Thames Tideway Tunnel
Thames Water Utilities Limited

Development Consent Order

Application Reference Number: WWO10001

Documents for Certification
September 2014

We, Lindsay Speed and Sarah Fairbrother hereby certify that this is a true copy of the environmental statement referred to in Article 61 (1) (f) of the Thames Water Utilities Limited (Thames Tideway Tunnel) Order 2014.

Lindsay Speed

Sarah Fairbrother

September 2014

Thames Tideway Tunnel

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Thames Tideway Tunnel
Thames Water Utilities Limited

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Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel

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Thames Tideway Tunnel

Environmental Statement

List of contents

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Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station site assessment

List of contents

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix A: Introduction

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January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

This page is intentionally blank

Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix A: Introduction

List of contents

Page number

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Appendix A: Introduction

A.1 Summary

A.1.1 This document presents the appendices that accompany the *Environmental Statement* Volume 11 Falconbrook Pumping Station site assessment.

A.1.2 Figures associated with the appendices are provided within a separate volume of figures.

A.1.3 For consistency and ease of use Volumes 3 to 27 of the *Environmental Statement* all utilise the same appendices contents and labelling protocol. For these volumes the appendices are as follows:

a. Appendix A: Introduction
b. Appendix B: Air quality and odour
c. Appendix C: Ecology – aquatic
d. Appendix D: Ecology – terrestrial
e. Appendix E: Historic environment
f. Appendix F: Land quality
g. Appendix G: Noise and vibration
h. Appendix H: Socio-economics
i. Appendix I: Townscape and visual
j. Appendix J: Transport
k. Appendix K: Water resources – groundwater
l. Appendix L: Water resources – surface water
m. Appendix M: Water resources – flood risk
n. Appendix N: Development schedule.

A.1.4 Where a topic has not been assessed the associated appendix does not include any supporting information. Also, if a topic has been assessed but does not need to present any supporting information then the appendix is intentionally empty.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix B: Air quality and odour

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Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

This page is intentionally blank

Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix B: Air quality and odour

List of contents

Page number

List of plates

Page number

List of tables

Page number

This page is intentionally blank

Appendix B: Air quality and odour

B.1 Model verification

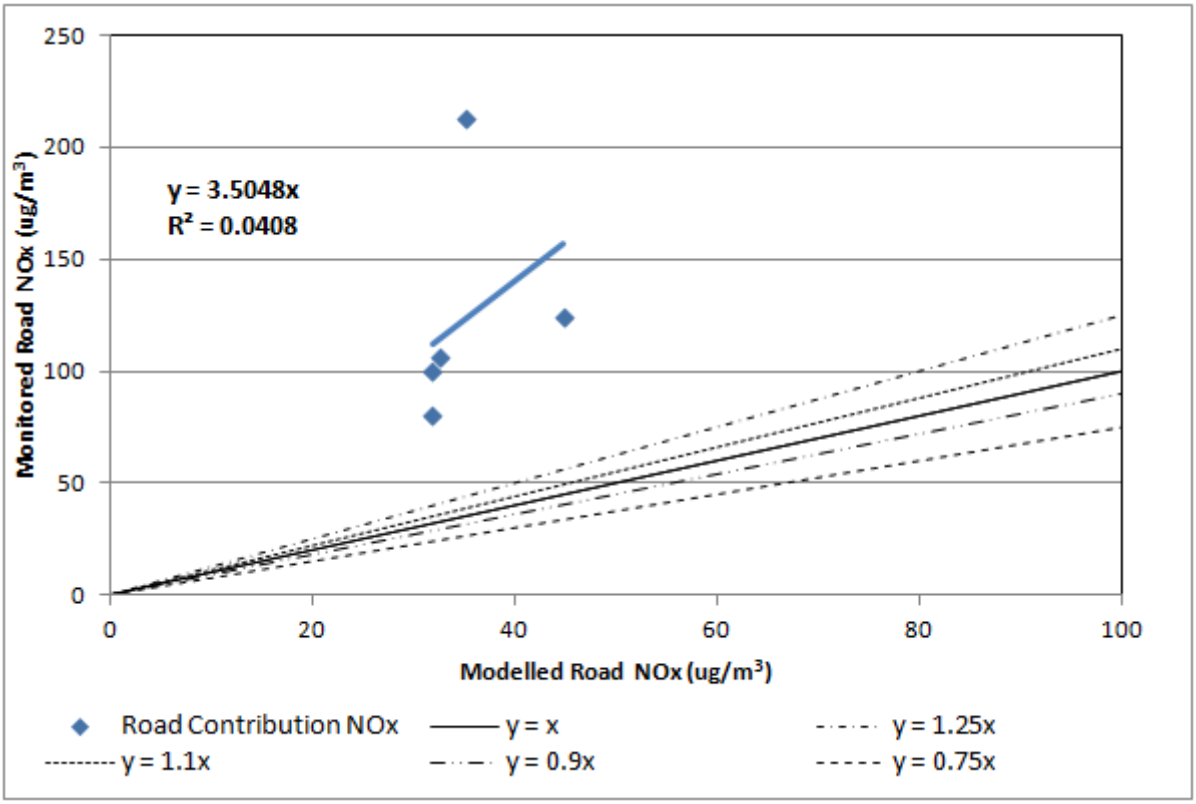
B.1.1 Modelled NO_2 concentrations have been plotted against monitored concentrations at the five diffusion tube sites (FPSM1 - FPSM5) shown in Vol 11 Figure 4.4.1 (see separate volume of figures).

B.1.2 This showed that the modelled results underestimated NO_2 concentrations by between 25% and 49%. As the model has been optimised and no further improvement of the model was considered feasible (such as reducing vehicle speeds or using different pollutant backgrounds, etc), a model adjustment factor was therefore deemed necessary.

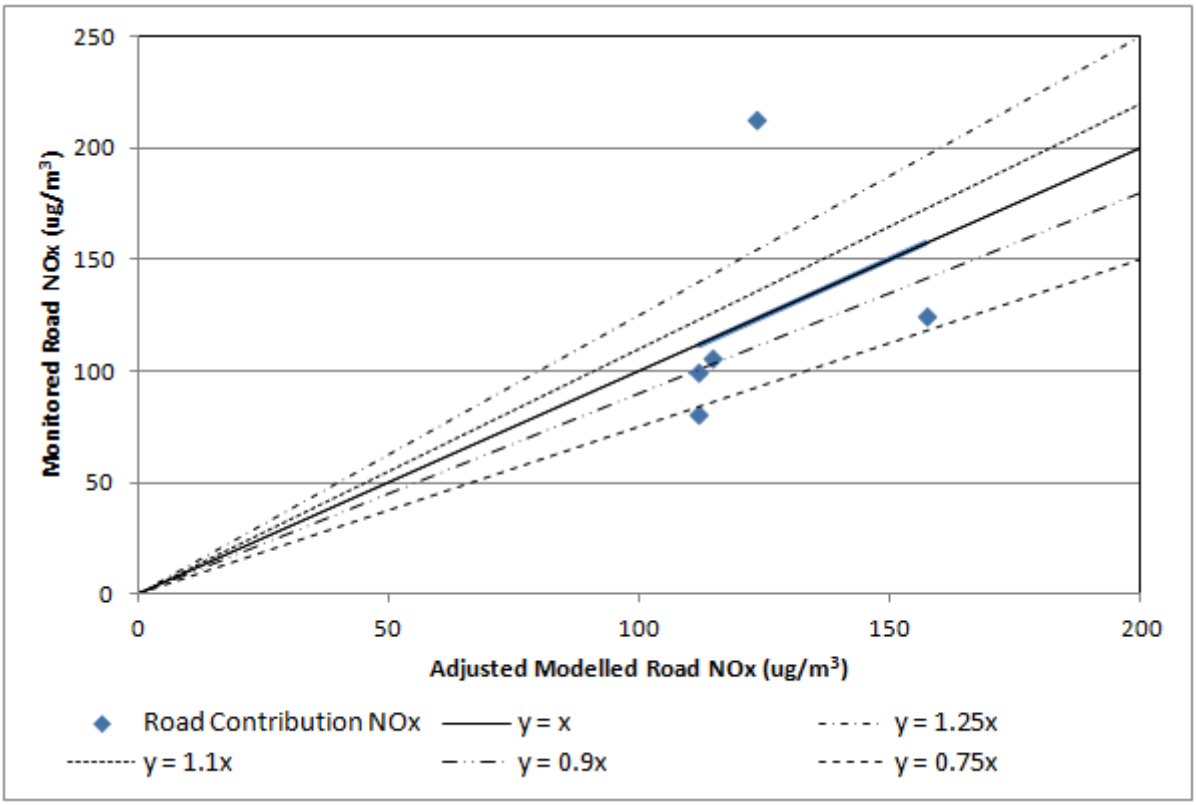
B.1.3 To derive the adjustment factor, modelled road NO_X concentrations were plotted against calculated monitored road NO_X concentrations - see Vol 11 Plate B.1 below. An adjustment factor of 3.50 was calculated to adjust modelled roadside NO_X concentrations, in accordance with LAQM.TG(09) (Defra, 2009)[1] and was subsequently applied – see Vol 11 Plate B.1. This factor was also applied to the PM_{10} results as the PM_{10} monitoring sites were more than 1km away from the site and traffic data were not available, so model verification could not be carried out.

B.1.4 Applying the NO_X adjustment factor and then calculating NO_2 concentrations, as shown in Vol 11 Plate B.2, provides better overall agreement between actual and predicted data. The subsequent linear regression calculation for monitored versus modelled total NO_2, as shown in Vol 11 Plate B.3, indicated that two of the five modelled concentrations were within 10% of the measured value and that all five were within 25% of the modelled value.

