 13.6 provides details of the level of risk based on the combination of the likelihood of an event occurring and significance of effects. Table 13.7 interprets the risk assessment.

Table 13.5: Likelihood matrix

Magnitude of Impact	Strength of Pathway		
	Weak	Moderate	Strong
Very Low	Unlikely	Unlikely	Low
Low	Unlikely	Low	Low
Medium	Low	Medium	Medium
High	Low	Medium	High

Table 13.6: Risk assessment matrix

Likelihood	Significance of Effect			
	Negligible	Minor	Moderate	Major
Unlikely	Very low risk	Very low risk	Low risk	Moderate / low risk
Low	Very low risk	Low risk	Moderate / low risk	Moderate risk
Medium	Low risk	Moderate / low risk	Moderate risk	High risk
High	Moderate / low risk	Moderate risk	High risk	Very high risk

Table 13.7: Risk criteria

Risk Assessment	Description
Very low risk	The presence of an identified hazard does not give rise to the potential to cause significant harm to a designated receptor.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that, at worst, this harm, if realised, would normally be minor.
Moderate risk	It is possible that, without appropriate remedial action, harm could arise to a designated receptor. It is relatively unlikely that any harm would be high, and if any harm were to occur it is more likely that such harm would be relatively minor.
High risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remedial action.
Very high risk	There is a high likelihood that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remedial action.

14 Waste Management and Resource Use

14.1 Introduction

14.1.1 The assessment will consider impacts anticipated as arising from the management of solid waste arising from the excavation, construction and operational phases of the BSCU Works.

14.1.2 For the purpose of the assessment waste is defined as *any substance or object...which the holder discards, or intends, or is required to discard* (European Directive 2006/12/EC on Waste, Official Journal of the European Union, 27.4.06).

14.1.3 The assessment of solid waste arisings associated with the BSCU Works Whole Block and Arthur Street Sites requires consideration of:

- existing local/regional waste arisings and the nature and capacity of infrastructure for waste management;
- anticipated waste arisings from excavation, construction and operation and effects arising from waste management; and,
- consideration of mitigation and waste reduction measures, in the context of relevant policies, plans, local strategies and planning guidance;

in order to support determination of the significance of residual impacts.

14.1.4 The study area primarily consists of the BSCU Works site boundaries, however, effects of the BSCU Works in the wider area will be considered where relevant.

14.2 Description of the Baseline

14.2.1 Baseline waste impacts are determined by the current activities at the sites, their associated waste arisings, waste management practice and infrastructure used. Demolition of the Whole Block Site will be carried out under the OSD permission, therefore baseline Whole Block Site waste arisings at the commencement of the BSCU Works will effectively be zero.

14.2.2 No waste arisings other than what is likely to be a negligible volume of street sweepings are considered to arise from Arthur Street.

14.2.3 The current local and regional commercial waste arisings baseline against which forecast BSCU Works waste arisings can be compared and contrasted will be described. This will include consideration of local and regional provision for management (collection/treatment/disposal) of this waste.

14.3 Potential Impacts

- 14.3.1 Excavation, construction (including station fit-out) and operational activities will generate waste. Guidance from sources such as WRAP will be followed in order to design out waste and initiatives such as the NISP network will be used to help find alternative uses for waste arisings/resources which cannot be designed out.
- 14.3.2 A Site Waste Management Plan (SWMP) will be developed during the design phase and implemented throughout this project; this will include targets for reuse and recycling of waste on the project and use of recycled materials in construction.
- 14.3.3 Specific attention will be given to the identification and realisation of opportunities for the beneficial use or recycling of excavated materials.
- 14.3.4 Potential impacts relating to the transportation of waste will be considered within the Transport and Movement assessment.

Excavation and Construction Waste

- 14.3.5 The quantity and composition of anticipated excavation waste arisings will be estimated by the project Quantity Surveyor and other members of the engineering team using knowledge of the planned design and local geology.
- 14.3.6 It is expected that construction phase demolition wastes will be minimal as demolition works will be completed prior to commencement of the BSCU Works under the OSD permission.
- 14.3.7 Quantities of construction phase waste generated during engineering tunnelling works (spray concrete lining), station fit out etc. will be estimated using published data derived from other projects and information generated by the project Quantity Surveyor and other members of the engineering team.
- 14.3.8 Potential impacts associated with management of excavation and construction waste arisings will involve consideration of the type and quantity of waste generated and anticipated method of management.

Operational Phase Waste

- 14.3.9 Operational waste arisings will be estimated using floor areas for the developed site, with commercial waste arisings estimated using BS5906:2005, Waste Management in Buildings – Code of Practice, which provides typical waste arisings for a range of buildings types/activities including offices. Associated quantities of waste and composition will then be determined using published densities and other data such as Envirowise document GG707 (undated). This approach is likely to overstate waste arisings from the Station Entrance and therefore provide a 'worst case' approach for assessing impacts. Where

available, operational waste data from other comparable London Underground Stations will be utilised.

- 14.3.10 Likely options for operational waste management will be considered in order to assess the associated impact associated with their management.

14.4 Assessment Methodology

- 14.4.1 The general environmental impact assessment methodology and criteria described in Section 5 will be applied in order to determine the significance of effects associated with the BSCU Works waste arisings and management.

