



**CLIENT:** LONDON UNDERGROUND LIMITED

**CONTRACT REF:** TLL 7917

**NORTHERN LINE EXTENSION**

**MAIN WORKS CONTRACT**

## **CODE OF CONSTRUCTION PRACTICE PART B BATTERSEA**



### **Issue and Revision Control**

Distribution and revision control is managed through the Electronic Document Management System - Asite, with the latest revision displayed.

This document is uncontrolled when printed.

<b>Revision History</b>			
<b>Rev No</b>	<b>Date</b>	<b>Summary of Changes</b>	<b>Section Number</b>
1.	04.12.2014	Review and approval.	All
2.	11.12.2014	Updated for review and approval.	All
3.	23.01.2015	Updated from review comments	All

## CONTENTS

<b>1.0</b>	<b>INTRODUCTION</b> .....	<b>8</b>
<b>2.0</b>	<b>AREA AND SCOPE</b> .....	<b>9</b>
<b>3.0</b>	<b>TEMPORARY WORK SITES</b> .....	<b>9</b>
<b>4.0</b>	<b>SUMMARY OF MAIN WORKS</b> .....	<b>9</b>
4.1	SITE ESTABLISHMENT .....	10
4.1.1	Site clearance.....	10
4.1.2	Temporary site services .....	10
4.1.3	Office and welfare .....	10
4.1.4	Site Roads and Storage .....	10
4.1.5	Asset protection.....	10
4.2	RIVER BED LEVELLING WORKS .....	11
4.3	TUNNELING WORKS .....	11
4.4	STATION BOX CONSTRUCTION .....	11
4.5	CROSSOVER BOX CONSTRUCTION .....	12
4.6	ELEVATED CONVEYOR AND JETTY MODIFICATIONS FOR SPOIL REMOVAL BY RIVER .....	13
<b>6.0</b>	<b>WATER RESOURCES</b> .....	<b>14</b>
6.1	SITE DRAINAGE .....	14
6.2	DEWATERING .....	14
6.3	SURFACE WATER POLLUTION CONTROL.....	14
6.4	GROUNDWATER POLLUTION CONTROL.....	15
<b>7.0</b>	<b>NOISE AND VIBRATION</b> .....	<b>16</b>
7.1	NOISE AND VIBRATION RECEPTORS.....	16
7.2	CONSTRUCTION ACTIVITIES.....	17
7.3	NOISE AND VIBRATION MITIGATION MEASURES .....	18
7.4	PRE-CONSTRUCTION AMBIENT NOISE AND VIBRATION SURVEY .....	19
7.4.1	Provision of Noise Insulation.....	21
7.5	NOISE AND VIBRATION MONITORING.....	21
<b>8.0</b>	<b>DUST AND AIR QUALITY</b> .....	<b>22</b>
8.1	SENSITIVE DUST RECEPTORS .....	22
8.2	ACTIVITIES REQUIRING SPECIFIC DUST MITIGATION MEASURES.....	22
8.3	CATEGORY TIER 3 DUST MITIGATION MEASURES FOR BATTERSEA .....	23
8.3	DUST MONITORING.....	24
<b>9.0</b>	<b>ENERGY</b> .....	<b>25</b>
<b>10.0</b>	<b>CONTAMINATED LAND</b> .....	<b>26</b>
<b>11.0</b>	<b>MATERIALS AND WASTE MANAGEMENT</b> .....	<b>27</b>
<b>12.0</b>	<b>ECOLOGY AND NATURE CONSERVATION</b> .....	<b>27</b>
12.1	TERRESTRIAL .....	27
12.2	AQUATIC .....	28
12.3	PROTECTION OF HABITATS.....	29
12.4	PROTECTION OF TREES .....	29
<b>13.0</b>	<b>LIGHTING</b> .....	<b>29</b>
<b>14.0</b>	<b>ARCHAEOLOGY</b> .....	<b>29</b>
<b>15.0</b>	<b>LISTED BUILDING AND CONSERVATION AREAS</b> .....	<b>30</b>
<b>16.0</b>	<b>SETTLEMENT</b> .....	<b>30</b>
<b>17.0</b>	<b>COMMUNITY AND STAKEHOLDER LIAISON</b> .....	<b>30</b>

**Appendix 1 – Worksite Locations**

**Appendix 2 – Figures**

**GLOSSARY AND ABBREVIATIONS**

**Alluvium Soil** - deposited by river processes

**Ambient** - Background levels

**Aquifer** - A below ground, water-bearing layer of soil or rock

**BAP** - Biodiversity Action Plan. A plan highlighting a species of concern within a specific geographical area

**Baseline** - Existing environmental conditions present on, or near a site, against which future changes may be measured or predicted

**Bentonite** – a type of absorbent clay formed by breakdown of volcanic ash, used especially as a filler.

**Best Practicable Means (BPM)** – A methodology having regard to the current state of technical knowledge, the local conditions and circumstances and the financial implications. It must also include consideration health and safety, design, installation, maintenance and manner and periods of operation, plant and machinery, and the design, construction and maintenance of buildings and structures.

**BREEAM** – BRE Environmental Assessment Method; an independently assessed scheme designed to improve the environmental performance of building projects.

**CEEQUAL** – Civil Engineering Environmental Quality assessment scheme, an independently verified assessment tool used to improve environmental performance of civil engineering projects.

**CoCP** - Code of Construction Practice. Document providing mitigation to reduce or eliminate adverse effects and enhance beneficial effects

**Code of Construction Practice Part A** – sets out the general principles and requirements to be applied during construction and are applicable project-wide.

**Code of Construction Practice Part B** – sets out the site-specific measures applied during construction, in addition to the general requirements indicated in Part A.

**Contamination** - Contamination is the addition, or the result of addition, or presence of a material or materials to, or in, another substance to such a degree as to render it unfit for its intended purpose

**Crushers** - Deconstruction plant used to reduce the size of demolition waste

**Cumulative Impacts** - Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions

**dB** - Decibel. The ratio of sound pressures, which we can hear, is a ratio of 106 (one million: one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (Lp) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

**dB(A)** - The unit of noise measurement (measured on a logarithmic scale), which expresses the loudness in terms of decibel (dB) scale and the frequency factor (A)

**Demolition** – Deconstruction of buildings and other structures

**Dewatering** - The removal of water from the soil to enable work to be carried out below the groundwater level

**Dust** - Fine particles of solid materials ranging in size from 1 to 75 micron diameter (see British Standard 3405) capable of being re-suspended in air and settling only slowly under the influence of gravity where it may cause nuisance

**Ecology** - The study of living organisms in relation to their surroundings

**Environmental Statement (ES)** - The outcome of the Environmental Assessment presented in a formal document or documents in accordance with EC Directive 85/337. Includes such information that is reasonably required to assess the environmental effects of a development.

**Environmental Impact** - Positive or negative impact of a project component or activity on the surrounding environment

**FLO** – the contractor joint venture between Ferrovial Agroman UK and Laing O’Rourke appointed by Transport for London to carry out the Northern Line Extension Project.

**Grade I Listed** - Building A listed building of exceptional interest

**Grade II\* Listed** - Building Particularly significant buildings of more than local interest

**Grade II Listed** - Building Buildings of special architectural or historic interest

**Habitat** - The living place of an organism characterised by its physical or biotic properties

**Hazardous** - A substance that is potentially damaging to the environment and harmful to humans and other living organisms

**Head house** - The above ground structure which is associated with and either directly above or off set from a below ground shaft

**Heritage Structures** - Buildings of historic significance

**Hoarding** - A temporary board fence set up on the perimeter of a building site

**Hydrocarbon** - An organic compound consisting entirely of hydrogen and carbon

**In-situ** - In the natural, original or appropriate position

**Listed building** - Buildings of special architectural or historic interest listed by the Secretary of State for Culture, Media and Sport on the advice of English Heritage - Buildings are graded to indicate their relative importance

**LU** – London Underground.

**M&E** - Mechanical and Electrical

**Made Ground** - Soils or other material that has been deposited by man rather than natural processes, for example to make up ground levels

**Mitigation (measure)** - The measures put forward to prevent, reduce and where possible, offset any adverse effects on the environment

**NO<sub>x</sub>** – oxides of nitrogen

**PAH** - Poly Aromatic Hydrocarbon

**Particulate matter** - Discrete particles in ambient air, sizes ranging between nanometres (nm, billionths of a metre) to tens of micrometres (µm, millionths of a metre)

**PM10** – the fraction of particulate matter with a diameter of 10 microns or less

**Passive Deposition Monitoring** - is the collection of a representative sample of particulate matter over a known area without any active intervention e.g. dust slides or sticky pads.

**pH** - A measure of the acidity or basicity of a solution

**Pre-cast** - cast (an object or material, typically concrete) in its final shape before arriving on site and positioning.

**Pile** - A timber, steel or concrete post that is driven jacked or cast (bored) into the ground to carry vertical or horizontal loads

**Plant** - A building’s generator, heating, ventilation, and/or electricity production system, or the machinery used in demolition and construction

**PPV** - Peak Particle Velocity in metres per second. The vibration measurement parameter that based on a form of acceleration that is frequency weighted to reflect human sensitivity to various frequencies

**Receptor** – something or someone that could be affected (beneficially or adversely) by changes caused as a result of a development of a scheme

**Reinforced concrete** - Concrete reinforced with steel bars to increase tensile strength

**Running Tunnels** - Basic sections of tunnels between stations, shafts and turnouts

**Runoff** - Rainwater flowing off the ground surface

**Secant Pile** – a way of constructing retaining walls and are formed by a series of interlocking bored concrete piles.

**Section 61 Agreement** - A Consent with the local authority issued under the Control of Pollution Act 1974 to agree ‘best practicable means’ associated with reducing the noise and vibration impacts for activities with the potential to cause nuisance from a worksite.