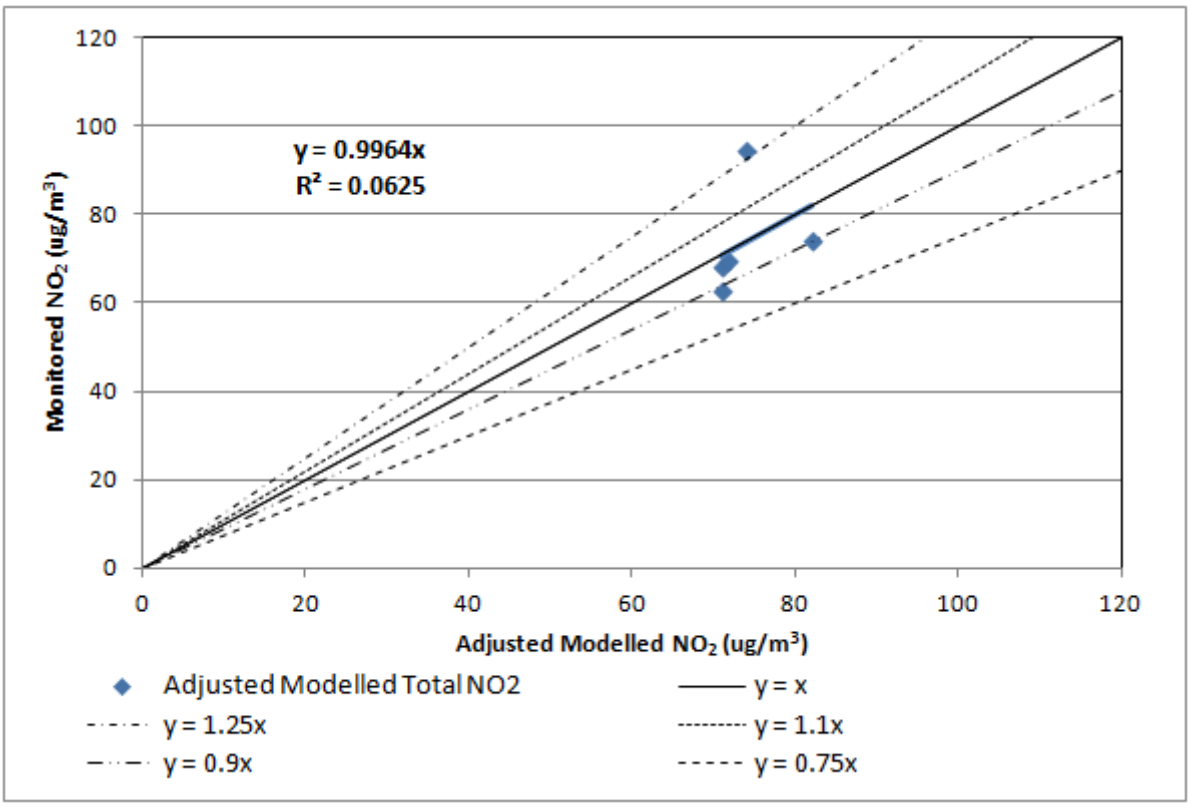
Vol 11 Plate B.1 Air quality - monitored road NO_X vs. modelled road NO_X



Vol 11 Plate B.2 Air quality – monitored road NO_X vs. adjusted modelled road NO_X



Vol 11 Plate B.3 Air quality – total monitored NO_2 vs. total adjusted modelled NO_2



B.2 Traffic data

B.2.1 The traffic data used in the air quality modelling for the Falconbrook Pumping Station site are shown in Vol 11 Table B.1.

Vol 11 Table B.1 Air quality - traffic data used model inputs

Source	Road link	2010 baseline AADT*	Baseline % HGV >3.5t	Speed limit (mph)	Model input speed (mph)	Growth factor % (2009 - 2018)	Peak const-ruction year AADT	Peak construction year AADT scheme construction HGV (HGV >3.5t)	Peak construction year development case (total AADT)	Peak construct-ion year develop-ment case AADT % HGV (>3.5t)
CTC** survey	York Road A3205	38890	7.2	30	27.1	6.4	41370	11	41418	7.3
CTC survey	Plough Road	11753	8.9	30	16.3	6.4	12503	0	12503	8.9
CTC survey	York Place	1202	3.1	30	30.0	6.4	1279	0	1279	3.1
CTC survey	York Road A3205	41382	6.4	30	27.1	6.4	44021	9	44068	6.5
CTC survey	York Road A3205	41493	5.7	30	27.1	6.4	44139	9	44185	5.7
ATC*** Survey	York Road A3205	22286	14.8	30	27.1	6.4	23707	9	23745	14.8
CTC survey	Battersea Park Road A3205	26881	11.6	30	27.1	6.4	28595	9	28621	11.6
CTC	Latchmere	16650	3.4	30	12.1	6.4	17712	30	17745	3.5

Source	Road link	2010 baseline AADT*	Baseline % HGV >3.5t	Speed limit (mph)	Model input speed (mph)	Growth factor % (2009 - 2018)	Peak const-ruction year AADT	Peak construction year AADT scheme construction HGV (HGV >3.5t)	Peak construction year development case (total AADT)	Peak construct-ion year develop-ment case AADT % HGV (>3.5t)
survey	Road A3220									
CTC survey	Battersea Bridge Road A3220	17161	5.6	30	12.2	6.4	18255	26	18283	5.7
CTC survey	Battersea Park Road A3205	24250	10.9	30	27.1	6.4	25796	5	25832	10.9
TfL Model	Falcon Road A3207	3084	7.1	30	8.0	6.4	3281	0	3285	7.0

** AADT – annual average daily traffic. ** CTC – classified traffic count; *** ATC – automatic traffic counter.*

B.3 Construction plant emission factors

B.3.1 For the purpose of the assessment, the following listed equipment in Vol 11 Table B.2 has been modelled for the peak construction year at the Falconbrook Pumping Station site.

Vol 11 Table B.2 Air quality - construction plant assessment model inputs

Construction activity	Typical location	Typical plant	Unit No(s)	% on-time	Power (kW)	NO_X emission rate ($g/s/m^2$)	PM_{10} emission rate ($g/s/m^2$)
Site set up and general site	Ground level behind hoarding	Compressor 250cfm*	1	50	104	9.9×10^{-7}	6.2×10^{-8}
	Ground level behind hoarding	Generator - 200kVA	1	100	160	3.1×10^{-6}	1.9×10^{-7}
	Ground level behind hoarding	JCB with hydraulic breaker	1	50	67	6.4×10^{-7}	4.0×10^{-8}
	Ground level behind hoarding	Cutting equipment (diamond saw)	2	10	2.3	2.2×10^{-8}	4.9×10^{-8}
	Ground level behind hoarding	Telescopic handler / FLT**	1	30	60	3.4×10^{-7}	2.1×10^{-8}
	Ground level behind hoarding	Hiab*** lorry/crane	1	5	56	5.4×10^{-8}	3.3×10^{-9}
	Ground level behind hoarding	Well drilling Rig	1	50	403	3.9×10^{-6}	2.4×10^{-7}
Shaft sinking by spray concrete lining	Within excavation	Shotcrete robot	1	20	14	8.6×10^{-7}	8.0×10^{-8}
	Ground level	Concrete deliveries	1	80	223	3.4×10^{-6}	2.1×10^{-7}

Construction activity	Typical location	Typical plant	Unit No(s)	% on-time	Power (kW)	NO_X emission rate ($g/s/m^2$)	PM_{10} emission rate ($g/s/m^2$)
	behind hoarding	(agitating)					
	Ground level behind hoarding	Concrete deliveries (discharging)	1	20	223	8.5×10^{-7}	5.3×10^{-8}
	Within shaft	12t excavator	1	80	66	1.0×10^{-6}	6.3×10^{-8}
	Ground level behind hoarding	100t crawler crane	1	80	240	3.7×10^{-6}	2.3×10^{-7}
	Ground level behind hoarding	25t mobile crane	1	20	275	1.1×10^{-6}	6.6×10^{-8}
	Ground level behind hoarding	25t excavator	1	50	125	1.2×10^{-6}	7.5×10^{-8}
	Ground level behind hoarding	400cfm compressor	1	50	104	9.9×10^{-7}	6.2×10^{-8}
Drive connection tunnel in spray concrete lining	Within tunnel	Shotcrete robot	1	20	14	8.6×10^{-7}	8.0×10^{-8}
	Ground level behind hoarding	Concrete deliveries (agitating)	1	80	223	3.4×10^{-6}	2.1×10^{-7}
	Ground level behind hoarding	Concrete deliveries (discharging)	1	20	223	8.5×10^{-7}	5.3×10^{-8}
	Within excavation	Butor tunnel excavator	1	50	30	4.6×10^{-6}	4.3×10^{-7}
	Within excavation	Piccini dumpers	2	50	81	1.5×10^{-6}	9.7×10^{-8}
	Ground level behind hoarding	100t crawler crane	1	50	240	2.3×10^{-6}	1.4×10^{-7}

Construction activity	Typical location	Typical plant	Unit No(s)	% on-time	Power (kW)	NO_X emission rate ($g/s/m^2$)	PM_{10} emission rate ($g/s/m^2$)
	Ground level behind hoarding	25t mobile crane	1	20	275	1.1×10^{-6}	6.6×10^{-8}
	Ground level behind hoarding	25t excavator	1	50	125	1.2×10^{-6}	7.5×10^{-8}
	Ground level behind hoarding	400cfm compressor	1	50	104	9.9×10^{-7}	6.2×10^{-8}
Shaft secondary lining	Ground level behind hoarding	100t crawler crane	1	50	240	2.3×10^{-6}	1.4×10^{-7}
	Ground level behind hoarding	Service crane 40t mobile crane	1	25	275	1.3×10^{-6}	8.2×10^{-8}
	Ground level behind hoarding	Concrete deliveries (discharging)	1	20	223	8.5×10^{-7}	5.3×10^{-8}
	Ground level behind hoarding	Concrete pump	2	20	223	1.7×10^{-6}	1.1×10^{-7}

*Note: For the purposes of this assessment, the above listed equipment has been modelled for the peak construction year. The data assumes a 10 hour working day. This schedule provides an illustration of typical plant that could be used in the construction of the Thames Tideway Tunnel at this site. The appointed Contractor must comply with section 6 of the CoCP but may vary the method and plant to be used. This schedule therefore represents the most reasonable assumption for the assessment that can be made at this stage. The appointed Contractor may vary the method and plant to be used. * cfm – cubic feet per minute. ** FLT – fork lift truck. ***Hiab – loader crane.*

References

[1] Defra. *Local Air Quality Management- Technical Guidance, LAQM.TG(09)* (2009).

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix C: Ecology - aquatic

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Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix C: Ecology – aquatic

List of contents

Page number

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Appendix C: Ecology – aquatic

C.1 Introduction

C.1.1 Construction and operational effects assessments at this site for this topic do not require the provision of any supporting information, so this appendix is intentionally empty.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix D: Ecology - terrestrial

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix D: Ecology – terrestrial

List of contents

Page number

List of plates

Page number

List of tables

Page number

This page is intentionally blank

Appendix D: Ecology – terrestrial

D.1 Notable species survey report

Introduction

D.1.1 A Phase 1 Habitat Survey was carried out on 26 November 2010 at the Falconbrook Pumping Station site as shown on Vol 11 Figure 6.1.2 (see separate volume of figures). Based on this, surveys for the following species have been undertaken:

a. bats

b. invasive plants.

D.1.2 The purpose of the surveys is to determine the presence or likely absence of these species at and around the site.