Determination of Significance

- 14.4.2 National and local policy and recognised best practice will be used to assess the significance of the effects. In the absence of specific guidance on assigning significance, professional judgement will be used to assess objectively the impact of the BSCU Works against the baseline.
- 14.4.3 The significance of environmental effects will be determined by considering the magnitude of impacts within the context of the sensitivity of resources or receptors affected, i.e.:
- local/regional waste recycling/reprocessing will be considered to be a low sensitivity resource, based on an assumption that such activity has a beneficial impact and demand for recycled/recovered materials exceeds supply;
 - the magnitude of forecast waste arisings for the development assessed against the current local and regional waste arisings baseline; and the sensitivity of receptors; and
 - landfill will be considered to be a medium to high sensitivity resource, due to the finite nature of landfill capacity.
- 14.4.4 Assessment of residual effects following mitigation will include consideration of:
- management of the waste within the context of the Waste Hierarchy, i.e. whether generation of the waste can be minimised, waste generated can be reused or recycled etc.;
 - management of waste in accordance with the Proximity Principle, i.e. the proximity of the waste management infrastructure used and the mode of transport used where waste is transported out of the region for management;
 - the ease of management of the waste generated, as determined by its physical and chemical characteristics, i.e. whether the waste can be easily treated with minimal residual waste, such as mechanical recycling, or

whether the waste requires specialised treatment with potentially hazardous residual waste; and

- potential environmental effects or human health risks associated with the waste e.g. if it is hazardous, infectious, etc.

14.4.5 Following consideration of the above, the overall classification of the effect will be categorised, according to the matrix shown in Table 5.1, and subsequently identified as being significant or not significant, depending on duration, reversibility and permanence of the effect.

Cumulative Effects

14.4.6 Baseline waste arisings for the Whole Block Site will have been estimated as part of the OSD assessment, using a range of floor areas (m²) for the site prior to demolition, with commercial waste arisings from these sources estimated using BS5906:2005, Waste Management in Buildings – Code of Practice. This provides typical waste arisings for a range of buildings types/activities including offices. Associated quantities of OSD waste and composition will have then been determined using published densities and other data.

14.4.7 Comparison of waste arisings associated with the new Station Entrance to the Whole Block Site waste arisings baseline is unlikely to be meaningful, as in terms of floor areas of the Station Entrance compared to the pre-development buildings and types of uses, such comparison is not meaningful. However, estimated Station Entrance waste arisings will be considered cumulatively with those estimated for the OSD, in order to assess the cumulative effects of both developments in comparison to the pre- OSD and BSCU Works baseline.

15 Socio-Economic and Community Effects

15.1 Introduction

15.1.1 This section sets out the scope of the proposed assessment of the socio-economic and community impacts of the BSCU Works. The assessment will consider the socio-economic and community effects, both during the construction and operational phases of the BSCU Works. The key socio-economic and community issues of relevance to the BSCU Works will be identified through a review of the relevant policy at the local, regional and national levels.

15.2 Description of the Baseline

15.2.1 A desk based analysis of secondary data and key legislation and guidance will be assessed studying potential effects on various issues such as population, employment, labour market and open space provision, during construction and the operational phase.

15.2.2 The BSCU Works is located within the local authority area of the City of London Corporation. The majority of the baseline will be analysed at local authority level and compared, to the Central Activities Zone (CAZ), the rest of the region (London) and nationally, as deemed appropriate.

15.2.3 The review of baseline conditions will cover:

- the dynamics within the London economy;
- the prominence of transport in the London economy;
- employment in London's construction industry;
- an overview of key sectors as measured by number of businesses and levels of employment; and
- a profile of the local resident population.

15.3 Potential Impacts

15.3.1 Impacts of the BSCU Works will be assessed in relation to their likely scale, permanence and duration associated with the following:

- displacement of economic activity (businesses) as a result of the construction activities;
- impacts relating to the temporary blockade of the Northern Line at Bank Station during the construction phase, including the effects on businesses linked to other stations for which travel will be affected;

- economic impacts during construction in relation to direct and indirect employment creation during the construction of the BSCU Works;
 - the net operational phase employment generated, taking into account the employment lost as a result of the demolition of existing employment space on site;
 - amenity impacts as a result of, for example, increased levels of noise and vibration during the construction period on businesses and social infrastructure;
 - broader social and community impacts to be assessed will include those associated with any loss or gain of retail provision;
 - the operational phase benefits of the new transport linkages and enhanced access to employment and training opportunities; and
 - effects on the wider economy arising from:
 - benefits to businesses; and
 - benefits to the City's economy including potential agglomeration effects and the improved position of the City as a place to do business.
- 15.3.2 The assessment will identify the key significant residual effects of the BSCU Works once mitigation has been taken into account.
- 15.3.3 The assessment will also take account of cumulative impacts, including a review of the surrounding developments submitted for planning (including the OSD) and the cumulative impacts on employment and amenity.
- ## 15.4 Assessment Methodology
- 15.4.1 The ES will provide an assessment of any socio-economic and community effects of the BSCU Works on the human population that live and work in close proximity to the sites. The analysis will not only assess the existing baseline conditions but also the potential of the BSCU Works to facilitate both direct and indirect employment in the local area. The analysis will consider the baseline conditions currently associated with the sites and the surrounding area, the likely significant effects of the BSCU Works and any mitigation measures required to prevent or reduce likely significant effects.
- 15.4.2 Baseline data sources that will be consulted comprise, amongst others, the 2011 Census, Annual Population Survey, Office of National Statistics (ONS) Labour Force and Neighbourhood Statistics and ONS Business Register and Employment Survey.