**SCL** - Sprayed Concrete Lining

**Shaft** - A vertical excavation used as a passage from the surface to the below ground works, used for ventilation, travelling, hoisting, or all three. Shafts are usually of limited cross section in relation to their depth

**Stakeholder** - A person, group, or organisation that affects or can be affected by an organisation's actions

**Station Box** - A deep cut and cover box below ground level which will contain the station concourse and relevant facilities

Step Plate Junction - A junction where two tunnels lined with plates of different diameters meet, and vertical plates are used to close the vertical faces, to form a step

**TBM** - Tunnel Boring Machine

**TPH** - Total Petrol Hydrocarbons

**TWAO** - Transport and Works Act Order. Can authorise railways, tramways, guided transport schemes and certain other types of infrastructure project in England and Wales

**Threshold** - A level of effect above which an assessment will be taken of whether any changes to procedures need to be made

**Trial Pits** - Intrusive investigation positions excavated by a mechanical Excavator

**VNEB** - Vauxhall Nine Elms and Battersea. This is identified as an 'Opportunity Area' in the London Plan for regeneration and redevelopment, as an integral part of the Central Activities Zone.

## 1.0 Introduction

This Code of Construction Practice (CoCP) Part B has been prepared by FLO (joint venture between two companies Ferrovial Agroman UK and Laing O'Rourke) for the construction of the Northern Line Extension (NLE) and covers the environmental impacts relating directly to the construction activity within NLE Battersea site boundary, but also within the local area that may be affected by the construction works.

This document takes into account the nature of the works, the local environmental 'receptors' and the results of ongoing engagement with the London Borough of Wandsworth, as well as with other stakeholders. Through the CoCP Part B, FLO aims to inform stakeholders of our proposed approach and mitigation to reducing adverse effects from the works.

The site specific measures detailed within this CoCP Part B (in addition to the mitigation measures specified in the CoCP Part A which are denoted by the use of italics) ensures that the environmental impacts resulting from the NLE construction at Battersea are effectively controlled and where possible eliminated. FLO will not only comply with all relevant environmental legislation and wider requirements but seek to exceed current industry best practice where possible. This will in part, be achieved, through our NLE environmental objectives below which will ensure continual improvement of our environmental and sustainability performance. We seek to:

- reduce greenhouse gas emissions;
- reduce pollutant emissions to the air (NOx and PM10);
- reduce resource consumption and improve green procurement;
- reduce the waste generated by applying the principles of "reduce, reuse and recycle";
- reduce water consumption
- BREEAM 'Very Good' score for the two station
- CEEQUAL 'Excellent' score for civil engineering works

The CoCP Part B will be submitted to the relevant local planning authority for approval before starting works at Battersea worksite. This document should be read in conjunction with the following documents that describe aspects of the project environmental management in more detail.

<b>Title of Document</b>	<b>Reference</b>
Code of Construction Practice (CoCP) Part A	TfL 13E/1 20/12/13
CoCP Part B – Nine Elms	FLO-N203-2360000-HSE-PLN-00001
CoCP Part B - Kennington Park	FLO_N202-2360000-HSE-PLN-00001
CoCP Part B - Kennington Green	FLO_N202-2360000-HSE-PLN-00002
Noise and Vibration Management Plan	FLO-N001-2360000-HSE-PLN-00006



Resource Efficiency Plan	FLO-N001-2360000-HSE-PLN-00007
Air Quality Plan	FLO-N001-2360000-HSE-PLN-00008
Water Conservation Plan	FLO-N001-2360000-HSE-PLN-00009
Sustainable Travel Plan	FLO-N001-2360000-HSE-PLN-00010
Archaeology and Built Heritage Management Plan	FLO-N001-2360000-HSE-PLN-00013
Energy Management Plan	FLO-N001-2360000-HSE-PLN-00011
Ecology Management Plan (including reinstatement)	FLO-N001-2360000-HSE-PLN-00012
Traffic Management Plan	FLO-N001-2360000-CON-PLN-00004

## 2.0 Area and Scope

The Northern Line Extension (NLE) will create a new underground line as an extension to the existing Charing Cross branch of the Northern line between Kennington Station and a terminus station to the south of Battersea Power Station. The extension will consist of new twin bore running tunnels of 5.2m internal diameter and covering a distance of approximately 3.3 km with new stations at Battersea and Nine Elms.

The Battersea Station and Crossover box works covered by this CoCP Part B includes civil engineering, interface with tunnelling, fit-out and services installations to provide the following:

- A new station adjacent to Battersea Park Road within the area of the Battersea Power Station Redevelopment. This includes a substructure box containing a track crossover immediately to the east of the Battersea Station Box;
- Banks of escalators from street to platform level;
- New lifts providing step free access for persons of reduced mobility (PRM) between the street, ticket hall and platform levels;
- Sprayed Concrete Lining for the tunnelling under Battersea Dogs and Cats Home.

## 3.0 Temporary Work Sites

The illustrations contained within Appendix 1 identifies the construction worksite for the NLE activities at Battersea, and how it fits within the wider Battersea Power Station development site. Please refer to diagram III within appendix 1 for the proposed initial layout of the worksite.

## 4.0 Summary of Main Works

A high level summary of the works at Battersea is included below. Detail of how site specific mitigation is to be applied for each environmental aspect on the Battersea Station scheme is included in the relevant section of this document.

In parallel with the initial construction activities, the perimeter hoarding and site accommodation (offices, welfare, workshops etc.) will be assembled within the site boundary.

#### 4.1 Site Establishment

Once access is granted, we will enclose the entire site with approved hoardings and establish a security system, to control access to the site for pedestrians and vehicles. Our programme requires the establishment of temporary site welfare/accommodation; erection of hoardings around the main site (along the conveyor route and around the pier area) from early 2015. We will obtain any required approval by the local council and hoarding licence, prior to erection.

The main vehicle access point during this initial phase will be via the existing gates used by the developer on Battersea Park Road which may also require temporary traffic control with marshalls. As the site establishment works progress we will introduce the new site gate arrangements (and necessary modifications to the traffic signals) in a phased manner.

##### 4.1.1 Site clearance

This will commence, focusing on the identification, disconnection and diversion of existing utilities within the site boundary to provide a safe working area. These typically include existing gas, water, low and high voltage and communications cables. Trial holes will be dug to confirm the locations of existing services and we will install ground movement or settlement monitoring equipment for baseline readings to be undertaken, prior to the main excavation works starting in April 2015.

##### 4.1.2 Temporary site services

The installation of temporary services and connections to the permanent routes in Battersea Park Road, for the main Battersea work site will be installed. Some Ground Investigation works have already been completed but further site investigations will be carried out, including boreholes to provide detailed information on soil strata depths and geotechnical properties for design purposes. Trial holes will be bored to identify and sample potential contamination hotspots for testing, prior to excavation works starting on site.

##### 4.1.3 Office and welfare

The location and layout of offices and welfare units originally proposed for the site is currently being reviewed with the Battersea Power Station Site, due to the reorganisation of the site layout.

##### 4.1.4 Site Roads and Storage

Temporary site haul roads; a one-way traffic system; segregated pedestrian routes and laydown areas, will be established as soon as possible on site. The main haul roads will be formed using a concrete, low maintenance and durable running surface. Preparation of the stockpile area for the temporary storage of excavation and tunnel arising's will also be carried out. It is intended to shallow dig to a depth of 1.5m of the existing ground level over the full area of the stockpile, and line the pit with concrete, to reduce overall visible height.

A maximum of approximately 7,500m<sup>3</sup> of arising's will be stored on site (at any one time). This will assist in the event that the conveyor system is being maintained or the barges are unable to reach it, due to adverse weather conditions, so that the material cannot be loaded at the jetty. This stockpile will provide approximately two to three days' storage for spoil arising's in an emergency. This figure is based on the combined outputs from the Tunnel Boring Machine's (TBMs) and excavation of the station and crossover boxes during normal production.

##### 4.1.5 Asset protection

There may be a requirement to install a temporary retaining wall or underpinning to the northern side of the existing Duchess Bridge road bridge (adjacent to the southwest corner of the station box). A permanent retaining wall solution may be necessary, adjacent to the existing brickwork retaining wall, this will be confirmed during the detailed design phase.

#### 4.2 River bed levelling works

Until further bathometric surveys are undertaken and GPS confirms the adequacy of jetty and camp sheds, FLO is not in a position to confirm if any river bed levelling works are required. Any survey required will be timed to avoid conflict with fish migration.

#### 4.3 Tunneling Works

The tunneling works at Battersea will comprise of twin bore running tunnels of 5.2m internal diameter and covering a distance of approximately 3km. There will be two SCL adits approx. 75m in length to facilitate the launch of the TBM's and two SCL overrun tunnels of 180m and 160m long respectively. The planned start date of the tunneling is May 2016 (*this is subject to programme change but is correct at time of print*). There will be a crane on site to facilitate the assembly of the TBM and a material holding area to store tunnel rings.

#### 4.4 Station Box Construction

After taking possession of the Battersea site area in January 2015 (but this may need to move back to March 2015 depending on Conditions Precedent), piling preparation works will be carried out, starting at the east end of the site to allow the Crossover Box construction to commence. These works will be addressed as per the following sequence:

- Completion of Unexploded Ordnance Surveys;
- Installation of sheet piled retaining walls to allow pile probing and piling operations to start;
- Pile probing / Removal of obstructions;
- Pile mat and guide walls construction.

In parallel with the above works, the bentonite plant (silos and de-sanding unit) will be set up within the site located along the northern boundary with Battersea Power Station Developer (BPSD). Bentonite is commonly used in construction projects to retain the sides of excavations in sandy, wet or unstable soil. It is integral to the construction of the diaphragm walls because it ensures the foundation remains stable during excavation and while the concrete is poured. Bentonite will be delivered to site as bentonite powder and added to a pre-determined volume of water. When mixing is complete, the bentonite is pumped into silos for hydration and storage.

Our waste water management system will be established (including the necessary Thames Water discharge consents) in advance of the main piling operations. Once a sufficient area of piling mat is prepared, we will mobilise the diaphragm wall and rotary piling rigs.