D.1.3 This report presents the survey findings. The survey area for each species is described with reference to the habitat types identified during the Phase 1 Habitat Survey as having potential for notable species (paras D.1.5 to D.1.11). The results from the surveys are then presented (paras D.1.12 to D.1.18). The final section provides an interpretation of the results (paras to D.1.19 to D.1.23). Figures referred to in this report are contained within Vol 11 Falconbrook Pumping Station Figures (see separate volume of figures).

D.1.4 Information on legislation, policy and methodology can be found in Volume 2 Environmental assessment methodology of the *Environmental Statement*. Information on site context can be found in Section 3 of this site assessment volume (Vol 11).

Survey area

Bats

D.1.5 Bats are associated with a diverse range of habitats, including woodland, scrub, riparian habitats and buildings. They roost in trees and buildings where suitable features are present, and they commute along linear features such as hedgerows, watercourses and tree lines, and forage around vegetation such as scrub, hedgerows, grassland, trees and river corridors.

D.1.6 A remote recording (bat triggering) survey using remote Anabat™ recording devices was undertaken. Based on the habitat types identified during the Phase 1 Habitat Survey and their potential to support foraging and commuting bats, two locations were chosen for the installation of the remote recording device, shown on Vol 11 Figure 6.4.3 (see separate volume of figures).

D.1.7 Location one was selected to record activity associated with commuting bats entering the site from the east and was attached to the building in the east of the site.

D.1.8 Location two was selected to record foraging and commuting habitat associated with the vegetation along the western boundary of York Gardens. The remote recording device was attached to the boundary fence on the western side of the pumping station building.

D.1.9 As more than 50 bat passes were recorded, the remote recording surveys triggered the need for an additional dawn survey at Falconbrook Pumping Station (see Vol 2 for bat triggering criteria). However, access to the site for night survey work was not available due to safety constraints. This is not considered to limit the results as a roost is not suspected to be present on site, and the usage of the site can be inferred from the remote recording survey results, as discussed in para. D.1.19 to D.1.22.

Invasive plants

D.1.10 Invasive plants that are listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) occur in a wide range of habitats, although they are more often associated with watercourses or wet areas, or within areas of disturbed ground, where material contaminated with seeds and rhizomes (sections of root that can re-grow), may have been imported into the area.

D.1.11 The invasive plants survey area comprises the proposed development site and an area within 10m of the proposed development site boundary as shown on Vol 11 Figure 6.4.4 (see separate volume of figures). The 10m zone beyond the site boundary was surveyed to record any invasive plants present adjacent to the site that could potentially spread onto the site, or that could have roots that extend into the site below ground (e.g. Japanese knotweed *(Fallopia japonica*).

Results

D.1.12 In this section, the results of the desk study, notable species surveys and the invasive plant survey are presented. The results are then interpreted in paras. D.1.19 and D.1.23.

Desk study

D.1.13 Species data recorded within 500m of the site from 2001 to 2011, as supplied by Greenspace Information for Greater London (GIGL), are summarised in Vol 11 Table D.1.

Vol 11 Table D.1 Terrestrial ecology – species recorded within 500m of the site between 2001 and 2011

Common name	Latin name	Record count
Mammals		
West European hedgehog	*Erinaceus europaeus*	2
Bats	*Vespertilionidae*	4
Birds		
Herring gull	*Larus argentatus*	2
House sparrow	*Passer domesticus*	2

Common name	Latin name	Record count
Reed bunting	*Emberiza schoeniclus*	2
Amphibians		
Common frog	*Rana temporaria*	4

Bat surveys

Bat triggering (remote recording) surveys

D.1.14 The bat triggering (remote recording) survey was undertaken over three nights between 12 and 14 July 2011 in suitable weather conditions (see Vol 11 Table D.2).

D.1.15 The remote recording surveys undertaken at this site recorded two species of bats using the site: common pipistrelle (*Pipistrellus pipistrellus*); and soprano pipistrelle (*Pipistrellus pygmaeus*).

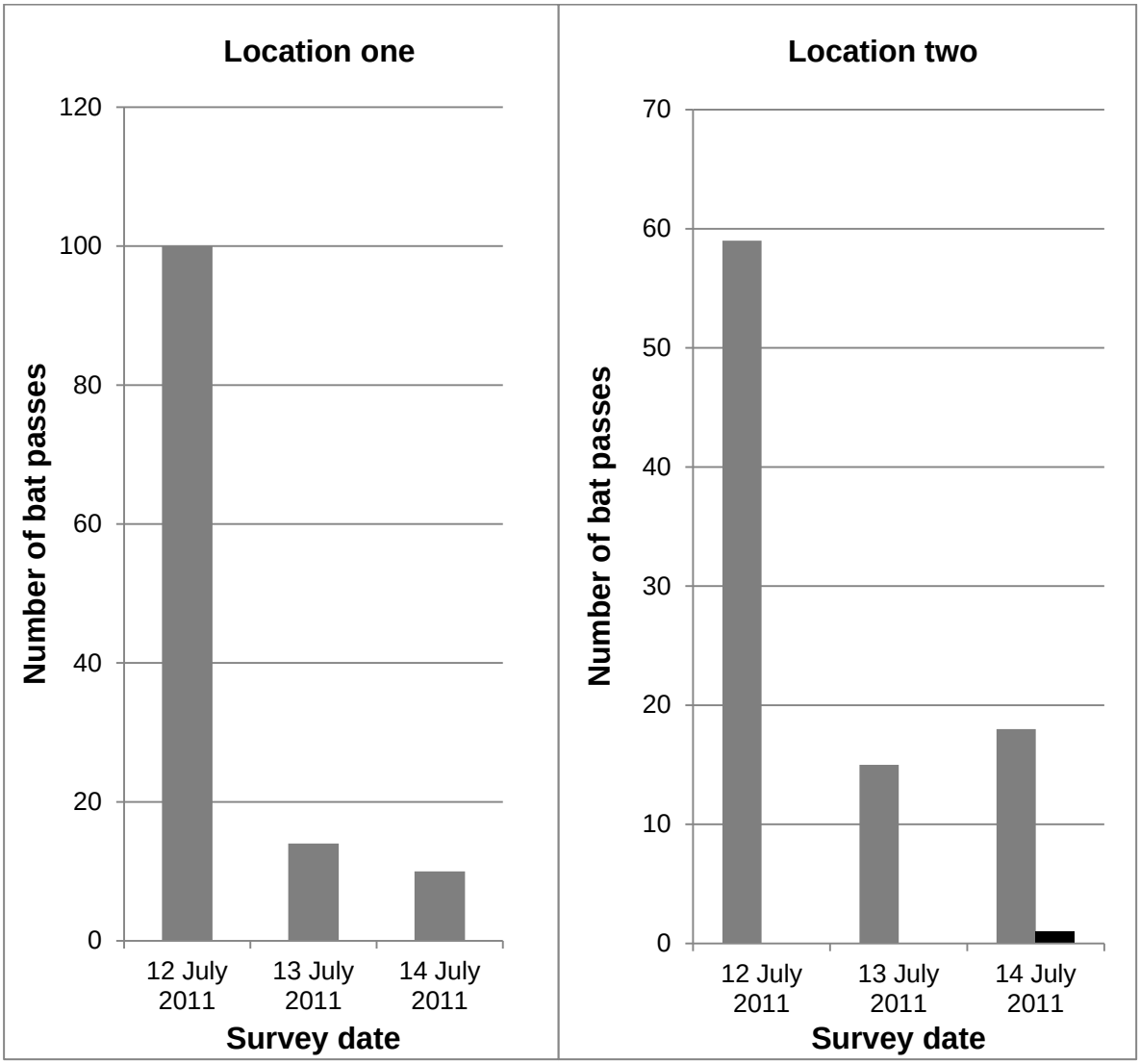
D.1.16 The maximum number of common pipistrelle bat passes recorded during any one night was 100 at location one and 59 at location two, both recorded on 12 July. Lower numbers of bat passes were recorded on the other two nights at each location (see Vol 11 Plate D.1). Two passes were recorded within half an hour of sunset (28 and 29 minutes after sunset).

D.1.17 One soprano pipistrelle bat pass was recorded on only one night (15 July 2011).

Vol 11 Table D.2 Terrestrial ecology – bat survey weather conditions

Survey visit	Weather conditions
12 July 2011	14°C, gentle breeze, 75% cloud cover, dry
13 July 2011	13°C, gentle breeze, 75% cloud cover, dry
14 July 2011	15°C, gentle breeze, 100% cloud cover, dry

Vol 11 Plate D.1 Terrestrial ecology – bat passes recorded during remote recording surveys at two locations at Falconbrook Pumping Station.



Invasive plants survey

D.1.18 The invasive plant species survey was undertaken on 2 September 2011. No invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 were recorded during the survey.

Interpretation

Bats

D.1.19 The survey area is used by soprano pipistrelle and common pipistrelle as a foraging resource and/or commuting route.

D.1.20 There was a noticeable difference in the level of common pipistrelle activity on the night of 12 July in comparison to the other two nights. Variability between survey nights is expected due to small variations in weather conditions, variability in the invertebrate foraging resource and local changes in roost usage. The variability here is likely to represent either an increase in foraging activity of the small numbers of bats present

on site, or a small increase in the number of common pipistrelle bats foraging on the site.

D.1.21 Two of the common pipistrelle bat passes were recorded within half an hour of sunset (when bats typically leave their roosts for the night). However, these were recorded 28 minutes and 29 minutes after sunset. It is considered unlikely that the bat passes were associated with a roost on site as a higher number of passes closer to sunset would be expected and bat passes close to dawn (when bats typically return to their roosts for the day) would also be expected. Nevertheless, it is likely that trees and buildings near to the site support one or more small roosts, and bats associated with these are likely to be foraging and/or commuting on site. Foraging activity is likely to be focussed around the trees and dense scrub on the western boundary of York Gardens.

D.1.22 Only one soprano pipistrelle bat was recorded during the remote recording survey. None of the bat passes were recorded close to sunset or sunrise when bats generally leave and return to their roost sites. The survey results indicate that soprano pipistrelle bats occasionally visit the site and the wider York Gardens for foraging purposes.

Invasive plants

D.1.23 No invasive plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 were present on or within 10m of the site boundary.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix E: Historic environment

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel

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This page is intentionally blank

Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix E: Historic environment

List of contents

Page number

List of plates

Page number

List of tables

Page number

Appendix E: Historic environment

E.1 Gazetteer of known heritage assets

E.1.1 Details of known heritage assets within the assessment area are provided in Vol 11 Table E.1 below, with their location shown on the historic environment features map (Vol 11 Figure 7.4.1, see separate volume of figures).