- 15.4.3 Impacts on potentially sensitive social and community receptors are assessed by various geographical impact areas, according to the most up-to-date socio-economic and community data or policy available.

Determination of Significance

Approach

- 15.4.4 Policy thresholds and best practice are used to assess the significance of the effects. In the absence of specific guidance on assigning significance, professional judgement is used to assess the impact of the BSCU Works on the social and economic baseline. The assessment will aim to be objective and quantify impacts and their effects as far as possible; however some impacts can only be evaluated on a qualitative basis.

Impact Magnitude

- 15.4.5 Impacts will be assessed on the basis of:
- magnitude of change - this entails consideration of the absolute number of people or businesses affected and the size of area in which impacts will be experienced;
 - scale of the impact - this entails consideration of the relative magnitude of each impact in its relevant market context (for example, the impacts on local employment will be considered in the context of the overall size of the local labour market);
 - scope for adjustment or mitigation - the socio-economic and community study will be concerned in part with economies. These adjust themselves continually to changes in supply and demand, and the scope for the changes brought about by the BSCU Works to be accommodated by market adjustment will therefore be a criterion in assessing significance.

Receptor Sensitivity

- 15.4.6 A receptor can experience a socio-economic and community impact in several different ways:
- as an economic / financial gain or loss;
 - as a gain or loss of a resource or access to a resource; and
 - as a gain or loss of amenity, including that which is derived from, or experienced while using, a resource such as a public open space.
- 15.4.7 The sensitivity of receptors will be identified on a case by case basis with reference made to relevant guidance where applicable and / or employing

professional judgement. Determination of this will vary depending on the type of receptor.

15.4.8 Where the receptor is an individual or group, the following factors will inform this classification:

- the value of an affected resource to the user (receptor);
- the scarcity of a resource from which the receptor derives benefit (such as a park/open space) and the availability of comparable alternatives within a reasonable accessible distance; and
- the receptor's capacity to experience a loss or gain of that resource.

15.4.9 Where the receptor is a business, consideration of the following factors will be undertaken to determine their sensitivity:

- the degree to which a business depends on its location in terms of
 - supply side factors; and
 - demand side factors (e.g., whereby the business derives a substantial portion of its business due to its location).
- the uniqueness or degree of specialisation of the business (e.g. if that business were to close, is there an alternative resource which customers could access); and
- the availability of alternative sources of employment (itself a combination of the transferability of a worker's skills and the size and general economic health of the relevant respective industry sector(s) in which workers would find alternative employment).

Classification of Effects

15.4.10 Following analysis of the magnitude of impacts of the BSCU Works and the sensitivity of resources and receptors that will be affected, the resultant effect is classified in the following categories:

- negligible;
- minor;
- moderate; or
- major.

15.4.11 These categories are broadly defined on a seven-point scale that has been generated through professional judgement as shown in Table 15.1.

Table 15.1: Definition of Socio-Economic and Community Effects

Effect	Description of Effect
Major adverse effect	<p>All or a large number of receptors are adversely affected and the effect detracts from receptors' well-being to a great extent.</p> <p>The effect is likely to make a measurable negative difference at local area level.</p>
Moderate adverse effect	<p>A number of receptors are adversely affected and the effect detracts from receptors' well-being to a moderate extent.</p> <p>The effect may make a small measurable negative difference at local area level.</p>
Minor adverse effect	<p>A number of receptors are adversely affected and the effect detracts from receptors' well-being to some extent.</p> <p>The effect is unlikely to make a measurable difference at local area level.</p>
Negligible effect	<p>Few or no receptors are affected and receptors wellbeing is unlikely to be affected in a lasting way.</p> <p>The effect is unlikely to make a measurable difference at local area level.</p>
Minor beneficial effect	<p>A number of receptors are beneficially affected and the effect enhances receptors' well-being to some extent.</p> <p>The effect is unlikely to make a measurable difference at local area level.</p>
Moderate beneficial effect	<p>A number of receptors are beneficially affected and the effect enhances receptors' well-being to a moderate extent.</p> <p>The effect may make a small measurable beneficial difference at local area level.</p>
Major beneficial effect	<p>All or a large number of receptors are beneficially affected and the effect enhances receptors' well-being to a great extent.</p> <p>The effect is likely to make a measurable beneficial difference at local area level.</p>

15.4.12 Following the classification of effects using this methodology, further consideration of whether an effect is significant and requires mitigation is carried out using professional judgement, taking account of:

- the positive, negative or neutral nature of the effect;
- whether the effect is temporary or permanent; and
- the duration or likelihood of the effect.

15.4.13 The category of an effect is generally considered to be significant at a moderate or major level.

15.4.14 If mitigation is proposed, the residual effect following mitigation is categorised using the same system to consider whether residual significant effects are likely.