The diaphragm walls will be installed, working from east to west with (at least) two rigs along with attendant cranes. Once the diaphragm walls are substantially complete the rotary piling rig will be mobilised to install the plunge column piles. FLO will use a bored-driven piling technique instead of driven piling which will reduce the noise and vibration from this activity.

The Battersea station will be constructed using a form of top down methodology (which helps to reduced noise and visual impacts) with permanent internal floor slab beams acting as the temporary propping, as the excavation progresses. Construction of the station will require large concrete pours.

Excavation below ground floor slab level will commence once the grillage of precast beams is in place and the in situ concrete stitches have achieved the required strength, using a long reach excavator. On completion of the bulk excavation for the base slab, the formation will be prepared and blinded for the base slab construction. Once the bulk excavation is complete we will demobilize the crawler cranes and install a series of 3 tower cranes for the remaining structural and fit out works.

Completion of the base slab will allow the start of the vertical concrete works above. On completion of the vertical concrete the platform will be constructed.

The superstructure frames at the west and east ends of the station box will be constructed using precast wall, beam and slab units (where possible). All the precast materials will be manufactured off site and delivered by lorry as necessary. The aim is to create a watertight environment, at the earliest possible stage, for the fit-out and Mechanical and Engineering installation within these areas.

Following the completion of the construction activities, the architectural finishes and services (mechanical, electrical, power and communications) installation will commence in a phased manner. Landscaping and external works will be the final stage of FLO works.

#### **4.5 Crossover Box Construction**

The roof slab of the Crossover Box is approximately 3.0m lower than that of the Battersea Station Box and to avoid breaking out a significant length of diaphragm wall we will excavate the existing ground level to a depth of 4.5m to construct the piling platform at this reduced level. Sheet piles will be installed (using vibratory piling rig which creates less noise than driven piling) as a temporary retaining structure around the perimeter of this zone.

These works will be constructed in the following sequence:

- Completion of Unexploded Ordnance surveys;
- Pile probing / Removal of obstructions for sheet piling;
- Installation of sheet piled retaining walls to allow pile probing and piling operations to start;
- Excavate from ground level to a depth of 4.5m (some of this material may be contaminated, see Section 9 below);
- Pile mat and guide walls construction.

These piling operations will be supported by the same bentonite plant and waste water management system referred to in section 4.4 above.

The Crossover box will be constructed using conventional bottom up methodology, temporary props are installed as the box excavation proceeds.

Excavation will be initially undertaken by a long reach excavator and grab. As the excavation deepens muck skips and a crawler crane will be used to complete the excavation.

On completion of the bulk excavation for the base slab, the base slab will be constructed. This then allows the construction of the Sprayed Concrete Lining (SCL) launch adit followed by the TBM main assembly underground.

On completion of the tunnelling works the remainder of the Crossover Box is constructed in the same manner as the Battersea Station box above.

#### **4.6 Elevated Conveyor and Jetty Modifications for Spoil Removal by River**

Pile probing and obstruction removal for construction of the spoil conveyor foundations between the stockpile area and the existing Battersea jetty will commence straight after the pile probing for the station substructure is complete. This will be followed by the construction of the reinforced concrete conveyor foundations. In parallel with these works, we will carry out structural surveys, design and modification to the existing jetty structure to suit our moveable conveyor spoil loader.

On completion of the modification works to the jetty and construction of the conveyor foundations, the spoil conveyor will be erected and commissioned. To minimise impact, we will liaise with London Underground and the developer to co-ordinate its final position and height.

#### **5.0 Public Access, Highways and River Transport**

The Transport and Works Act Order (TWAO) authorises certain matters concerning highways as set out in the relevant articles and Schedules of the Order, the Deposited Plans and planning direction Drawings. The matters include the formation of accesses (temporary and permanent) as shown on the plans, temporary stopping up of streets as listed in Schedule 2 and temporary changes to traffic regulations as listed in Schedule 9. These do not therefore require the further approval of the highway authority, although in all cases FLO will consult with them on the timing and scope of any highway works (and conditions 12 and 18 of the deemed planning permission require approval of certain highway matters). Where works are not authorised by the TWAO, FLO will obtain approval of the highway authority for any highway works, including permits under the London Permit Scheme, the need for which is not disapplied by the Order.

Where works are not authorised by the TWAO, FLO will obtain approval from the highway authority for any highway works. The works shall be undertaken to standards suitable for highway adoption.

FLO participates fully in the Vauxhall Nine Elms Battersea (VNEB) site level meeting (monthly frequency) and has regard for the VNEB Construction Charter. This forum is managed by Arup to coordinate the projects that are being delivered in the Vauxhall Nine Elms Battersea development area.

FLO will discuss with all relevant stakeholders, including local residents and businesses on the proposed traffic management arrangements required to facilitate the NLE Battersea station construction. This will allow alternative arrangements (if necessary) to be agreed and implemented in a timely manner. All traffic management will have prior approval from the Local Authority before implementation.

##### Traffic management and Logistics

Traffic management arrangement drawings and overall traffic management detail such as the movement of materials by road, will be prepared as defined in the Traffic Management and Logistics Plan, documents. Designed Traffic Schemes will be submitted to Transport for London (TfL) for assessment and approval. Discussions will be held with the appropriate parties during the design development.

Traffic management schemes being designed for the construction phase will ensure that all the construction related traffic avoids the Vauxhall Gyratory (a requirement of the contract).

FLO will design and implement a signalised junction for the construction worksite access and exit point at Battersea. Access for all FLO construction vehicles will be provided within the construction compound in order to ensure construction traffic impacts on local residents and businesses are minimised. If necessary, controls shall be put in place by FLO on the roads adjoining the site, to prevent parking by site workers. The Sustainable Travel Plan sets out FLO's strategy, encouraging site workers to use public transport, walk, or cycle.

FLO will endeavour to also make available motorcycle parking areas at the main site office location. Provision will be made for parking of bicycles. Further details can be found within the NLE Sustainable Travel Plan.

## 6.0 Water Resources

The River Thames is located at its closest point 350m to the north from the proposed NLE Battersea station and will be used to transport excavated material by barge from the existing jetty at Battersea Power Station (BPS), at this location the river is tidal. The Battersea site drainage is connected to existing combined sewers.

Steps to eliminate or minimise water usage will be utilised where possible i.e. the cooling system for the TBM will be closed circuit – all water will travel through a cooling tower on site which will then be pumped back to the TBM, making the process more water efficient. For water and foam injected into the TBM cutterhead, approval from the Environment Agency will be sought for the foam products used. The FLO tunnelling team will ensure the application and quantities of foams used by the TBM are optimised, to minimise the likelihood of foam entering the waste water stream.

### 6.1 Site Drainage

Waste water is expected from site cabins, dewatering (if necessary) and the tunnel grout washing, as well as from other general construction operations. Appropriate licences will be obtained from Thames Water to permit the necessary discharge to the foul sewer and any offsite disposal (e.g. concrete slurry) will be managed by a licensed waste contractor.

FLO will be installing a waste water treatment plant for the surplus water from the tunnel grout washing, which will be treated to remove solids and correct the pH before discharge.

### 6.2 Dewatering

Construction processes will minimise the requirement for dewatering, however investigations are ongoing to determine whether dewatering (or de-pressurisation) will be required during the construction of the station box. In the event that dewatering is required, water from this process will be discharged to a sewer with an appropriate permit, controls and monitoring regimes as required by the permit.

### 6.3 Surface Water Pollution control

The only surface water receptor that could potentially be affected by works at Battersea is the River Thames; pollution has potential to enter the Thames through the drainage/sewer network via the Combined Sewer Outfall (CSO) during heavy rain.

To reduce this risk, FLO will ensure that the below protection measures (*identified in section 7.5 of the CoCP Part A*) to control the risk of pollution to surface water are deployed:

- a) *securing fuel and oil containers in bunded areas*

- b) *careful management of refuelling activities*
- c) *preventative maintenance regimes and use of drip trays under static plant*
- d) *management of waters from any vehicle washing (PPG13 – Pollution Prevention Guidance on Vehicle washing and cleaning)*
- e) *use of biodegradable hydraulic oils when working near watercourses*
- f) *management of silty runoff from earthworks*

In addition the following steps will be implemented where appropriate and reasonably practicable:

- Any container with contaminative potential will be kept within a lockable and bunded store with the lid securely tightened. These measures will be checked and audited during site inspections.
- Secondary bunding and plant nappies (or similar) will be used to minimise the risk of spillages from semi-static plant, temporary storage of fuels and during re-fuelling
- A wheel wash facility or localised jet washing of wheels on hard standing
- Road sweepers deployed as required within the site and on roads leaving the site
- Settlement tanks (e.g. silt busters), water filters and hessian matting to drains will be used to ensure that silt does not enter the surface water drainage network.
- Temporary blocking of drains to prevent runoff entering the CSO
- Spill response including access to site drainage plans and regular spill response training.
- Management of bentonite slurry

There is also a pollution risk to the Thames from where the conveyor (carrying tunnel arising's) crosses the river wall onto the jetty, with material spillage potentially dropping down into the river whilst the barges are being filled. FLO have mitigated this risk by altering the conveyor alignment to minimise the length of the conveyor above the River Thames. FLO have also designed the conveyor to be wider with a steeper angle of the sides (40 degree angle as opposed to 30 degree angle) at the transfer points which are the critical areas where spillages could occur. Additionally the conveyor has been designed to have a sliding tray fitted underneath along its whole length which will collect any material spillages preventing them from entering the river or roads.

To prevent material spillages and splatter from entering the river during loading of the barges, FLO have installed a 'skirt' (also known as a 'sock') on the end of the discharge tripper to shield along the length of the vertical drop height from the conveyor into the barge. Furthermore the barges will be fitted with splash curtains, the tripper is retractable and the conveyor belt will have a variable speed which will all provide FLO with greater control when loading. The barges will be regularly maintained and pollution booms deployed as required in the event of spills.