E.1.2 All known heritage assets within the assessment area are referred to by a historic environment assessment (HEA) number. Assets within the site are referred to (and labelled in the historic environment features map) with the prefix 1, eg, **HEA 1A**, **1B**, **1C**. References to assets outside the site but within the assessment area begin with 2 and continue onwards, eg, **HEA 3**, **4**, **5**.

Vol 11 Table E.1 Historic environment – gazetteer of known heritage assets within the site and assessment area

HEA Ref no.	Description	Site code/ HER ref:
1A	Granite sets, possibly relating to 19th century housing development.	——
1B	The site of the original Falconbrook Pumping Station. This was constructed in 1905, with additional machinery in 1913. The building was demolished and replaced by the existing 1970s pumping station.	——
2	Cotton Row, York Road, Price's Candle Factory Archaeological investigation by PCA (Pre-Construct Archaeology) in 1998 recorded substantial truncation due to a previous factory development. Price's Patent Candle Factory was established in York Place in 1856. The industrial buildings were altered throughout their use in the 19th and 20th centuries. Possible traces of a late medieval or post-medieval fishpond, associated with a known mansion of the Archbishops of York, were found.	CTT98 022317 MLO76171
3	Dover Court Motors, York Road Archaeological investigation by the Museum of London Department of Greater London Archaeology (DGLA) in 1991 revealed no archaeological features.	DCM91
4	Jack Barclays Garage, York Road, SW11 Archaeological investigation by the Museum of London Archaeology Service (MoLAS; now MOLA) in 1991 recorded a 19th century brick-lined well or cesspit.	JBG91 021361
5	Price's Patent Candle Factory, York Place, York Road, SW11	YPE02 MLO77610

HEA Ref no.	Description	Site code/ HER ref:
	Archaeological excavation by PCA in 2002 revealed a single Bronze Age ditch in the southwest of the site. In addition a small area of brickearth was recorded containing mid/late Bronze Age pottery. This was possibly till deposit. The southern side of the Archbishop's Battersea Palace was recorded across the southwest of the site. This is thought to have been constructed in 1474 and survived through to the late 18th or early 19th century. Details of the structure included the moat, five rooms including basements, courtyards and the southwest corner tower. Evidence of garderobes, drainage, windows, arched recesses and doorways were also recorded. During the late 16th and 17th centuries, the Battersea Palace was heavily modified and became a prison for papists. The moat was infilled and built over and a number of new rooms were observed to the north. Some of these new rooms represented the infilling of courtyards within the earlier house. During the late 17th and early 18th centuries, a new house was built in the north of the site which appeared to utilize the 16th and 17th century buildings as basements and the late 15th century house as out-buildings. In the mid-18th century the buildings on site were occupied by a sulphuric acid factory and then, between 1753 and 1756, the Battersea Enamel Works. The latter is of great significance as it was these works which pioneered the tin glazing of enamel. The archaeological remains for both these industries comprise of drains and sluices. In the late 18th century the earlier buildings are heavily modified and added to the new house, York House. In the mid-19th century it was removed by the construction of the candle factory.	022318
6	Price's Candle Factory, York Place, York Road, SW11 Building recording in 2001 of existing 19th century building. During the late 17th century or early 18th century, a house was built to the north of the site of the Price's Patent Candle Factory. This new house, known as York House, underwent many alterations and remained standing until the 19th century incorporated the industrial building.	YPL01 MLO77609
7	York Road, Price's Candle Factory, SW11 Archaeological investigation by PCA in 1996 revealed remains of the southern side of York Place, a late medieval and post-medieval residence of the Archbishops of York.	YRD96 MLO77608 022315−6 022345−7
8	Locally listed Southeast tower of St Peter's Church, (formerly listed as Church of St Peter) and St Peter's Church Hall, Plough Road/Newcomen Road, London.	LB/104 212197

HEA Ref no.	Description	Site code/ HER ref:
	The church dates to 1875, and replaced a temporary church building and school house, erected on a small plot of land on Plough Road for the workers and their families. The tower was not part of the original building plan but was added in 1911. It was built in similar brick with a gabled spire and appeared large in proportion to the rest of the church.	LB/123
9	Kambala Road, Wandsworth Chance find of a Bronze Age stone axe recorder on the HER.	031256
10	York Road Chance find of a prehistoric flake and lithic implement recorded on the HER.	021367
11	York Road Site of a medieval settlement recorded on the HER.	025379
12	St Peter's Church Chance find of a Roman coin recorded on the HER.	031316
13	York House Way Site of a medieval moated house and post-medieval house recorded on the HER.	031372
14	Battersea Thames Chance find of a Middle Bronze Age sword recorded on the HER.	100147
15	Falcon Wharf, Lombard Road, Wandsworth Chance find of 19th century to modern made ground recorded on the HER.	MLO75501
16	Price's Candle Factory, 19th century factory development	——
17	Bridges Wharf, Bridges Court, SW11 Archaeological investigation by PCA in 2006 revealed series of timber revetments that would have supported the northern bank of a small tributary known recently as Battersea Creek, formerly the Falcon Brook, near the confluence of the main Thames channel. The earliest of these consisted of oak uprights and elm planking, probably not pre-dating the 16th century. A second more substantial revetment survived to the south in the form of baseplates. Pottery recovered from the deposits sealing the revetment suggests that it was demolished and replaced in the late 17th or early 18th century. The third river wall survived as re-used oak uprights supporting oak planking. Pottery and clay tobacco pipe recovered from the foreshore deposits to the south of this structure show that it was probably in use	BFQ06 MLO99054

HEA Ref no.	Description	Site code/ HER ref:
	from the late 17th or early 18th century onwards.	
18	Thames foreshore, Wandsworth The findspot of a later medieval pot shard and badge, as recorded by the Portable Antiquities Scheme (PAS).	LON-223381; LON-084865
19	York Gardens, post war gardens.	——
20	Line of Sir Joseph Bazalgette's mid/late 19th century sewer. The sewer follows the line of York Road.	——

E.2 Site location, topography and geology

Site location

E.2.1 The main site is bounded by York Road to the west, a community playground to the north and York Gardens to the east and south. The highway works site comprises a section of York Road to the north of the main site. The site falls within the historic parish of Battersea and formerly lay within the county of Middlesex, prior to being absorbed into the administration of the London Borough of Wandsworth.

E.2.2 The site lies 195m to the east of the current course of the River Thames. The main site lies immediately to the south of the subterranean course of the Battersea Creek, formerly known as the Falconbrook. This watercourse rose in Balham and Tooting, joining near Clapham Common (Weinreb and Hibbert, 1995)[1] to flow approximately along the course of modern Northcote Road and Falcon Road.

Topography

E.2.3 The site and immediate vicinity are flat with street levels along York Road and in York Gardens at approximately 104.0m ATD (above Tunnel Datum; the equivalent to 4.0m Ordnance Datum).

E.2.4 Buildings occupy the northern, eastern and central parts of the main site, between which is tarmac. The western and southwestern parts of the main site are grassed areas. The highway works site is paved.

Geology

E.2.5 The site straddles three geology types (British Geological Survey)[2]. The northern part of the main site overlies alluvium associated with the Falconbrook, a small tributary of the Thames entering the Thames floodplain from the southeast. The southern part of the site overlies Kempton Park river terrace (sand and gravel). In the central part of the main site and the highway works site the gravel terrace is overlain with Brickearth (Langley Silt Complex: a fine-grained silt believed to have accumulated by a mixture of processes, eg, wind, slope and freeze-thaw, mostly since the Last Glacial Maximum around 17,000BP).

E.2.6 Where the Falconbrook has entered the Thames floodplain in the area of the site, it has eroded both the river terrace and the overlying Langley Silts backward in an easterly direction (British Geological Survey)[3].

E.2.7 A single historic borehole (GLC178) within the northern part of the site records gravel from 98.91m ATD. Peat deposits probably associated with the Falconbrook were recorded from 98.69m ATD and alluvial clays from 97.26m ATD. These deposits are sealed by 1.22m of made ground. Within the wider assessment area, there is one borehole (TQ27NE1059) some 130m to the south of the site, on the river terrace, and four closely spaced boreholes (PR1100D, SR1099A, SR1099 B & C), 60m to the northwest, within the area of alluvium associated with the Falconbrook. The boreholes are relatively modern and are detailed, and the ground levels noted at these locations are similar to that of the site, at 104.1–104.4m ATD.

E.2.8 The boreholes near the Falconbrook revealed varying thicknesses of made ground. Two of the boreholes (PR1100D and SA1099A) revealed made ground 3.8–4.7m thick, overlying terrace gravels at 99.8–100.6m ATD. Two boreholes (SR1099B & SR1099C) revealed 2.6m of made ground overlying alluvial clay associated with the Falconbrook Channel at 101.8m ATD, over terrace gravels at 101.0m ATD.

E.2.9 The borehole on the river terrace to the south of the site (TQ27NE1059) revealed 3.2m of made ground lying directly on gravel terrace at 101.2m ATD. This borehole should be indicative of levels of terrace gravels lying beneath the southern half of the site, suggesting a similar depth of made ground may be present (the nature of such made ground is not known: the lower strata may contain remains of archaeological interest).

E.2.10 Although the alluvium and the river terrace represent distinctly different geological areas, they are linked by the changing environmental conditions affecting the Thames and the Falconbrook. The alluvium on which the northern edge of the main site lies extends in a westerly direction and probably accumulated throughout the late prehistoric period onwards.

E.2.11 From the Mesolithic to the Bronze Age, the Falconbrook and its confluence with the Thames would have provided rich natural resources and the closeness of the high ground of the terrace a focus point for settlement/occupation. The Thames would have been fresh water until the late prehistoric, then becoming brackish and tidal due to the effect of rising relative sea level (RSL). This would have had an effect on the site area, as the Falconbrook would have been similarly brackish and tidal and is likely to have flooded the local area.

E.3 Past archaeological investigations

E.3.1 Seven archaeological investigations have been carried out within the 300m radius assessment area around the site, although none are within the site itself. The nearest investigations have been carried out at the Price's Candles Factory (**HEA 2**–**3** and **5**–**7**), 60m to the west and southwest of the main site, between 1991 and 2002. These investigations recorded a Bronze Age ditch and Bronze Age pottery; medieval and post-

medieval remains of a former residence of the Archbishops of York, and later post-medieval industrial development.

E.3.2 An archaeological investigation 175m to the northwest (**HEA 17**), recorded a series of timber revetments from the 16th to the 18th century that would have supported the northern bank of a small tributary known as the Falcon Brook, near the confluence of the main Thames channel. Another archaeological investigation, 215m to the northeast (**HEA 4**), recorded a post-medieval well or cess pit.

E.3.3 The results of these investigations, along with other known sites and finds within the assessment area, are discussed by period, below.