16 Ecology

16.1 Introduction

16.1.1 The following section outlines the rationale for scoping ecology and nature conservation out of the EIA.

16.2 Description of the Baseline

16.2.1 A site inspection was made by an experienced ecologist to the Bank Station Capacity Upgrade Project sites in 2011 and again in August 2013 to identify any potential for ecological receptors on site and, where vegetated habitats existed, to map them in accordance with Joint Nature Conservation Committee (JNCC) guidance.

16.2.2 The Arthur Street Work Site is situated entirely within the Arthur Street thoroughfare itself which consists of tarmac, concrete and other hardstanding and has negligible ecological value.

16.2.3 The Whole Block Site consists entirely of hardstanding/tarmac and large flat-roofed commercial buildings split between various tenancies. There is no vegetation either on the site or within its vicinity (other than some scattered pot plants). The buildings are primarily concrete, consisting of large support beams interspaced with window panels on each floor. The buildings have negligible potential to support roosting bats, with no evidence of cracks, crevices or cavities. Block-work is in a good state of repair and eaves are flush against the wall. Coupled with the local context (entirely hardstanding with almost no vegetation for hundreds of metres) it is considered that there is a negligible likelihood of bats using the buildings.

16.2.4 The buildings have very low potential for supporting birds of conservation concern and provide negligible foraging potential in the surrounding area. The ledges around the roof of the buildings may support common ledge-nesting species such as feral pigeon although no evidence of their occupation was observed on either site visit.

16.2.5 A desk study was undertaken to identify designated sites, important habitats or records of protected or otherwise notable species within 1km of the Whole Block Site by searching available publications, reports and online databases from the National Biodiversity Network (NBN) Gateway, Multi-Agency Geographic Information for the Countryside (MAGIC) and a data request to Greenspace Information for Greater London (GIGL) in 2011. This was then used to determine whether there was a potential impact pathway linking the Whole Block and Arthur Street Sites to habitats or species off-site.

16.2.6 There are no statutory designated sites within 1km of the Sites. The nearest Site of Special Scientific Interest (SSSI) is Walthamstow Marshes 7km to the north of the Whole Block Site. There are 10 Sites of Importance for Nature Conservation (SINC) within 1km of the Whole Block Site (Table 16.1; sourced from Mott MacDonald), the closest of which are the River Thames Site of Metropolitan Importance, just over 300m to the south of the site (from the centre of the site to the foreshore – the value of 500m in Table 16.1 relates from Whole Block Site to river centres), and Cleary Gardens Site of Local Importance, approximately 500m west of the Whole Block Site. The River Thames lies approximately 120m to the south of the Arthur Street Work Site. There is no impact pathway connecting these SINCs to the Whole Block or Arthur Street Sites.

Table 16.1: Designated Sites

Name of SINC	Designation	Summary	Grid ref and approximate distance from the Whole Block site
River Thames and tidal tributaries	Site of Metropolitan Importance for Nature Conservation	The Thames, London's most famous natural feature, is home to many fish and birds creating a wildlife corridor running right across the capital.	TQ 302 806 500m south
The Barbican and St Alphage's Gardens	Site of Borough Grade II Importance for Nature Conservation	An interesting mix of Roman and medieval London alongside 1970's architecture, with surprising range of wildlife alongside the historic and cultural value.	TQ 323 818 950m south
London Wall and the wall of the Tower of London	Site of Borough Grade II Importance for Nature Conservation	Historic walls with important populations of plants including London Rocket.	TQ 337 806 750m east
Pepys Garden, Seething Lane and St Olave's Churchyard	Site of Local Importance for Nature Conservation	Two small gardens with plenty of mature trees, both with a strong historic atmosphere.	TQ 334 808 608m east
St Paul's Cathedral Gardens	Site of Local Importance for Nature Conservation	The grounds of St Paul's Cathedral contain many fine mature trees.	TQ 321 811 700m west
Cleary Gardens	Site of Local Importance for Nature	This is an attractive and imaginatively designed garden, constructed on	TQ 322 809 500m west

Name of SINC	Designation	Summary	Grid ref and approximate distance from the Whole Block site
	Conservation	three levels.	
St Boltoph's Bishopsgate Church Grounds	Site of Local Importance for Nature Conservation	A charming and mature garden, spacious by the standards of the City with plenty of trees, wide lawns, tall hedges and some substantial areas of tall shrubbery.	TQ 331 815 725m north east
Aldermanbury Gardens	Site of Local Importance for Nature Conservation	An attractive garden on this site of the former Wren Church of St Mary, with uncommon ferns on the tombstones.	TQ 324 814 640m north west
Roman Wall, Noble Street	Site of Local Importance for Nature Conservation	This section of the wall supports a good range of wild flowers.	TQ 322 815 820m north west
Finsbury Circus	Site of Local Importance for Nature Conservation	The oldest public park in London, dating from 1606, with plenty of mature trees	TQ 328 816 700m north

Source: Mott MacDonald Phase 1 Ecology Survey 2011

- 16.2.7 A small number of notable fauna have been recorded within 1km of the Whole Block Site including house sparrow (*Passer domesticus*), dunnock (*Prunella modularis*) and Nathusius pipistrelle (*Pipistrellus nathusi*) but the buildings on the Whole Block Site provide poor habitat for these species. Two London Biodiversity Action Plan (BAP) plant species (cornflower *Centaurea cyanus*) and annual knawell (*Scleranthus annuus*) have both been recorded within 1km of the Whole Block Site but neither was present on the Whole Block or Arthur Street Sites. Five invasive plant species have also been recorded within 1km of the Whole Block Site (cockspur, buddleia, false acacia, evergreen oak and tree of heaven) but none were present on the BSCU Works sites.