#### **6.4 Groundwater Pollution control**

The risk of impacting upon groundwater quality from the construction of the Battersea Station is low. A three-sided sheet pile cofferdam and dewatering points along the fourth face will seal off the upper aquifer during construction of the station box. Any potentially contaminative materials (such as oils and lubricants) that may be used or stored on site during the construction will be controlled and managed in accordance with the CoCP Part A in order to minimise the risk to groundwater resources. In addition water and foam will be

injected into the TBM cutterhead so approval from the Environment Agency will be sought for the foam products used.

*Measures to control the risk of pollution in the CoCP Part A include:*

- *Compliance with relevant legislation*
- *Avoidance of materials that can pollute groundwater where practicable*

Water containing silt will be minimised and intercepted as specified in the CoCP Part A in order to minimise the risk to surface and ground waters.

Discharge of water will be undertaken to sewer subject to the necessary approvals being obtained from Thames Water and in accordance with the CoCP Part A.

## 7.0 Noise and Vibration

FLO will comply with the commitment to achieving best practicable means (BPM) as specified in section 5 of the CoCP Part A for the management of noise and vibration. This includes agreed hours of working, selection and use of quiet or low noise equipment, measures agreed with the Section 61 consents agreed with the London Borough of Wandsworth for the Section 61 consent under the Control of the Pollution Act 1974 and monitoring.

Normal working hours will be 0800 to 1800 weekdays and 0800 to 1300 on Saturdays. Where practicable, operations with the potential for causing material disturbance and/or disruption will be limited to these hours. There is one hour either side of these hours for quiet preparatory start-up and shut down activities only. However the tunnelling, conveyors and barge loading activities will be taking place on a 24/7 basis.

BPM techniques will be used to minimise the risk of impacts from noise and vibration such as selection of quiet/low noise equipment, controlling noise and vibration at source, screening, provision of acoustic enclosures and correct orientation of plant and equipment i.e. ensure that the piling rig is facing away from sensitive receptors during piling operations.

### 7.1 Noise and Vibration Receptors

The location of the Battersea Station is situated between Battersea Park Road and Battersea Power Station, the area comprises a number of sensitive receptors and public houses including:

- residential properties and public house along Battersea Park Road;
- offices in Kirtling Street;
- future properties in Battersea Power Station; and
- the Battersea Cats and Dogs Home.

FLO commissioned a noise monitoring exercise to validate the Environmental Statement (ES) predictions for the existing baseline ambient noise environment by measuring noise levels at locations that are considered to be representative of the surrounding noise sensitive receptors which may be exposed to changes in ambient noise due to the construction of the scheme.

The monitoring locations identified in 7.5 were selected to ensure that a “realistic worst case” assessment of noise and vibration impacts can be undertaken. This will facilitate an



accurate prediction of the impact on receptors is maintained throughout the works and appropriate mitigation measures (discussed in 7.4) can be implemented to minimise the likelihood that the thresholds, as agreed with the local authorities, are not exceeded.

## 7.2 Construction Activities

The Battersea works (described in section 4) include construction activities that have the potential to cause a noise and/or vibration nuisance unless appropriately mitigated.

### Construction

The noisiest activities for the construction Battersea Station are predicted to occur during the early phases of the construction programme. These being:

- enabling works – including concrete breaking and diaphragm-walling (approximate duration 1 year);
- tunnel enabling works/station box structure – including station box excavation (approximate duration 1 year); and
- night time excavated material removal (approximate duration 1 year)
- barge loading and above ground conveyor

Vibration will be generated by the concrete breaking and removal of obstructions using a hydraulic hammer and the breaking down of the diaphragm walls, although predicted levels are not considered to pose a material risk of causing a nuisance, nor pose a risk of property damage. Where possible FLO will mitigate further through selection of plant.

### Tunnelling

The two railway tunnels from Battersea Station to Kennington Park and Kennington Green will be constructed using two Tunnel Boring Machines (TBMs). This method can give rise to groundborne noise and vibration that may affect properties above the route alignment however the groundborne noise from the TBMs would only be audible inside properties above the line for no more than one day so no additional noise mitigation will be required.

### Temporary construction railway and underground conveyor

The removal of excavated material from the tunnels will be achieved using a tunnel conveyor whilst the delivery of construction materials underground will be transported using a diesel locomotive utilising the temporary construction railway (TCR). FLO does not expect the TCR or the underground conveyor to generate noise and vibration that is audible on the surface.

### Barge loading and above ground conveyor

The conveyor need to have the capacity to run 24/7 to load barges that are dependent on the tides. FLO recognises that noise and vibration may be an issue for the surrounding community and as such have ensured that the elevated conveyor transporting the tunnel arising's will be fully clad (apart from on the jetty) on all four sides side's to contain all noise and prevent spillages. The conveyor will also be well maintained e.g. fully tensioned and run efficiently to prevent any nuisance noise from occurring during its operation, FLO have also ensured that the conveyor is fitted with low noise and vibration motors.

The installation of the conveyor is predicted to be the main source of noise, this will be temporary and installation will be during the core site hours only.

Located within the stockpile there will be a hopper and a sizer for the tunnel arising's, noise is likely to arise during the operation of the sizer therefore to prevent any associated noise impacts this machine will be installed with an acoustic enclosure which will keep the noise level within the acceptable levels.

The tunnel arising's will be removed from the Battersea site by barge. The barges will be loaded via the existing jetty to the north of the Battersea Park site. The closest sensitive receptor will be the residential block which forms phase 1 of the Battersea Park redevelopment. Initial jetty activities will involve the installation of fenders along the front of the jetty, this could potentially have a noise impact but to mitigate this FLO will be using vibration piling instead of impact piling, additionally the anticipated duration of this activity is expected to be short.

### 7.3 Noise and Vibration Mitigation Measures

Civil engineering works in the Battersea Station area have the potential to impact upon nearby residents, however, FLO will strive to minimise these impacts. All relevant and practicable measures as outlined within the CoCP Part A will be employed. At Battersea the following site specific measures will be implemented:

- Site hoarding will help shield the noise from the adjacent community
- During the initial site setup temporary super silent generators will be used and located away from the nearest receptor at a suitable distance to minimise any adverse impacts
- Where top down construction is used it will provide more attenuation from construction noise due to the work activity being below ground and therefore providing a shielding effect
- Location of semi-permanent plant such as the concrete crusher away from sensitive receptors.
- The site cabins will be located to provide additional screening from noisy activities
- Layout of the site haulage route will minimise the requirement for vehicles to reverse (thereby reducing noise from reversing alarms)
- The sizer machine operating within the stockpile will be installed with an acoustic enclosure
- Use of sound attenuated equipment where practicable
- Use of acoustic blankets where necessary

*Specific provisions as per the CoCP Part A (section 5.3) to minimise noise and vibration during construction are summarised below:*

- *Each item of plant used on the project will comply with the noise limits quoted in the relevant European Commission Directive 2000/14/EC/United Kingdom Statutory Instrument (SI) 2001/1701 The Noise Emission in the Environment by Equipment for Use Outdoors Regulations (as amended).*
- *FLO will adopt the recommendations for the control of noise, as set out in BS 5228-1:2009 section 8 and for the control of vibration, as set out in BS 5228-2:2009 section 8 or alternative industry guidelines.*
- *Plant and equipment liable to create noise and/or vibration whilst in operation will, as far as reasonably practicable, be located away from sensitive receptors. The use of barriers to absorb and/or deflect noise away from noise sensitive areas will be employed where required and reasonably practicable.*
- *All plant, equipment, and noise control measures applied, shall be maintained in good and efficient working order and operated such that noise emissions are minimised as far as reasonably practicable. Any plant, equipment, or items fitted with noise control equipment found to be defective will not be operated until repaired.*
- *Where reasonably practicable, fixed items of construction plant shall be electrically powered in preference to being diesel or petrol driven.*

- *Vehicles and mechanical plant utilised on site for any activity associated with the construction works will be fitted with effective exhaust silencers and shall be maintained in good working order and operated in a manner such that noise emissions are controlled and limited as far as reasonably practicable.*
- *Machines in intermittent use will be shut down or throttled down to a minimum during periods when not in use. Static noise-emitting equipment operating continuously will be housed within suitable acoustic enclosure, where appropriate.*
- *For underground activities, and also for conveyors above surface level, the following measures will be adopted, where reasonably practicable and appropriate:*

#### Conveyors

- (a) The mounting for any conveyors used to remove excavated material from the works (underground, sub-surface or surface) will be designed and installed so as to mitigate the transmission of noise and vibration;*
- (b) A maintenance programme will be implemented to ensure that the noise generation of any conveyor does not deteriorate over time.*
- (c) The surface conveyor systems will be of similar standard to underground conveyors and will be acoustically enclosed where they run through, or adjacent to, noise sensitive areas. They too will be subject of a maintenance programme. (Note: the conveyor will be covered throughout its length to prevent material spillage.)*

#### Temporary Construction Railway

- (a) The alignment, jointing and mounting of the temporary construction railway will be installed, maintained and operated in a manner so as to minimise the transmission of vibration and ground borne noise from the passage of rail vehicles.*
- (b) Any diesel locomotives used will be fitted with efficient exhaust silencers.*

#### Temporary Tunnel Ventilation

*All tunnel ventilation plant with connections to the atmosphere in any noise-sensitive location will be subject to mitigation measures appropriate to its local environment.*

#### Notifications

*Occupiers of nearby properties shall be informed in advance of the works taking place, including the duration and likely noise and vibration effects. In the case of work required in response to an emergency, the relevant local authority and local residents shall be advised as soon as reasonably practicable that emergency work is taking place. Potentially affected residents will also be notified of the helpline number.*

### **7.4 Pre-construction Ambient Noise and Vibration Survey**

A pre-construction ambient noise and vibration survey has been undertaken by FLO's noise and vibration specialists during October/November 2014. An ambient noise and vibration survey measures the back ground levels of noise and vibration that occurs over a period of time. This is done to establish the 'normal' level of noise and vibration occurring in the surrounding area, which informs the strategy for managing noise and vibration arising from FLO's activities within the worksite.

Attended noise and vibration measurements were taken at four survey locations (refer to Appendix 2 for a location plan of the survey locations) over a period of six separate days and nights. The measurement locations were chosen to be representative of sensitive receptors around the Battersea worksite. The table below summarises the measurement locations.