E.4 Archaeological and historical background of the site

E.4.1 The following section provides a detailed archaeological and historical background for the site. It should be read alongside the research framework presented in Appendix C to Vol 2 Appendix E2, which sets the overall Thames Tideway Tunnel project, and the individual site-specific assessments, within a broader historic environment context (i.e. past landscapes and human activity within such landscapes). It identifies the main route-wide heritage themes, of which the built and buried heritage assets identified within this assessment form a part.

Prehistoric period (700,000 BC–AD 43)

E.4.2 Throughout this period, the Falconbrook and its confluence with the Thames would have provided rich natural resources, with the nearby high ground of the terrace providing a focus for settlement or occupation. Over time the area at the confluence of the rivers would have become increasingly marshy and seasonally flooded as the rising relative sea level resulted in higher levels in the Thames and Falconbrook. The nearby wetlands would however have provided valuable and predictable resources of food (ie, game and fish), water and mud and reeds for the production of pottery and for building materials.

E.4.3 In 2002, an archaeological excavation at the Price's Candles Factory, 75m to the west of the main site (**HEA 5**) recorded a Middle Bronze Age ditch in the southwestern part of the factory site, along with sherds of Bronze Age pottery.

E.4.4 Evidence for prehistoric activity within the assessment area is otherwise limited to isolated chance finds, in the form an undated prehistoric flake and lithic implement 230m to the north of the main site (**HEA 10**), a Bronze Age stone axe 200m to the northeast (**HEA 9**), and a Middle Bronze Age sword from the Thames foreshore, 190m to the northwest (**HEA 14**). The finds may be residual (outside of the context that they were originally deposited), but along with the ditch feature, suggests later prehistoric activity in the general area, the nature and extent of which is currently little understood.

Roman period (AD 43–410)

E.4.5 The site lay 7.5km to the southwest of the Roman town of *Londinium*, which grew up in the mid-1st century AD in the area of the City of London. The surrounding hinterland, in which the site is located, would have been a rural landscape of scattered farmstead and small nucleated settlements typically located along the major roads leading to the capital, which acted both as markets and as producers to the capital (Museum of London Archaeology service, 2000)[4]. The closest main road on the south side of the river was Stane Street, which followed the approximate northeast to southwest line of Clapham Road, 2.9km to the southeast of the site (Margary 1967)[5]. A minor road is thought to have extended off westwards, to pass through central Wandsworth, 1km to the south of the site.

E.4.6 Evidence for Roman activity in the assessment area is limited to an isolated chance find of a Roman coin found 180m to the south of the site (**HEA 12**). The northern part of the main site was probably located within or on the bank of the Falcon Brook, whilst the central and southern parts were on the dry land of the higher terrace gravels and suitable for settlement, but probably open fields.

Early medieval (Saxon) period (AD 410–1066)

E.4.7 The site lay on the western edge of the manor (estate of Battersea), within a district of Wassingham. Battersea is first referred to in a 7th century charter, when land at 'Badoricesheah [Battersea] next [near] Hydaburn' (the Falcon Brook) was granted to Barking Abbey by Erkenwald, Bishop of the East Saxons. It is not clear whether Barking Abbey subsequently held any lands in Battersea (Victoria County History, 1912)[6].

E.4.8 Another charter, dated AD 693, mentions a district of Wassingham (or Walsingham). This probably extended along the River Thames between Battersea and Wandsworth, as far as the Wandle, 1.3km to the southwest of the site (Victoria County History, 1912)[7], and is likely to have included the site.

E.4.9 Chance finds of artefacts from the Thames suggest Early Saxon activity at Battersea, and documentary sources indicate a riverside settlement had been established there by the late 7th century. In 1975–8, a small Middle Saxon occupation site was excavated at Althorpe Grove[8], 925m to the north of the site. Activity appears to have been domestic rather than trade or manufacturing, and was mainly dated to around AD 750–800. The settlement is close to the site of the later medieval parish church (Cowie and Blackmore, 2008)[9]. The Greater London Historic Environment Record (GLHER) also records Saxon occupation between Westbridge Road and Battersea Bridge Road, 1.1km to the northeast of the site[10].

E.4.10 No evidence of early medieval activity or occupation has been recorded within the assessment area. In all likelihood the site was located in open land beside the Falcon Brook (originally the Hidaburna).

Later medieval period (AD 1066–1485)

E.4.11 The site lay within the medieval manorial estate of Battersea. At the Norman Conquest (AD 1066), King William I seized the manor (sometimes

known as the manor of Battersea and Wandsworth), and shortly afterwards granted it to the Abbey of Westminster in exchange for land in Windsor. It included meadow and woodland, and seven mills (Williams and Martin, 1912)[11]. During William's reign several parts of land of the manor were sold off. In AD 1225, Battersea was assigned to the monks of Westminster for their maintenance in bread and ale. From an account of the steward of the manor in AD 1303, it appears that the manor's lands were directly farmed by the monks (Victoria County History, 1912)[12].

E.4.12 The parish church of St Mary, on Battersea Church Road, 975m to the north of the site, is documented from AD1157, although the present building dates from AD 1775–6 (Cherry and Peysner, 1983)[13]. The church, and the nearby manor house, which is documented from the 13th century[14] formed the focus of the main settlement in the manor. The GLHER also records a village and manor house[15] close to modern Battersea Bridge Road, 1.1km to the northeast of the site.

E.4.13 The site itself lay within, or immediately outside, the medieval hamlet of Bridges. The settlement probably took its name from a timber bridge on York Road over the Falcon Brook (the name may have derived from the crest of the St John Family, at one time lords of the manor, or possibly from a nearby 18th century tavern (Weinreb and Hibbert, 1995)[16]). The exact extent of the settlement is not known as it is not shown on any historic maps, but is likely to have been situated around the bridge crossing beside the site, and it is possible that there were buildings within the site. Alternatively, the hamlet grew up at a crossroads to the south of the bridge, 75m to the southwest of the site, as suggested by Rocque's map of 1746 (Vol 11 Plate E.1).

E.4.14 Bridge Court was a sub-manor by the 13th century (known as Sylverton, Bridges or, later, York Place). In the 15th century it was held by the Stanley family and by 1474 by the Bishop of Durham, Laurence Booth, later Archbishop of York, who bequeathed the estate to the See of York (Victoria County History, 1912)[17]. The GLHER locates the manor house close to the bank of the Thames on York Place, 160m to the southwest of the site (**HEA 13** and **HEA 11**).

E.4.15 Booth's manor house of Bridges Court (later known as York Place) may have been the first on the site (Hawkins et al, 2000)[18]. It was used by successive Archbishops of York throughout the later medieval and post-medieval periods. In 1996 and 1998, archaeological investigations at the Price's Candle Factory (**HEA 2** and **7**), 65m to the west of the main site, and on the other side of York Road, recorded a remains of the southern side of the manor house, along with a fishpond.

E.4.16 Throughout this period the site was located beside the medieval bridge over the Falcon Brook, and may have been in the area of the Bridges settlement, although little is known about it.

Post-medieval period (AD 1485–present)

E.4.17 Historic maps indicate that the site remained within open fields until the mid/late 19th century. Rocque's map of 1746 (Vol 11 Plate E.1), shows the northern part of the main site crossed by the Falcon Brook whilst the

southern part lies in an open pasture at the side of the main road. There is no indication of a nucleated settlement around the bridge (ie, of medieval origin), although there is a small settlement at the junction of York Place and York Road, 75m to the southwest of the site. The map shows York Place as an extensive walled property on the opposite side of the main road. In AD 1554, when Queen Mary had deprived Archbishop of York of his See, the mansion at York Place was broken into and plundered. The property was returned to the Archbishop of York in 1660. By 1753, the pioneering Battersea enamel works had been established on the site of the former manor house, and towards the end of the 18th century the property passed out of the ownership of the Archbishops and had a number of owners[19]. In 1856, Price's Patent Candle Company Limited purchased the estate for the Price's Candle Factory (**HEA 2−3** and **5−7**).

E.4.18 The Battersea Tithe map of 1838 (not reproduced) shows no change within the site. The map shows the post-medieval development of York Place gardens and buildings to the west, on the opposite side of the main road.

E.4.19 By 1874, the riverfront 200m to the west of the site had become a thriving industrial area filled with warehouses, docks, several mills and large factories for silk, starch, candles and other materials. Between the river and Clapham Junction grew streets of terraced houses for the local workers and their families. As a response to the growing population a temporary church building and school house were erected on a small plot of land on Plough Road, and in 1876 St Peter's Church was founded, 150m to the south of the site (**HEA 8**).

E.4.20 The Ordnance Survey 1st edition 25":mile map of 1862–95 (Vol 11 Plate E.2) shows the extensive suburban development, part of the massive expansion of London largely brought about by the coming of the railways. The central and southern parts of the site are built up with rows of terraced houses along a new east-west aligned 'Creek Road', whilst the northern third of the main site and the highway works site lie in an open field. The houses have small back yards. The Falcon Brook is not shown and has been culverted and covered over: it is open on the north side of York Place to the west of the site. The map shows the extensive industrial complex of Price's Candle Factory on the former site of York Place estate, to the west.

E.4.21 The Ordnance Survey 2nd edition 25":mile map of 1896–98 (Vol 11 Plate E.3) shows no change in the central and southern parts of the site, whilst the formerly open northern part of the site is occupied by a newly built row of terraced houses. Much of the former open land to the north and east of the site became a network of streets lined with terraced houses. Tramlines are shown along the centre of York Road to the west of the site.

E.4.22 The Ordnance Survey 3rd edition 25":mile map of 1909–20 (Vol 11 Plate E.4) shows the new building as a single large rectangular structure, on the site of former terraced houses in the centre of the western part of the main site. The map shows no other change within the site. The new structure is the original Falconbrook Pumping Station, which was constructed in 1905

(**HEA 1b**) (London County Council, 1913)[20]. Original London County Council volumes (Thames Water; 'Abbey Mills Books' Book 0A Falconbrook Pumping Station Works Below Ground Contract No. 1 1905; Additional Pumping Power 1913) contain detailed historic plans and sections of the building, including below ground works (see Vol 11 Plate E.5 and Vol 11 Plate E.6). These indicate that there was a deep basement 7.5m deep, with three large, deep culverts beneath the pumping station building connecting it to the main Victorian Bazalgette sewer along the line of York Road, immediately to the west of the main site (**HEA 20**). Additional machinery was added to increase pumping power in 1913.

E.4.23 The site remained untouched during enemy bombing in the Second World War, although residential properties to the north of the main site, on the opposite side of Ingrave Street, were damaged beyond repair (London Topographical society, 2005)[21].

E.4.24 The Ordnance Survey 1:2500 scale map of 1951 (Vol 11 Plate E.7) labels the 'Pumping Station' in the centre of the western part of the main site. The map shows no other changes within the site or the immediate vicinity.