16.3 Conclusions

- 16.3.1 Due to the negligible potential of the sites to support protected or otherwise notable species ecology is scoped out of this EIA as there is no scope for a likely significant adverse effect on ecology.

17 Daylight, Sunlight, Overshadowing and Microclimate

- 17.1.1 The above ground works associated with the BSCU Works at the Whole Block and Arthur Street Sites will be temporary and are likely to be relatively transient in their form during the construction stage. The permanent Station Entrance that will be present during operation will be located within the form of the OSD. It is therefore not considered likely that the BSCU Works will result in any permanent significant adverse effects on daylight, sunlight or overshadowing and it is therefore proposed to scope this topic out of the assessment.
- 17.1.2 Similarly, as there will be no significant surface level buildings as a result of the BSCU Works (beyond the Station Entrance within the envelope of the OSD which will be assessed as part of the OSD Environmental Impact Assessment), no significant microclimate (local wind) effects are considered likely and it is similarly proposed to scope this topic out of the assessment.

18 Electromagnetic Compatibility

- 18.1.1 Electromagnetic Compatibility (EMC) considers the ability of equipment to operate adequately in a given electromagnetic environment, while not introducing intolerable electromagnetic disturbance itself. An assessment of EMC considers the potential for electromagnetic interference (EMI) (one piece of equipment interfering with another) and for electromagnetic fields (EMF) which have the potential to affect humans.
- 18.1.2 The EU Electromagnetic Compatibility Directive 2004/108/EC is transposed into UK Law by the corresponding UK Statutory Instrument 2006, No. 3418 'The Electromagnetic Compatibility Regulations'. Apparatus intended for railways is within the scope of the EMC Regulations and therefore must be certified in accordance with its provisions.
- 18.1.3 LUL implement standards and guidance to control potential electromagnetic compatibility effects, including:
- LU Category 1 Standards, including LUL S1222 (electromagnetic compatibility), LUL S1193 (Electromagnetic Compatibility (EMC) with LU Signalling System Assets and Standard S1196 (signalling and signalling control - concept and requirements).
 - Guidance Document LUL G222, Manual of EMC Best Practice.
- 18.1.4 Tunnelling undertaken as part of the BSCU Works will be carried out manually and with the use of sprayed concrete lining. This will avoid the use of Tunnel

- Boring machines which are typical sources of power and magnetic fields during construction.
- 18.1.5 Construction and operational equipment and systems will be procured as CE marked to the EMC Directive 2004/108/EC by their respective manufacturers and using standards (including LUL standards) appropriate to the environment of use.
- 18.1.6 Generally, production of EMC compliant designs will minimise the requirement for mitigation of electromagnetic effects. Strategies such as specifying equipment with the appropriate level of EMC certification, suitable for the environment of use, observing accepted good practice for the segregation and routing of differing cable types and effective EMC management through the project lifecycle will assist in minimising the need for countermeasures and mitigation. This will be promulgated by means of an overarching EMC Management or Control Plan. Such a management plan will require preparation of other documents such as EMC Assurance Documents, Test Reports and Hazard Logs. EMC will be managed and co-ordinated throughout the design and construction phase by an EMC Specialist.
- 18.1.7 It is anticipated that based on running tunnel depths, the overall operational electromagnetic impacts from the running tunnels will be mitigated by the tunnel lining and surrounding soil.
- 18.1.8 These considerations and design according to European, UK Regulations and LUL standards, lead to the conclusion that significant environmental effects and unintended EMI events during construction and operation are not considered likely. It is therefore proposed to scope out assessment of EMC from the Environmental Impact Assessment.

19 Construction Environmental Management

- 19.1.1 City of London Corporation has prepared a *Code of Practice for Deconstruction and Construction Sites* (Seventh Edition – May 2013) which details the standards to which they expect sites to be maintained and operated. Under this code, a Scheme of Protective Works document is required in order to detail the environmental control measures that would be implemented during the construction phases of the project and to minimise their environmental impacts.
- 19.1.2 London Underground requires a Code of Construction Practice, which has the same broad aims and objectives as the Scheme of Protective Works. It is therefore proposed to produce a Scheme of Protective Works document which for the purposes of the BSCU Works will be referred to as a Code of Construction Practice (CoCP).
- 19.1.3 The primary reference source for Best Practicable Means standards for construction environmental management to be included in the CoCP will, as would be expected, be the City of London Corporation *Code of Practice for Deconstruction and Construction Sites*. Paragraph 1.4 of that document states that *This Code is intended as a guide to Best Practicable Means but must not replace consultation between developers, contractors and regulators*. It is intended that the CoCP for the BSCU Works will adhere to the standards in the *Code of Practice for Deconstruction and Construction Sites*. However the CoCP will be specifically applied to the BSCU Works. Reference will also be made to other standards, including those of the Mayor of London, London Underground and the Principal Contractor, and British Standards, in order to provide a comprehensive CoCP.
- 19.1.4 The CoCP will be prepared in liaison with London Underground, City of London Corporation's Department of Markets and Consumer Protection and the Principal Contractor's construction team. The involvement of the Principal Contractor (and where relevant its subcontractors) at this stage of the document's preparation represents a major opportunity to ensure that the measures prescribed in the CoCP are specific, detailed and achievable on-site. This in turn also informs the EIA.
- 19.1.5 The proposed content of the CoCP are as shown in Table 19.1.