<b>Battersea</b>		
<b>ID</b>	<b>Location</b>	<b>Co-ordinates</b>
BS1	Battersea Park Road	528936/177101
BS2	Battersea Park Road / Savona Street	529116/177267
BS3	Kirtling Street	529250/177375
BS4	Battersea Power Station	528667/177694

Attended monitoring was taken during the following time periods:

- Monday to Friday 07:00- 19:00;
- Monday to Friday 19:00- 23:00; and
- Monday to Friday 23:00- 07:00.

As 24 hour tunnelling activities will be supported from the Battersea Station site it was necessary to undertake surveys representative of the weekend, therefore; attended noise and vibration measurements were undertaken at Battersea to obtain data representative of the following time periods:

- Sunday 07:00- 18:00;
- Sunday 19:00- 23:00; and
- Sunday 23:00- 07:00.

The attended noise measurements comprised a sequence of 10min duration periods at each location over three consecutive hours during the daytime and two each during the evening and night time periods. The sound level meters were mounted at each location on a tripod at a height of approximately 1.5m above local ground and all were fitted with relevant manufacture's specification windshield.

Vibration measurements were undertaken simultaneously with the noise monitoring. Measurements were taken over 10 minute periods with 1 minute intervals to measure Peak Particle Velocity (PPV). The geophone was mounted on a rigid surface where possible, usually on a pavement.

The table below compares the 2014 FLO baseline survey data with the 2008 data reported in the Environmental Statement (ES).

<b>Battersea Weekday</b>		<b>2014 Survey Data</b>			<b>2008 Survey Data</b>		
<b>ID (2008/2014)</b>	<b>Time Period</b>	<b>Typical L<sub>Aeq T</sub> dB</b>	<b>Typical L<sub>A90 T</sub> dB</b>	<b>Typical L<sub>AFmax T</sub> dB</b>	<b>Typical L<sub>Aeq T</sub> dB</b>	<b>Typical L<sub>A90 T</sub> dB</b>	<b>Typical L<sub>AFmax T</sub> dB</b>
S1/BS1	Daytime	76.0	65.5	97.2	74.0	62.0	-
	Evening	68.3	60.2	83.3	-	-	-
	Night-time	64.2	55.1	69.0	68.0	48.0	-
S3/BS2	Daytime	78..5	63.3	100.7	74.0	64.0	-
	Evening	73.1	59.3	86.1	-	-	-
	Night-time	63.0	50.8	69.7	70.0	44.0	-
L2/BS3	Daytime	67.6	58.4	85.8	61.0	48.0	-
	Evening	66.9	54.0	82.9	58.0	-	-
	Night-time	59.3	53.1	66.8	55.0	43.0	-
-/BS4	Daytime	60.2	54.5	72.5	-	-	-
	Evening	60.9	52.6	73.9	-	-	-
	Night-time	51.2	48.3	55.9	-	-	-

Comparison of the measured noise levels reported in the ES against our new survey data shows that the baseline conditions measured are broadly consistent. However the FLO survey did identify a significant increase in the daytime noise levels at Kirtling Street (BS3), than stated within the ES. Therefore for this location the ambient noise level is higher than predicted by the ES therefore the effect of noise from our works may be less.

Levels of vibration during the vibration survey were below a perceptible level to the technician at the measurement locations.

#### **7.4.1 Provision of Noise Insulation**

In accordance with the CoCP Part A sensitive receptors likely to be subject to noise levels above the trigger levels identified in the NLE Construction Noise and Vibration Mitigation Scheme will be identified prior to works commencing on site and the appropriate action taken.

### **7.5 Noise and Vibration Monitoring**

#### Noise

Monitoring locations have been selected on Battersea Park Road and Kirtling Street to facilitate an accurate assessment of the likely effects experienced by residents in those areas, their location is illustrated in Appendix 2.

There are two types of noise monitoring –attended and unattended. Attended measurements, facilitate the collation of data associated with specific construction activities, and allow detailed observations to be made concurrently regarding other (non-related) noise sources. Unattended measurements, also called continuous measurements, enable long term, 24/7 data to be collated for use in reporting, analysis of incidents, and to assist proactive management of BPM.

Unattended noise monitors shall be positioned at locations agreed with the local authorities to represent sensitive receptors for the duration of the potentially noisy construction activities. These receptors have been selected due to their close proximity to the construction activities that may generate noise and vibration. To the east side of the site there is an existing construction site (Battersea Power Station Development) where noise from FLO's activities is unlikely to have an impact.

Unattended monitoring will be undertaken using type 1 class real time noise monitors and data downloaded a minimum of once a week, but also after any complaints have been received to aid investigation and resolution of the complaint. Noise monitors that detect an elevated noise reading (averaged over the appropriate timescale) will send an automated alert to the Battersea site manager and environmental manager so that they can take appropriate action to mitigate impact. This enables an instant response to a potential problem. Noise monitors are fitted with alarms to enable monitoring against trigger levels. The trigger levels are defined in the Section 61 agreement with the Local Authorities.

FLO shall also measure construction noise levels using a hand-held meter (attended) where works require it (for instance when starting new potentially noisy activities), to both verify the unattended results and also to provide supplemental measurement data at additional locations. The frequency and location of these surveys will be dependent upon the nature and sensitivity of the works being undertaken.

### Vibration

FLO will undertake attended vibration monitoring should it be discerned by the environment team that vibration associated with certain activities extends beyond site boundaries, or complaints are received. Vibration predictions will be included within the S61 and monitoring will be undertaken in agreement with the local authority.

Vibration monitors will have their alarms set at a trigger level defined by the agreement with the building owner / occupier or best practice. These will also be enabled to provide real-time alerts of breaches so that action can be taken to rectify the problem.

All noise and vibration monitoring will be made available to the Local Borough as per arrangements outlined within the Section 61 consents. The data shall be presented in a format which shall be agreed with the London Borough of Wandsworth.

## **8.0 Dust and Air Quality**

FLO will comply with the general measures to control air quality impacts as detailed within the CoCP Part A section 6 and the Air Quality Management Plan which details the general controls to limit dust emissions, such as the use of water suppression, regular cleaning and hard standing areas. FLO will use the Supplementary Planning Guidance (SPG) document on 'the control of dust and emissions during construction and demolition' as the basis of site specific controls to manage dust.

The FLO Air Quality specialists have completed an assessment of the potential dust generating activities at Battersea and have assessed the Battersea worksite as a Tier 3 category (Tier 1 = Low risk, Tier 2 = Medium risk, Tier 3 = High risk). This corresponds with the tiered mitigation measures specified in the CoCP Part A section 6.3. If the works methodology assumptions on which the air quality assessment was based upon, changes sufficiently to render the assessment unreliable, then FLO will arrange for a reassessment.

### **8.1 Sensitive Dust Receptors**

Considering their proximity to the works, the following properties have been identified by FLO's Air Quality specialists as potentially the most sensitive receptors in the proximity of the Battersea worksite:

- Residential properties on Battersea Park Road to the south;
- Eustace Building, Queenstown Road, Wandsworth (ground floor flat);
- Bank Court, Battersea Park Road, Wandsworth (ground floor flat);
- 258 Queenstown Road, Wandsworth;
- 75 Battersea Park Road, Wandsworth (ground floor flat).

### **8.2 Activities Requiring Specific Dust Mitigation Measures**

The following activities at Battersea have been identified as requiring specific dust mitigation measures:

#### Earthworks and Piling

Early phases of the works at Battersea are likely to involve removal of obstructions, piling mat preparation works, secant piling and top down excavation activities, followed by construction and trackout of material and the movement of construction related road vehicles.

The earthworks undertaken here would involve installation of main deep foundations to the station box and the excavation for the diaphragm wall works, the main station box, the basement slab to the station and the crossover box. The construction works associated with the diaphragm walls would include the use of ready-mixed concrete. Once the lid is laid, the works will then begin on the station and crossover boxes. The nearest sensitive receptors to these construction works are the residential properties located on Battersea Park Road, approximately 46m to the southeast, and Bradmead, 90m to the south.

These activities are likely to be the principal sources of dust during the construction phase. FLO will maximise the use of precast concrete where possible to reduce the need for grinding, sawing and cutting on site to further reduce dust emissions.

### Tunnelling

The two tunnels between Battersea and the Kennington Park and Kennington Green shafts will be constructed by Tunnel Boring Machines. The material from this tunnel excavation is unlikely to create dust due to its moisture content, however sprayers (high volume water atomisers) will be fitted on the conveyor discharge points and the shoots lubricated to further mitigate any potential dust.

The remainder of the tunnelling from the Kennington shafts to Kennington Station will be mechanically excavated and sprayed concrete lined (SCL), these SCL works will be carried out on a 24/7 basis and are detailed further in the CoCP Part Bs for Kennington Green and Kennington Park.

FLO are undertaking an assessment to design a bespoke ventilation system to specifically ensure that no adverse effects arise. The air will be drawn from the surface and transported along the tunnel through a ventilation chute, therefore dust will only be disturbed within the tunnel itself and will only travel a small distance before settling inside the tunnel, therefore no surface impacts are expected. FLO will control and monitor the environmental conditions within the tunnels i.e. dust monitoring, which will be supported by a resilient communications capable of relaying data and information under all operational modes to the surface operators.