E.4.25 During the 1960s, the former terraced housing on the site was cleared and left vacant, other than the pumping station on its western part, as shown in the Ordnance Survey 1:1250 scale map of 1964 (Vol 11 Plate E.8).

E.4.26 The Ordnance Survey 1:10,000 scale map of 1976 (not reproduced) shows the current buildings on the site surrounded by York Gardens (as shown in the photograph in Vol 11 Plate E.9). The existing pumping station buildings were built in the early 1970s of concrete with brick cladding. The main pumping station building has a three level basement. The new building lies to the immediately northeast of the earlier pumping station, which was located beneath the disused toilet building currently on the main site.

The current site

E.4.27 The main site includes a 1970s reinforced concrete framed building with brown brick infill and steel sheeting roof to the north; a smaller two–storey structure with an unusual roof shape to the south of this and a single storey concrete framed building along the eastern boundary of the main site (Vol 11 Plate E.10). Collectively they form the current pumping station. The main building is of two storeys above ground and contains a deep basement of three levels with steel-framed walkways running against the structural walls. The bottom floor and walls, to various heights, are clad in brown and terracotta tiles. Machinery and pipes related to the current function fill the basement (Vol 11 Plate E.11). Natural light is provided by a series of lights running the full length and width of the second floor of the main building.

E.4.28 The smaller central building is formed in the same manner but has a triangular-shaped roof with a vent facing south. There is a single-storey concrete-framed structure running north to south along the eastern boundary, formed in the same way as the first two structures. The pumping station is surrounded by a boundary wall of brown brick in English bond with a metal vehicular gateway and separate pedestrian

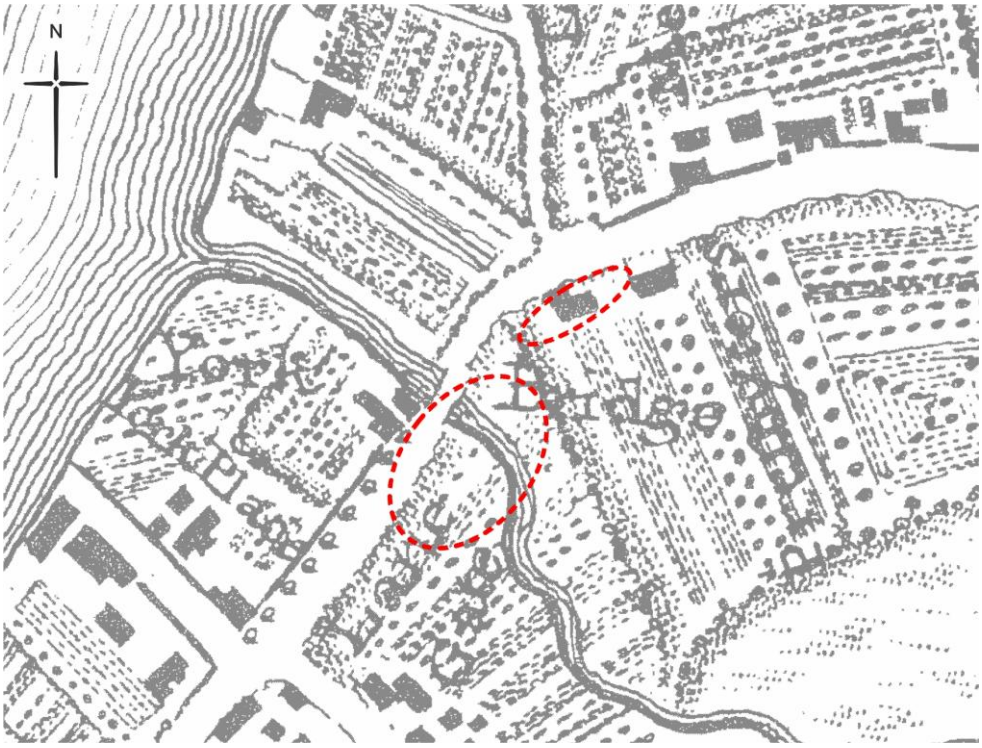
access to the south creating a compound surrounding the station (Vol 11 Plate E.12).

E.4.29 A cobbled surface of granite sets (**HEA 1a**; Vol 11 Plate E.13) is located immediately to the west of the pumping station, leading towards York Road, and appears to be aligned to a street layout that existed in the mid/late 19th century, and is probably an original street surface.

E.4.30 Located in the southwestern corner of the main site is a small rectangular building with chamfered corners and an overhang rectangular roof (Vol 11 Plate E.14). It is constructed of a reinforced concrete frame with red brick infill. There is a concrete string course running around the building and providing a lintel for the doorway and sills for the upper windows, grilled. The underside of the overhang is formed of shuttered concrete and roof is flat and coated with tar paper. This building dates to the late 20th century as public conveniences and is now disused. At the time of the site visit, all windows and doors were blocked. A large, modern billboard slotted into cement block supports is located west of the pumping station.

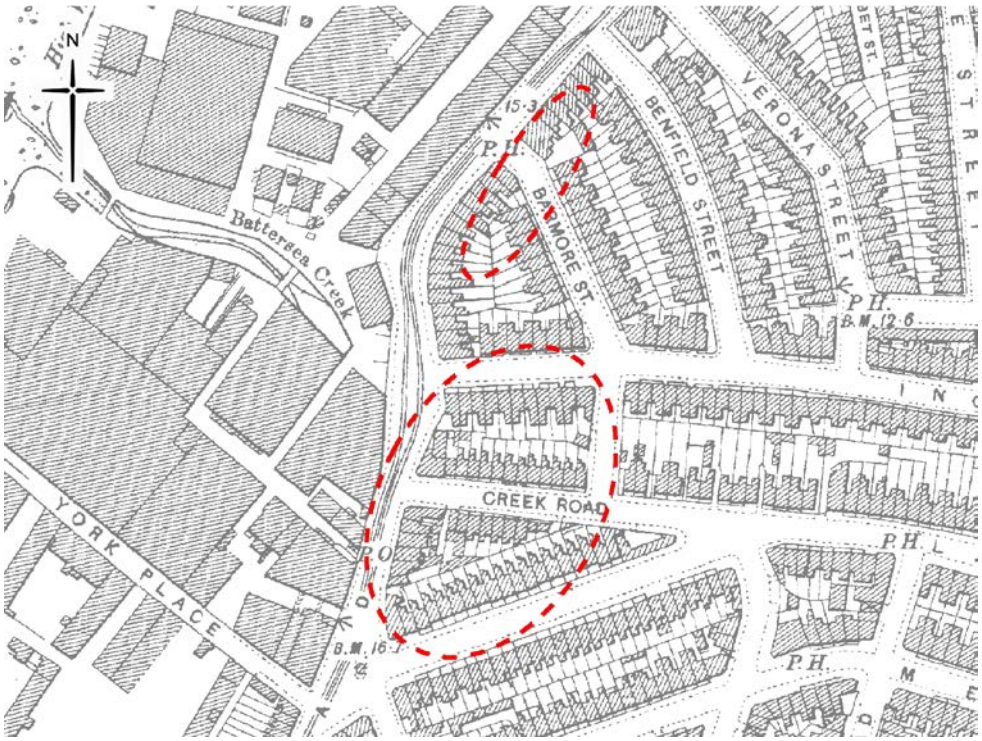
E.5 Plates

Vol 11 Plate E.1 Historic environment – Rocque's map of 1746



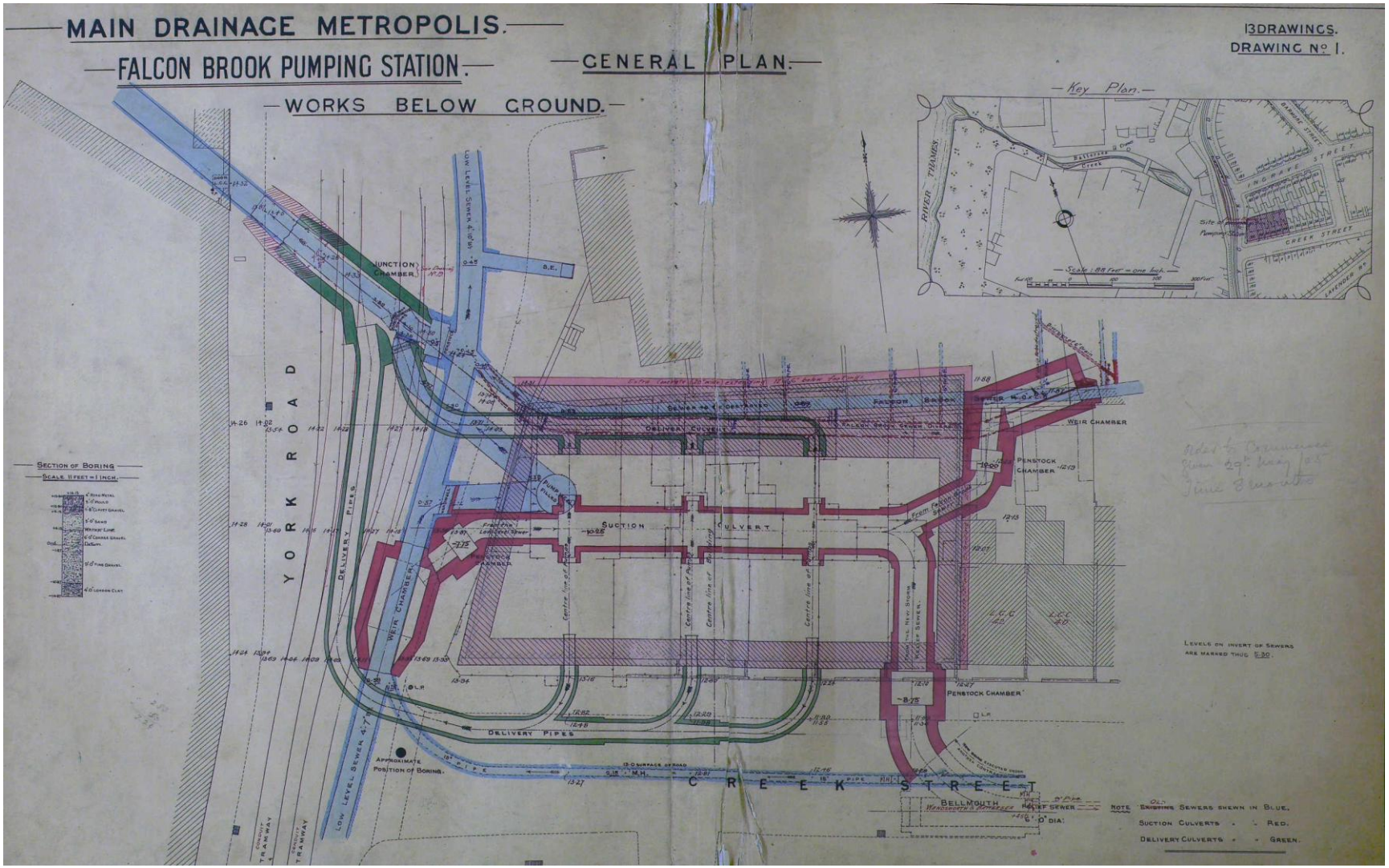
Vol 11 Plate E.2 Historic environment – Ordnance Survey 1st edition 25":mile map of 1862–95