Table 19.1: Proposed CoCP Contents

Proposed Contents
1. Introduction
2. General Principles of Construction Environmental Management
3. Sites and Works
4. Highways and Access
5. Noise and Vibration
6. Air Quality
7. Water Resources
8. Materials and Waste Management
9. Contaminated Land
10. Energy
11. Ecology
12. Townscape
13. Heritage

20 Other Reports and Elements of Assessment

20.1.1 As well as the EIA topics as discussed in the preceding sections of this scoping report, there are a number of other potential issues associated with the project that will either be considered as stand-alone reports/assessments or which may be appended to the ES and will inform the EIA (or be informed by the EIA) as described below.

20.2 Sustainability

20.2.1 A CEEQUAL assessment of the BSCU Works and associated infrastructure works will be undertaken to aid the consideration of environmental sustainability and drive improvements in performance during the design development, construction and operational phases on the project. CEEQUAL inputs will operate on two levels. Firstly, the CEEQUAL Interim Design Award process is to be followed during the TWAO preparation stage, with the aim of completing the scoring prior to submission of the TWAO application. Secondly, a CEEQUAL Whole Project Award will be sought for the overall BSCU Works following completion of the construction works.

20.2.2 A Sustainability Statement will also be produced which will examine the BSCU Works against the national, regional and local policies, the client's objectives and the Mayor's Essential and Preferred Standards as set out in the GLA Sustainable Design and Construction Supplementary Planning Guidance. Evaluation and analysis will include use of the TfL Sustainability Toolkit and information shared and common workshops with Health Impact Assessment (HIA), Equality Impact Assessment (EqIA) and other specialist teams undertaken as relevant.

20.3 Energy Statement

20.3.1 An Energy Statement which considers the energy strategy for the BSCU Works will be provided as part of the TWAO application. This will consider the requirements of the GLA, City of London Corporation, TfL and LUL.

20.3.2 The Energy Statement will be undertaken to comply with the Mayor's energy hierarchy to consider the potential for passive design features, energy efficiency measures and low and zero carbon technologies, whilst having regard for site constraints and project delivery. The energy statement will consider the targets for CO₂ emissions reduction set by the Mayor within the framework of the energy hierarchy and will include consideration of whole life energy use/carbon emissions.

20.4 Climate Change

- 20.4.1 Climate change adaptation is concerned with a proposed development's vulnerability and resilience to climatic change. Climate change mitigation is concerned with Green House Gas (GHG) emissions and the project's contribution to an increase or reduction in emissions.
- 20.4.2 Climate change adaptation will be considered within relevant specialist assessments, for example principally within the water resources assessment, which integrates consideration of the potential impacts and risks that forecast climatic changes pose to the development.
- 20.4.3 Similarly, consideration of climate change mitigation will be included within the energy statement, which will consider the carbon emissions of options.

20.5 Health Impact Assessment

- 20.5.1 The Mayor of London is under an obligation to promote the health of Londoners and to take into account the effect of his policies on the health of London's population. As part of the GLA, TfL is therefore supporting the delivery of these obligations by considering the opportunities to enhance public health and reduce health inequalities during the design and consent processes for the Bank Station project. A Health Impact Assessment (HIA) of the BSCU Works will therefore be undertaken to be submitted with the TWAO application in 2014.
- 20.5.2 With regard to methodology, URS, in agreement with TfL, are using the London Healthy Urban Development Unit (HUDU) Rapid Health Impact Assessment Tool to determine the likely health impacts of the BSCU Works. The HIA will focus specifically on the BSCU Works and no other associated development (e.g. the OSD). There will however be a cumulative impacts section which will address any health impacts caused by such ancillary development.
- 20.5.3 The HIA will be a stand-alone assessment informed by elements of the EIA.

20.6 Equality Impact Assessment

- 20.6.1 As a Public Body, TfL must comply with the Race Relations (Amendment) Act 2000, the Disability Discrimination Act 2005 and the Equalities Act 2010. As such an Equality Impact Assessment (EqIA) will be undertaken alongside the EIA. It will consider the effects of the project during the construction phase for protected groups. It will also assess the operational outcomes of the BCSU project for customers and employees belonging to protected groups. The protected groups are: age, disability, gender reassignment, marriage and civil partnership, race, religion or belief, sex and sexual orientation.