### **8.3 Category Tier 3 Dust Mitigation Measures for Battersea**

The CoCP Part A (section 6.3) provides a range of mitigation measures corresponding to the relevant tier number (1-3) / dust raising potential of the works. Battersea has been allocated a Tier 3 (high risk category). In accordance with the CoCP Part A the highest standard of dust control reasonably achievable will be adopted by FLO which incorporates all relevant Tier 1, Tier 2 and Tier 3 techniques, the site specific dust control procedures for a Tier 3 worksite (applicable to Battersea) *as described in the CoCP A are outlined below:*

*The enhanced dust control procedures, Tier 2, will include, as appropriate, site controls to:*

- 1) bag and remove biological debris (such as birds' nests and droppings) or damp down such material prior to demolition;*
- 2) screen buildings, where dust producing activities are taking place, with debris screens or sheeting;*
- 3) avoid carrying out earthworks during dry weather if reasonably practicable having regard to programme and contracting arrangements for the relevant works or provide and ensure appropriate use of water sprays to control dust;*
- 4) seed or seal medium or long term excavated materials and soil stockpiles;*
- 5) ensure slopes on stockpiles are no steeper than the natural angle of the material and maintain smooth profile;*

- 6) ensure appropriate equipment is readily available on site and clean up any spillages as soon as reasonably practicable after the event using wet cleaning methods;
- 7) ensure mixing of cement, bentonite, grout and other similar materials takes place in enclosed areas remote from site boundaries and potential receptors; and
- 8) consider full enclosure of sites or specific operations where there is a high potential for dust production and the site is active for an extensive period.

Advanced Dust Control Procedures for Sites /Operations with a High Risk of Dust Emissions (Tier 3) are as follows:

- 1) These procedures are relevant where there is a high risk of significant adverse impact from dust emissions due to the proximity of receptors, the type of activity on site or the duration of operations. In such cases the highest standard of dust control reasonably achievable will be adopted, which will incorporate all relevant Tier 1 and Tier 2 techniques as set out above, as well as additional relevant monitoring measures as outlined below. Measures to be used will be site specific and will be proportionate to the level of risk arising, such as having personnel on site to monitor and manage dust emissions. Techniques such as total enclosure of certain operations to protect vulnerable receptors would be implemented where appropriate.

### 8.3 Dust Monitoring

Battersea has been allocated a Tier 3 (high risk category) therefore the below monitoring techniques (Tier 1 and 2) (as stated with the CoCP Part A) will be adopted according to specific site conditions:

#### Tier 2 Category monitoring

Passive deposition monitoring techniques will be adopted at appropriate locations (site boundaries/local receptors). Passive systems collect and measure deposited dust and are best suited for measuring over days weeks and months.

A comprehensive site survey will be undertaken to determine the prevailing wind direction (using available meteorological data) and a minimum of two permanent PM10 monitoring stations will be installed along the line of the average wind direction and to make data readily available to the local authority.

#### Tier 3 Category monitoring

In addition to the monitoring outlined above for a Tier 2 category, existing baseline dust levels will be established prior to the commencement of any potentially significant dust-creating activities. Where practicable, such baselines will make reference to data sourced from local background PM10 concentrations (such as measured by the Automatic Urban and Rural Network (AURN) monitoring sites and appropriate local authority automatic monitoring sites and those established by dust monitoring in the neighbourhood) and will ideally refer to data from the preceding 12 month period.

As part of this baseline work, FLO is required, as far as is reasonably practicable, to ensure that:

- I. Monitoring data is available for a suitable duration prior to construction.
- II. Data is collected as PM10  $\mu\text{g.m}^{-3}$ , the same units as suggested for the site action level in the SPG.



- III. *Any unusual activity in the vicinity of monitoring sites that may affect monitoring results and/or create a false baseline (e.g. local construction activity) are avoided or noted by local monitoring site operators.*
- IV. *Dust monitoring commences as soon as reasonably practicable to provide localised data to augment the data obtained from the AURN/local authority sites.*

*During the “high risk” construction events themselves, particulate monitoring will be undertaken using appropriate survey instruments such as Osiris, Topaz, DustScan or similar devices sited at appropriate locations such as site boundaries, potential receptors or in a transect orientated to the prevailing wind, as required by specific site characteristics.*

*The survey instruments used will operate an alarm (PC based or mobile phone) should a predetermined site action level be reached. This level will be established in consultation with the relevant local authority and by reference to both local authority and AURN PM10 monitoring data. Subject to such consultation, a preliminary site action level of 250µg.m-3 (15 minute average) is proposed for both Total Suspended Particulates (TSP) - a leading indicator of PM10 - and PM10.*

*If the alarm is triggered the following actions will be taken:*

- (a) The nominated person or someone delegated by the nominated person will as quickly as reasonably practicable investigate activities on the site to ascertain if any visible dust is emanating from the site or activities are occurring that are not in line with dust control procedures.*
- (b) Any identified causes will be rectified where practicable. Actions will be recorded in the site logbook and the relevant local authority notified of the incident and actions by telephone or email as soon as practicable after or during the incident.*
- (c) If no source of the incident is identified the local authority and/or AURN monitoring sites will be contacted to establish if there is a wider area increase in particulate concentrations.*
- (d) If the cause of the alarm is not related to site operations the outcome of any investigation will be recorded in the site logbook and reported to the relevant local authority at an appropriate time.*

*To ensure plans are co-ordinated and dust and particulate matter emissions are minimised, regular liaison meetings with site managers and /or environmental managers of other high risk construction sites within 500m of the site boundary will occur.*

With the provisions specified in the CoCP Part A (section 6.3) coupled with the mitigation and monitoring measures specified above it is not expected that significant dust deposition will occur as a direct result of the works. However should dust deposition occur as a direct result of the works, FLO will make efforts to address the concerns raised.

If dust depositions occur because of a build-up emanating from the NLE Battersea worksite and the adjoining construction sites such as the BPS Development, FLO will co-operate with the other contractors to address the problem of cumulative build up.

## **9.0 Energy**

General procedures to reduce energy consumption across the whole NLE scheme is detailed within the Energy Management Plan however FLO is committed to being as energy efficient and responsible as possible through specific methods that will include but not be

limited to; early connection to mains power where practicable, purchasing/hiring energy efficient equipment and lighting, avoiding unnecessary lighting, provision of energy efficient and well insulated site accommodation, metering and sub-metering for data collection, regular communication and reporting and exploring options to procure energy from renewable sources.

## 10.0 Contaminated Land

The area of Battersea Station and Battersea Crossover has potentially had a contaminative land use history. Historical contaminative activities on-site have included a railway goods depot, railway lines and a freight depot. The surrounding area has a history of industrial use, the most pertinent contaminative industries comprising the former Battersea Power Station (BPS), a paint and colour works, engineering works, tanks, wharves, depots and railway lines. In view of the industrial activities onsite and in the vicinity of the site, a moderate to high potential for contamination exists.

A separate Resource Efficiency Plan has been produced to set out the management process to reduce the risks associated with any contaminated material identified at the site, and how to deal with any previously unidentified contaminants. All contaminated material will be removed by lorries and remediated and/or disposed of offsite. Contaminated land issues will be addressed in a separate site specific Contaminated Land Management Plan which will be produced once all the ground investigation data has been assessed.

Potential contaminants that could arise from the sites industrial history include:

### Onsite (Battersea Station)

- Polycyclic Aromatic Hydrocarbons (PAHs), Total Petroleum Hydrocarbons (TPH), metals, ground-gas and hazardous material from the Made ground imported to the site as part of its historic development;
- PAHs, TPH and metals from the former works, factories and depots;
- TPH, PAHs and metals from the former railway lines.

### Offsite (Battersea station)

- PAHs and metals within the ash, clinker and metal identified during the CCL site investigation in the Made Ground underlying the BPS site;
- PAHs, TPH and metals from the former above ground tanks;
- Solvents, TPH, PAHs, hazardous material and metals from the former BPS;
- TPH, PAHs and metals from the historic and current railway lines;
- PAHs, TPH, metals, solvents and hazardous material from the wharf activities;
- PAHs, TPH and metals from the various works and depots;
- PAHs, TPH, metals and sulphur compounds from the breweries;
- PAHs, TPH and metals from Garages.

Potential off-site derived contamination sources are unlikely to significantly impact on the sites as the proposed development areas of the sites are assumed to be predominantly covered in hard standing. Consequently, migration on-site would be restricted to and dependent on the presence, extent and flow direction of any shallow groundwater beneath the site.

In accordance with the CoCP Part A, where the investigation reveals any presence of contaminated land, an appropriate remedial strategy will be developed, submitted to and approved by London Borough of Wandsworth to identify the most appropriate option for

managing the contamination. If material contamination is discovered during the investigation or construction the most likely course of action would be to halt works, make any excavation safe, segregate all contaminated material, and investigate the type and level of contamination. Once established this will be used to inform an appropriate remediation strategy which will be agreed with the local authority.

## 11.0 Materials and Waste Management

The general material resource management and reduction of waste is detailed within the Resource Efficiency Plan. However the specific measures FLO are implementing on the Battersea worksite are detailed below.

All clean excavated material will be beneficially reused;

- Removal of contaminated material from the excavation of the Battersea Station Box will be loaded onto lorries during the day and transported offsite by road;
- Removal of material from the over-run tunnels and platform tunnels at Battersea will be loaded into barges and transported offsite by water transport.

The tunnel arising's are to be removed from the tunnel entrance via an inclined conveyor into an inverted hopper. Material will then be transported via a series of conveyors to the jetty, where it will be loaded into barges at a two berth facility at the Battersea Power Station jetty.

Where practicable FLO will maximise all opportunities for the onsite reuse of material, for example the concrete obstructions removed during the initial works will be crushed and reusing within the piling mats. This is preferable to re-using the material off site.

A capacity to stockpile will be required at the Battersea Power Station site as a precautionary measure, as there are a number of reasons why the barges may not be available every high tide (e.g. due to closures of the Thames Barrier).

## 12.0 Ecology and Nature Conservation

General procedures to control and limit disturbance to areas of nature conservation interest, protected species and habitats, and measures to be adopted in the event of the discovery of protected species across the whole NLE scheme are detailed within the Ecology and Ecological Reinstatement Management Plan. However site specific information is detailed below.

The Battersea station site lies within the Battersea Power Station (BPS), Site of Borough Importance for Nature Conservation (SBINC or SBI) (Grade 1 Importance) and the River Thames & Tidal Tributaries Site of Metropolitan Importance for Nature Conservation (SMINC). The site comprises a mosaic of semi natural (grassland, scrub and trees) and man-made (buildings and hard standing) habitats and is situated adjacent to the River Thames. FLO undertook an ecological site walkover of the Battersea Station Site in November 2014 which concluded that no additional ecological investigation/survey is required.