Vol 11 Plate E.3 Historic environment – Ordnance Survey 2nd edition 25”:mile map of 1896–98

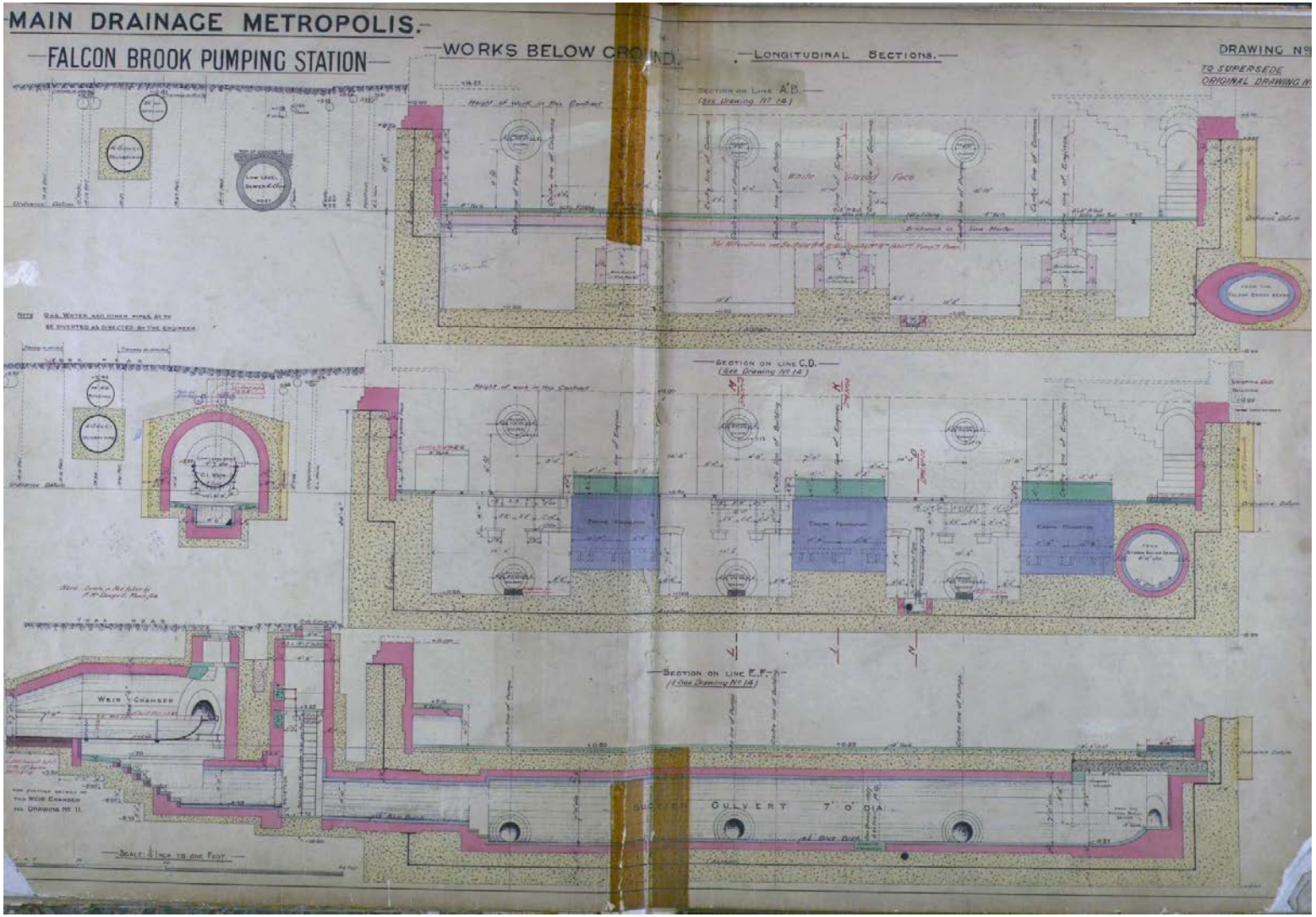


Vol 11 Plate E.4 Historic environment – Ordnance Survey 3rd edition 25”:mile map of 1909–20

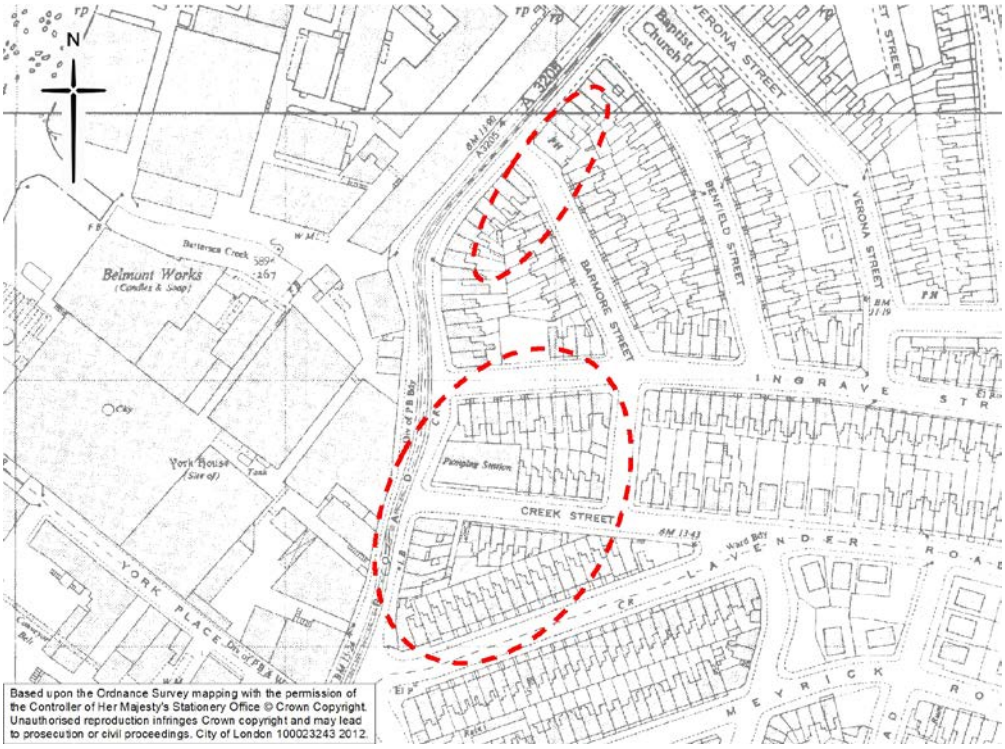
Vol 11 Plate E.5 Historic environment – Plan of the original (1905) pumping station (Thames Water; 'Abbey Mills Books' Book 0A Falconbrook Pumping Station Works Below Ground Contract No. 1 1905; Additional Pumping Power 1913)



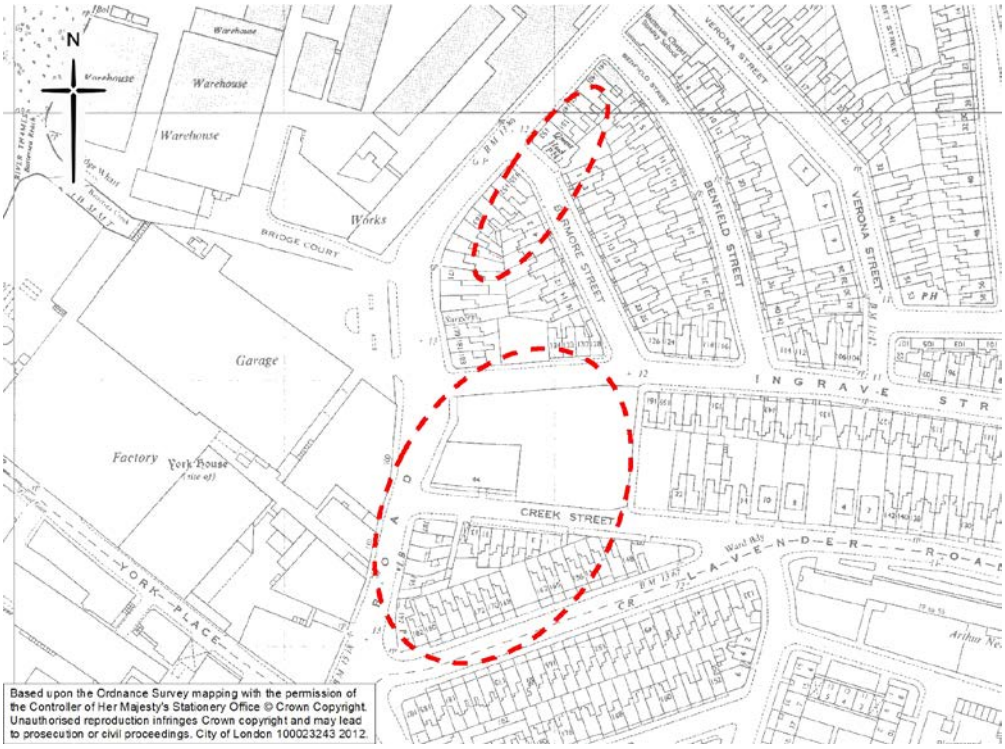
Vol 11 Plate E.6 Historic environment – Section through the original (1905) pumping station (Thames Water; 'Abbey Mills Books' Book 0A Falconbrook Pumping Station Works Below Ground Contract No. 1 1905; Additional Pumping Power 1913)



Vol 11 Plate E.7 Historic environment – Ordnance Survey 1:2500 scale map of 1951



Vol 11 Plate E.8 Historic environment – Ordnance Survey 1:1250 scale map of 1964



Vol 11 Plate E.9 Historic environment – General view across York Gardens towards the site

April 2011; standard lens; looking west (MOLA 2011)

Vol 11 Plate E.10 Historic environment – Falconbrook Pumping Station

April 2011; standard lens; looking north (MOLA 2011)

Vol 11 Plate E.11 Historic environment – Interior of the main pumping station building

May 2011; standard lens; looking east (MOLA 2011)

Vol 11 Plate E.12 Historic environment – Falconbrook Pumping Station compound

April 2011; standard lens; looking northwest (MOLA 2011)

Vol 11 Plate E.13 Historic environment – View of 19th century cobbled surface within the site (HEA 1a)

April 2011; standard lens; looking southwest (MOLA 2011)

Vol 11 Plate E.14 Historic environment – View looking west of the late 20th century rectangular structure within the site

April 2011; standard lens; looking west (MOLA 2011)

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[20] London County Council 'Abbey Mills Books'. *Falconbrook Pumping Station. Works Below Ground. Contract No. 1 1905, Additional pumping power (*1913).