20.6.2 The EqIA will identify ways to minimise harmful effects during construction and to build in best practice at the design stage of the project, to maximise the benefits. The EqIA will be informed by stakeholder engagement during the design stage, including engagement with relevant equality stakeholders. By conducting the EqIA during the detailed design stage, this will enable TfL to comply with its statutory equality duties to have due regard for the impact of its services on protected groups. In accordance with TfL requirements, a draft EqIA report will be published for public consultation.

21 Scoping Summary

21.1.1 Table 21.1 summarises the preceding specialist sections in order to provide an overview of the proposed scope of assessment.

Table 21.1: Summary of the proposed scope of assessment

Environmental Aspect	Included in the EIA Scope	Rationale
Townscape and Visual Effects	Yes	The significance of impacts upon the townscape and visual receptors around the Whole Block and Arthur Street Sites will be assessed.
Transport and Movement	Yes	The BSCU Works will place demands on the local highway network, particularly during construction. A Transport Assessment will accompany the planning application and this will inform the assessment of transport impacts within the ES.
Noise and Vibration	Yes	The BSCU Works has the potential to result in noise and/or vibration impacts on the closest surrounding receptor locations to the Whole Block and Arthur Street Sites, both during construction and operation which will be assessed.
Built Heritage	Yes	The works could impact upon the setting of heritage assets, and ground settlement associated with tunnelling work has the potential to directly impact built heritage assets. A built heritage assessment will be included within the ES.
Archaeology	Yes	The Whole Block and Arthur Street Sites have the potential to contain below ground archaeological remains which will be considered within the assessment.
Air Quality	Yes	The BSCU Works has the potential to affect air quality through emissions to air during construction and operation – primarily from transport related impacts. The significance of impacts upon receptors around the Whole Block and Arthur Street Sites will be assessed, including consideration of dust.

Environmental Aspect	Included in the EIA Scope	Rationale
Water Resources and Flood Risk	Yes	<p>Despite the presence of potential groundwater receptors associated with the deep aquifer, the BSCU Works will not impact these and therefore the deep aquifer can be scoped out of the EIA. However it is possible that the shallow aquifer could be impacted and therefore it is proposed that consideration of the shallow aquifer is included in the assessment.</p> <p>Analysis has not identified significant potential flood risk from or to the Whole Block and Arthur Street Sites from tidal/fluviol, surface water, sewers or artificial sources. The circumstances of the sites do not require a Flood Risk assessment under the National Planning Policy Framework.</p> <p>Groundwater flood risk will however be considered in the water resources assessment.</p>
Land Contamination	Yes	<p>Development of the Whole Block and Arthur Street Sites has the potential to disturb any pre-existing ground contamination and open pathways for pollution which will be investigated.</p>
Waste	Yes	<p>The management of construction related waste, including excavated material, could give rise to significant environmental effects. Waste arisings and methods of management will be assessed.</p> <p>A draft design phase site waste management plan will also be produced.</p>
Socio-Economic and Community Effects	Yes	<p>The development has the potential to impact upon local businesses and the community which will be considered in the assessment.</p>

Environmental Aspect	Included in the EIA Scope	Rationale
Ecology	No	<p>Baseline survey work has identified almost no ecological potential within or close to the BSCU Works sites and therefore no scope for the project to result in significant ecological effects. Whilst the redevelopment of the OSD may therefore offer scope for the enhancement of local ecology, this is not considered likely to result in a significant environmental effect. It is therefore proposed that ecology be scoped out of the environmental assessment, however any enhancement measures that are proposed will be reported in the sustainability statement for the project.</p>
Daylight, Sunlight, Overshadowing and Microclimate	No	<p>The permanent above ground elements of the BSCU Works will be entirely within the form of the OSD building. It is therefore not considered likely that the BSCU Works will result in any permanent significant adverse daylight, sunlight or overshadowing effects and it is therefore proposed to scope this topic out of the assessment.</p> <p>Similarly, as there will be no significant surface level buildings as a result of the BSCU Works (beyond the Station Entrance within the OSD which will be assessed as part of the OSD EIA), no significant microclimate (local wind) effects are considered likely and it is similarly proposed to scope this topic out of the assessment.</p>
Electromagnetic Compatibility (EMC)	No	<p>The construction method and project circumstances, such as the depth of the running tunnels, combined with design according to European, UK Regulations and LUL standards, leads to the conclusion that significant environmental effects and unintended EMI events during construction and operation are not considered likely. It is therefore proposed to scope assessment of EMC out of the Environmental Impact Assessment.</p>

Environmental Aspect	Included in the EIA Scope	Rationale
Sustainability	Not as a separate EIA topic.	<p>The sustainability of the BSCU Works will be considered as part of a CEEQUAL pre-assessment of the development, as well as within a separate Sustainability Statement.</p> <p>Actions to improve sustainability that are to be undertaken as part of the development design will be considered within the specialist chapters of the Environmental Statement, particularly where any measures might be considered mitigation.</p>

22 Environmental Statement

22.1.1 The ES will include all required information as defined by Rule 11 and Schedule 1 of the Transport and Works (Applications and Objections Procedure)(England and Wales) Rules 2006.