### 12.1 Terrestrial

### Mammals

The Battersea worksite has the potential to support common mammal species such as hedgehog and red fox. FLO will reduce the risk of them accessing the site by the covering of all deep holes and trenches overnight and/or the provision of planked escape routes for any trapped wildlife.

### Birds

The buildings and areas of scattered scrub on-site could provide some opportunity for birds to nest during the breeding season. To mitigate this risk, FLO will not leave the worksite dormant for more than two weeks during the construction phase and during the black redstart breeding season (February to mid-August) as Black Redstart may be nesting adjacent to the site. Activity, noise and light on the site during this period should cause a large enough disturbance impact to deter any nesting birds.

If however, the site is left dormant for two weeks or more during the construction phases of the NLE between February and mid-August, a suitably qualified ecologist will check for the presence of nesting birds before work continues. If any active nests are found, construction will cease and an appropriate buffer zone will be established. This will comprise an area that will be left intact until it has been confirmed by the ecologist that the young have fledged and the nest is no longer in use.

Peregrine Falcon are known to nest on the BPS and on a peregrine mast currently located approximately 50m to the west of the conveyor belt to the north-western corner of the Battersea station site. Noise and human disturbance generated as a result of the operation of the conveyor belts and spoil removal activities at the jetty are not anticipated to significantly disturb peregrine potentially nesting on BPS or the peregrine mast. In the absence of mitigation, it is therefore unlikely that construction activities associated with the NLE at Battersea will disturb breeding peregrine.

## **12.2 Aquatic**

### Fish

The Environment Agency annual fish surveys at Battersea revealed that fifteen fish species use the stretch of the River Thames adjacent to BPS. These include four species listed on the UK BAP and London BAP (European eel, Sand Smelt, Sea Trout and Atlantic salmon), although Sea Trout and Atlantic salmon only use this section of the river for part of the year when on migration.

The river bed levelling (if required) and fender installation (piling) activities have the potential to interfere with the migratory movement of fish within the River Thames. Potential impacts on fish would be most significant between March and October due to migration and stage of development for some species. Although any impacts would be temporary, as the potential for disturbance would cease once the work has stopped and the sediments have settled. Should in channel activities be required FLO will consult with the appropriate authorities such as the PLA, MMO and EA. FLO has scheduled the construction programme so that in-channel activities are timed to avoid periods of fish migration and scheduled to occur between the months of November and February. Furthermore FLO will also use sensitive piling methods - vibration piling (as opposed to impact piling), to reduce the effect of increased noise and vibration on fish.

### 12.3 Protection of Habitats

The River Thames and Tidal Estuaries SMINC is also sensitive to habitat degradation in the form of potential spills of water containing suspended sediment oils/fuels, concrete or cement products, contaminated runoff or wind-blown dust or contaminants during construction. Any discharge of contaminants onto the mudflats and into the River Thames could destabilise the fragile ecosystem and impact the diversity of wildlife it supports, including invertebrates, fish, mammals and birds. However, the pollution prevention measures listed within the CoCP Part A and Section 6.3 of this document will eliminate the likelihood of a pollution event occurring.

### 12.4 Protection of Trees

No trees are present on the Battersea worksite.

### 13.0 Lighting

Site lighting and signage will be provided to ensure the safety and security of the construction site and will be at the minimum luminosity necessary. FLO shall design the lighting to be specific to the requirements of the 24/7 tunnelling operation (in accordance with HSE minimum standards for working during the hours of darkness) as well as meeting the needs of the local residents. Where appropriate, lighting to site boundaries will be provided and illumination will be sufficient to provide a safe route for the passing public and the lux levels on footways shall be at least equal to those provided by the existing street lighting. In particular, precautions will be taken to avoid shadows cast by the site hoarding on surrounding footpaths, roads and amenity areas.

Site specific lighting measures to minimise the adverse impacts on adjacent buildings, wildlife sites and land uses at Battersea will be taken from the 'Guidance Notes for the Reduction of Obtrusive Light GN01:2011' (published by the Institution of Lighting Professionals).

### 14.0 Archaeology

Where possible, FLO will minimise all potential impacts to archaeology and will take a proactive approach to handling both buried and above ground archaeology should it arise. The station site is not within an Archaeological Priority Area (APA), but the conveyor route and jetty are within an APA designated for the archaeological and palaeo-environmental potential of the Thames riverside and floodplain.

General procedures to control and limit disturbance to Archaeology across the whole NLE scheme is detailed within the Archaeology and Built Heritage Management Plan, however pertinent archaeological considerations relating to the Battersea worksite are detailed below.

At Battersea there is potential to discover the following archaeological remains

- Palaeoenvironmental remains (a resource assumed to extend beyond the site);
- Foreshore archaeology; including prehistoric or later structures; and
- Unknown archaeology such as deep cut features which might have survived the 19th-century waterworks development.

Below is a list of works relevant to archaeology/heritage at the Battersea worksite:

- Shallow excavations to remove potential below ground obstructions

- Commencement of piling
- Commencement of Excavation

It is expected that no buried archaeological remains of sufficient significance to merit preservation in-situ, will be discovered within the Battersea area. However FLO will engage with an archaeological contractor to provide a Written Scheme of Investigation which will detail our strategy should we make a discovery. This will be submitted to the London Boroughs of Wandsworth prior to material ground break within the site.

## **15.0 Listed Building and Conservation Areas**

General procedures to control and limit disturbance to built heritage across the whole NLE scheme is detailed within the Archaeology and Built Heritage management plan. However site specific buildings of historical or architectural significance that could be impacted by the activities at the Battersea worksite are discussed below.

Built heritage potential at Battersea is predicted as follows:

- The site contains two cranes (which have been removed by Others), a jetty and intake and outlet chambers which are within the curtilage of the Grade II\* listed BPS (and included in the listing of BPS), and part of the river wall, likely to date to the mid-19th century or earlier;
- The site is within the setting of BPS, a Grade II\* listed building of very high sensitivity, and Battersea Water Pumping Station, a Grade II listed building of high sensitivity;
- The site is within the setting of a locally listed building (Whittington Lodge) of medium sensitivity and undesignated buildings of low sensitivity.

FLO will be carrying out condition/structural surveys on the above buildings where necessary. All proposals for works directly affecting any of the above buildings will be in accordance with Listed Building or Conservation Area Consent and attached conditions.

## **16.0 Settlement**

Robust control of ground movement is essential on the NLE due to the critical infrastructure and residential areas above, below and adjacent to the works. FLO will carry out a comprehensive regime of settlement monitoring prior to, during and after tunnel boring. This will provide real time alerts if any significant movement is detected.

FLO will further develop its response to sensitive buildings and infrastructure and will liaise directly with any potentially affected parties.

## **17.0 Community and Stakeholder Liaison**

FLO will provide a dedicated stakeholder management team and resources to enable the successful delivery of the NLE project. FLO will achieve this by establishing and maintaining positive relationships with the project stakeholders and contributing to maintaining and improving the reputation of the FLO JV and London Underground. This will create a lasting legacy after the works have been completed. FLO shall provide the the local community (including Community Liaison Groups, business and residential properties, future housing developments, schools, churches and other organisations) around the Battersea Station worksite with information relating to construction activities that are likely to affect them.

As the project progresses additional stakeholders may emerge and they will be included in works notifications and other project communications as appropriate.

These communications would typically be to inform parties of any proposed works, the nature, timing and planned disruption, measures to reduce the impact of these works, the helpline telephone number and address to which any enquiries should be directed. Advance notice of works will be sent out at least two weeks prior to their commencement where possible (exceptions may occur such as short-notice utility works).

FLO will maintain regular communication to ensure that the wider community and other stakeholders and affected parties are kept well informed. Regular newsletters providing information on the works will be distributed to local residents and businesses and other key stakeholders. The works update page on the NLE website will be updated on a monthly basis or as appropriate. FLO will also provide on a regular basis an update of the schedule of work to London Borough of Wandsworth.

The Battersea Community Liaison Group chaired by a local ward Councillor from Wandsworth, is an established forum through which a timely and informed discussion of the works can take place. This Community Liaison Group aims to keep representatives of local residents and businesses informed about the work and provide an opportunity to raise matters of interest or concern. It is comprised of representatives from FLO, London Underground (LU), London Borough of Wandsworth, local resident representatives, local landowners and business representatives and aims to meet a minimum of four times per year and more frequently if necessary. Pertinent issues raised within the Battersea NLE Liaison Group meetings will be escalated to the Core Liaison Group meeting.

The FLO complaints procedure will be approved by LU (as required by the CoCP Part A) and has been developed to ensure that all complaints received, relating to the construction of the project, are dealt with efficiently and in an appropriate timeframe. We recognise the importance of enquiries and complaints as a valuable form of feedback and we are committed to using this information to help drive forward improvements. FLO is responsible for maintaining a complaints register up to date and available for review at internal and external meetings.