22.2 Structure of the Environmental Statement

22.2.1 The structure of the ES is anticipated to be as follows:

Context

- Introduction
- Environmental Impact Assessment legislation
- Planning Policy Context
- Sites and Surrounding Area

Project Description

- The Proposed Development
- Need for the Development
- Consideration of Alternatives

Assessment

- Method of Assessment
- Townscape and Visual Effects
- Transport and Movement
- Noise and Vibration
- Built Heritage
- Archaeology
- Air Quality
- Water Resources and Flood Risk
- Land Contamination
- Waste
- Socio-Economic and Community Effects
- Inter-relationships and Cumulative Effects

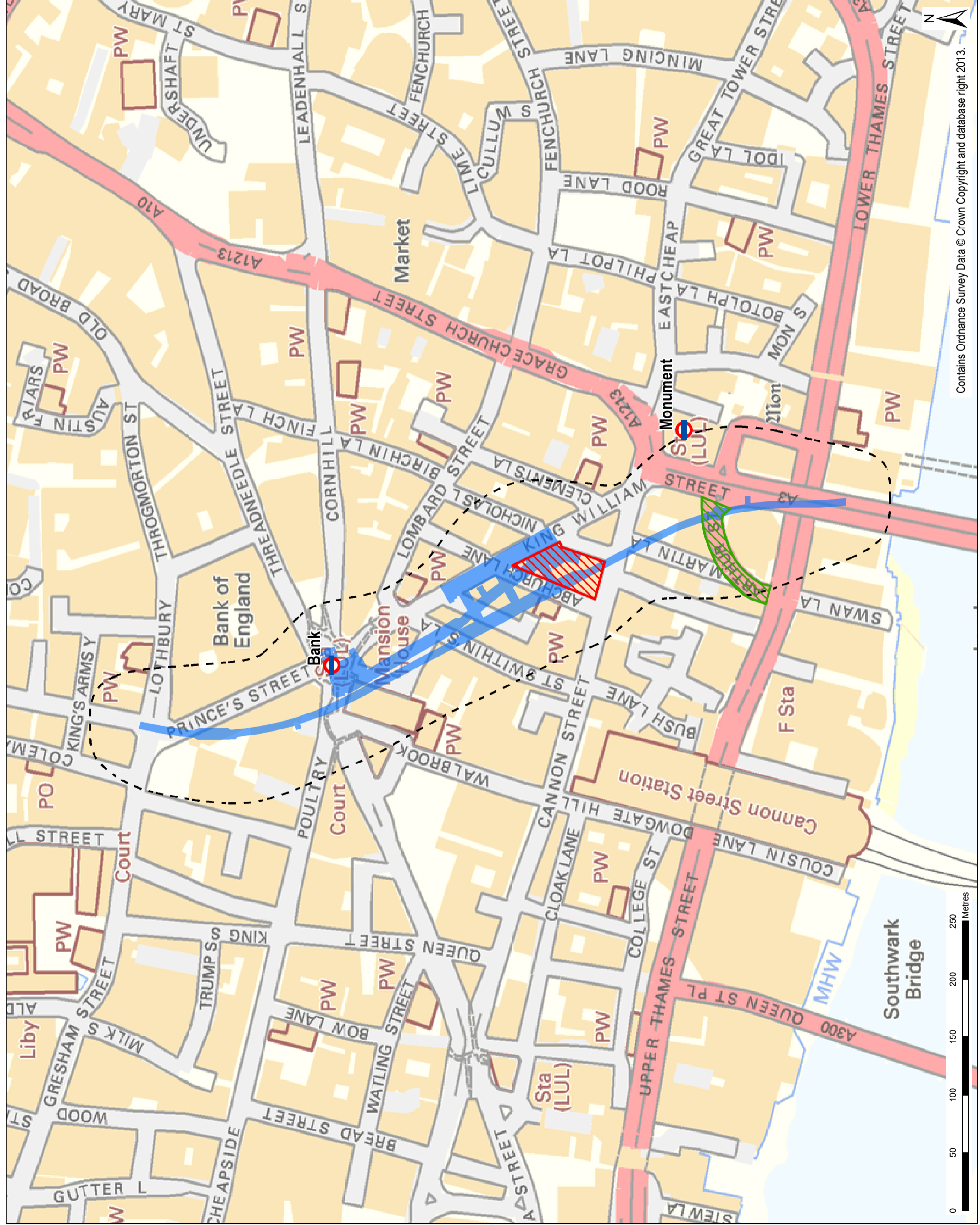
Conclusions

- Summary of residual environmental effects, mitigation and monitoring.
- 22.2.2 The ES will also include technical appendices as required in support of the above key chapters and topics, as well as a separate Non-Technical Summary.

Appendix 1: Context Map

LEGEND

- Proposed development locations**
-  Whole Block Site
 -  Arthur Street Work Site
 -  Underground station
 -  Below ground works
 -  1mm settlement contour - land potentially affected by the works



Purpose of Issue	DRAGADOS		
Client	BANK STATION CAPACITY UPGRADE		
Project Title	PROPOSED DEVELOPMENT LOCATIONS		
Drawing Title	PROPOSED DEVELOPMENT LOCATIONS		
Drawn	Checked	Approved	Date
JW	SP	SP	26/09/2013
URS Internal Project No.		Scale @ A3	
47067970		1:3,000	

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Drawing Number: **FIGURE A1**

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