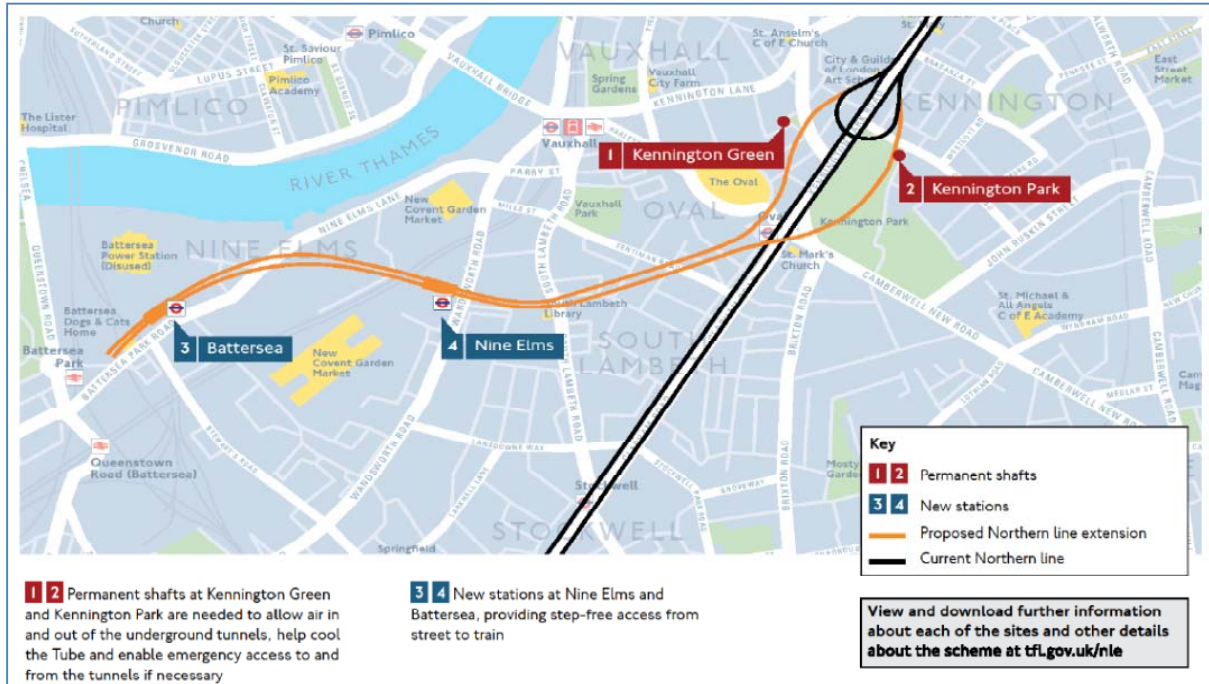
There is a 24 hour helpline for enquiries and complaints (0343 222 2424) and an email account (nle@tfl.gov.uk) to receive complaints and enquiries from the public which is monitored on a daily basis.

- All calls to be logged and complaints tracked through to resolution
- Every complaint to be acknowledged within 24 hours of being received
- The complaint will be forwarded to the relevant person to action within 24 hours
- FLO will endeavor to resolve all issues within 10 days
- Weekly reports to be provided to the LU Stakeholder Manager and the LU Project Manager.
- Quarterly reports to be shared at Community Liaison Groups.

Project web pages can be found at [www.tfl.gov.uk/northern-line-extension](http://www.tfl.gov.uk/northern-line-extension) providing general information on the project, regular progress updates, details of forthcoming works, any impacts on travel arrangements, relevant publications including minutes of the Battersea NLE Liaison Group meetings and contact details.



## Appendix 1 – Battersea Worksite Location

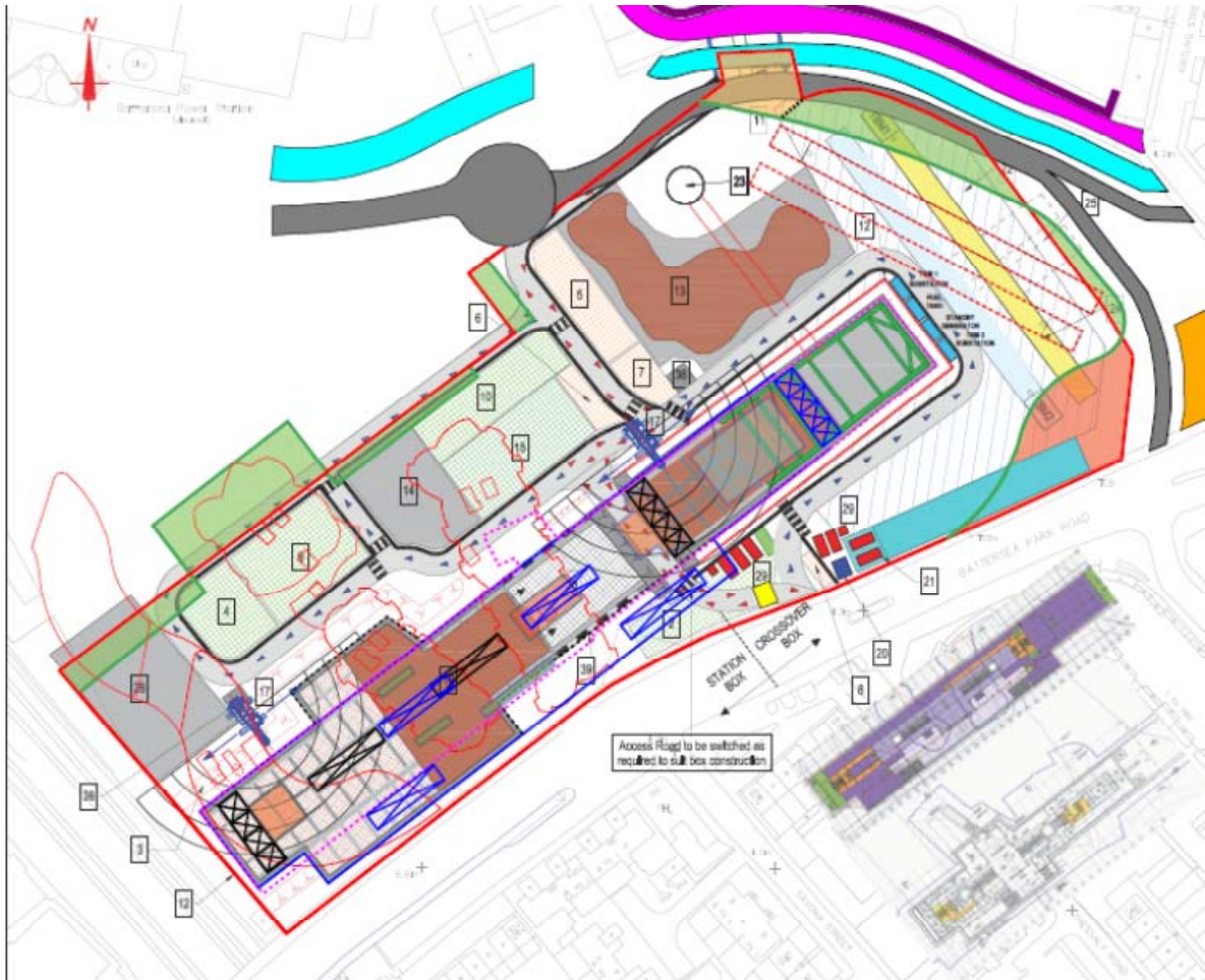


### I Site Location Plan



### II Site Location plan



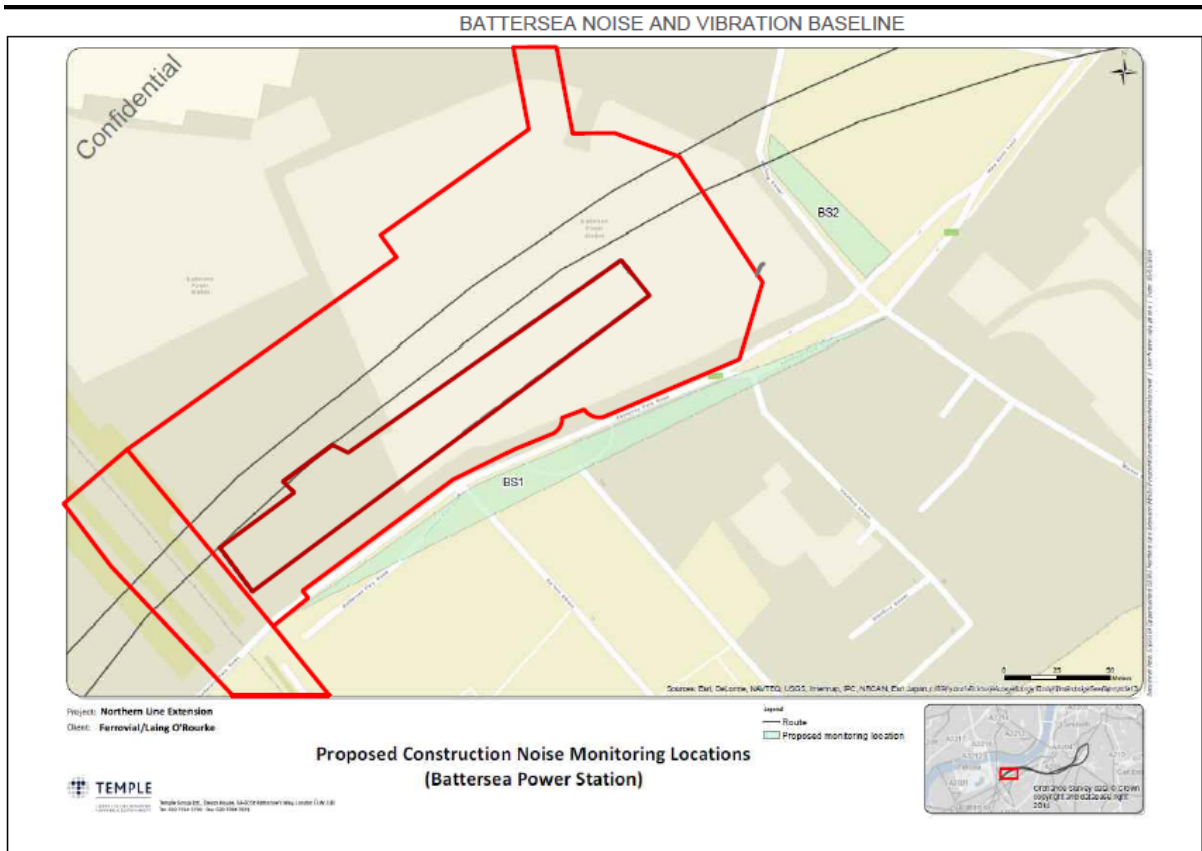


### III Site Layout Plan

## Appendix 2 – Figures



I. Location of four noise and vibration baseline survey locations (BS 1, 2, 3, 4)



## II. Location of proposed unmanned noise monitoring locations

*The noise monitors will be located at points within the two areas shaded pale green. The exact locations will be determined following consultation with the local authority.*