[21] London Topographical Society, *The London County Council Bomb Damage Maps 1939–1945* (2005).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix F: Land quality

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix F: Land quality

List of contents

Page number

List of tables

Page number

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Appendix F: Land quality

F.1 Baseline Report

F.1.1 Baseline data is sourced from:

a. a walkover survey

b. the Landmark Information Group database, which includes historic maps and environmental records

c. stakeholder consultation.

F.1.2 The baseline report relates only to the main Falconbrook Pumping Station site. The Highway site is referred to explicitly where relevant.

Site walkover

F.1.3 A site walkover survey of Falconbrook Pumping Station was undertaken on 25th May 2011.

F.1.4 The aim of the walkover survey is to inspect the condition of the site and surrounding areas in order to identify evidence of historic or ongoing contamination sources, as well as any nearby sensitive receptors.

F.1.5 The site comprises a sewage pumping station and electrical substation. No further potential contamination sources were noted on or adjacent to the site.

F.1.6 No access to the pumping station was available during the walkover survey. The entire site could be viewed from the publicly accessible areas.

F.1.7 Detailed site walkover notes are provided in Vol 11 Table F.1 below.

Vol 11 Table F.1 Land quality – site walkover report

Item (Site ref: PW8HX, Falconbrook Pumping Station)		Details
Date of walkover	25th May 2011	
Site location and access	Thames Water operated Falconbrook Pumping Station, located within York Gardens and accessed via York Road, Wandsworth. The site comprises the main construction site and the Falconbrook Pumping Station highway works site, located on York Road.	
Size and topography of site and surroundings	Record elevation in relation to surroundings, any hummocks, breaks of slope etc	The Falconbrook Pumping Station site is flat and level with surrounding land (public open space). The Falconbrook Pumping Station highway works site is located along York Road.

Item (Site ref: PW8HX, Falconbrook Pumping Station)		Details
Neighbouring site use (in particular note any potentially contaminative activities or sensitive receptors)	North	Adventure playground situated within the wider York Gardens and York Gardens Children's Centre.
	South	York Gardens and a community centre.
	East	York Gardens and electrical substation building. Residential properties located on Newcomen and Lavender Road.
	West	The site is bounded by York Road. Beyond York Road are a number of former factory buildings, new build apartments and car dealers.
Site buildings	Record extent, size, type and usage. Any boiler rooms / electrical switchgear	Falconbrook Sewage Pumping Station, a three storey brick and concrete building.
Surfacing	Record type and condition	Hard surfacing
Vegetation	Any evidence of distress, unusual growth or invasive species such as Japanese Knotweed	None
Services	Evidence of buried services	No
Fuels or chemicals on- site	Types/ quantities	None observed
	Tanks (above ground or below ground)	None observed
	Containment systems (eg, bund, drainage interceptors). Record condition and standing liquids	None observed
	Refill points located inside bunds or on impermeable surfaces etc	None observed
Vehicle servicing or refuelling on-site	Record locations, tanks and inspection pits etc	None observed
Waste generated/stored on-site	Adequate storage and security. Evidence of fly tipping	None observed

Item (Site ref: PW8HX, Falconbrook Pumping Station)		Details
Surface water	Record on-site or nearby standing water	None
Site drainage	Is the site drained, if so to where? Evidence of flooding?	None observed
Evidence of previous site investigations	eg trial pits, borehole covers	None observed
Evidence of land contamination	Evidence of discoloured ground, seepage of liquids, strong odours?	None observed
Summary of potential contamination sources		Adjacent electrical substation.
Any other comments	Eg, access restrictions/ limitations	No

Review of historical contamination sources

F.1.8 Historical mapping (dating between 1869 and 1989) has been reviewed in order to identify potentially contaminating land-uses at the site and within the 250m assessment area.

F.1.9 Vol 11 Table F.2 tabulates the potentially contaminating land-uses, inferred dates of operation and typical contaminants associated with the land-uses in question. Potential contaminants are sourced from CLR8: *Potential contaminants for the assessment of land* (Defra and EA, 2002)[1] and former Department of the Environment industry profiles (Department of the environment, 2011)[2].

F.1.10 All dates are approximate, where no other information is available the dates relate to when the items first appeared and disappeared from the mapping rather than actual dates of construction, operation or demolition.

F.1.11 Items listed in the table below are also shown on Vol 11 Figure F.1.1 (see separate volume of figures). In addition, figures illustrating the historical environment of the site and the surrounding area are provided in Vol 11 Appendix E.

Vol 11 Table F.2 Land quality – potentially contaminating land-uses

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item1,2
On-site			
1	(a) Pumping station	c1905-c1970	Heavy metals, arsenic, free cyanide, nitrates, sulphates, sulphides, asbestos, oil/fuel hydrocarbons, chlorinated aliphatic hydrocarbons, chlorinated aromatic hydrocarbons, polychlorinated biphenyls (PCBs), pathogens (eg, faecal coliforms)
	(b) Falconbrook Pumping Station	c1970-present	
2	Electrical substation	c1973-present	Oils, PCBs
Off-site*			
3	(a) Belmont Works (candle and soap) (15m west)	c1869-c1955	Hydrocarbons (including tars, paraffin, waxes), fats, salts, acids. Mineral oils, metal ions including sodium, ammonium, calcium, glycerol
	(b) Grove Works (15m west)	c1896	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, poly aromatic hydrocarbons (PAHs), PCBs, chlorinated aliphatic hydrocarbons
	(c) Saw mill (15m west)	c1896	Heavy metals, arsenic, boron, sulphates, phenol, acetone, aromatic hydrocarbons, PAHs and cresols
	(d) Tanks (15m west)	c1916-c1973	Content unknown
4	(a) Silk manufactory (125m southwest)	c1869-c1874	Heavy metals, boron, nitrates, sulphates, asbestos, phenol, acetone, oil/fuel hydrocarbons, aromatic hydrocarbons, chlorinated aliphatic hydrocarbons, dieldrin, PCBs
	(b) Starch and glucose factory (125m southwest)	c1973	Oils, fuels, greases, diesel associated with machinery and back-up power, toluene,

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item1,2
			sulphides, acids, chlorine, ammonia
5	Engineering works (140m west)	c1896	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons
6	Saccharin works (45m southwest)	c1896	Oils, fuels, greases, diesel associated with machinery and back-up power, toluene, sulphides, acids, chlorine, ammonia
7	Southampton Wharf (180m west)	c1896-c1984	Hydrocarbons, PAHs, PCBs, sulphates, sulphides, chlorinated aromatic hydrocarbons, chlorinated aliphatic hydrocarbons
8	(a) Sugar works (125m southwest)	c1916-c1949	Oils, fuels, greases, diesel associated with machinery and back-up power, toluene, sulphides, acids, chlorine, ammonia, heavy metals, content of tanks unknown
	(b) Glucose works and associated tanks (125m southwest)	c1950-c1963	
	(c) Works (125m southwest)	c1967-c1975	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons
9	Electrical substation (130m southwest)	c1950-c1973	Oils, PCBs
10	Tank (165m west)	c1950-c1963	Contents unknown
11	Tank (155m west)	c1950-c1989	
12	Heliport (140m northwest)	c1963-present	Metals, hydrocarbons, volatile organic compounds (VOCs), semi VOCs, particulate matter, oil/fuel hydrocarbons
13	Garage (30m west)	c1963-c1989	Heavy metals, asbestos, oil/fuel hydrocarbons, aromatic hydrocarbons, PAHs, chlorinated aliphatic hydrocarbons,

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item1,2
			organolead compounds
14	Group of warehouses (105m west and (150m west)	c1963-c1989	Use of warehousing unknown
15	Works (15m west)	c1963-c1975	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons
16	Works (55m southwest)	c1963	
17	(a) Paint works (85m northwest)	c1916-c1955	Solvents, chlorinated hydrocarbons, acetone, heavy metals, paints, dyes
	(b) Works (85m northwest)	c1963-c1978	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons
	(c) Warehouse (85m northwest)	c1986-c1989	Contents unknown
18	Electrical substation (50m northeast)	c1973-c1989	Oils, PCBs
19	Candle factory (165m west)	c1973-c1989	Hydrocarbons (including tars, paraffin, waxes), fats, salts, acids
20	Electrical substation (110m northeast)	c1973-c1989	Oils, PCBs
21	Electrical substation (110m south)	c1973-present	
22	Electrical substation (119m east)	c1989-present	
23	Electrical substation (102m southeast	c1989-present	
24	(a) Works (200m southwest)	c1949-c1967	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item1,2
	(b) Steel construction works (200m southwest)	c1950-c1951	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons
25	Tin box factory (225m southwest)	c1951	Heavy metals, arsenic, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, chlorinated aliphatic hydrocarbons
26	Electrical substation (230m southwest)	c1972-c1989	Oils, PCBs
27	Works (130m northeast)	c1986-c1989	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons
28	(a) Falcon Wharf (120m northwest)	c1898	Heavy metals, arsenic, asbestos, phenols, oil/fuels, hydrocarbons, PAHs, PCBs, sulphide, sulphate, chlorinated aromatic hydrocarbons, chlorinated aliphatic hydrocarbons
	(b) Council yard depot (120m northwest)	c1965-c1986	Oil/fuel hydrocarbons, VOCs, benzene, toluene, ethylbenzene and xylene , (BTEX) solvents, oil and greases, heavy metals, particulates
29	Dock (200m northwest)	c1896	Heavy metals, arsenic, asbestos, phenols, oil/fuels, hydrocarbons, PAHs, PCBs, sulphides, sulphates, chlorinated aromatic hydrocarbons, chlorinated aliphatic hydrocarbons
30	(a) Chemical works (205m northwest)	c1896-c1920	Heavy metals, arsenic, boron, selenium, nitrates, sulphates, sulphides, asbestos, PAHs, phenols, acetones, aromatic hydrocarbons, PCBs, dioxins, furans

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item1,2
	(b) Builders Yard (205m northwest)	c1978	Oil/fuel hydrocarbons, VOCs, BTEX, solvents, oil and greases, heavy metals, particulates
31	(a) Chemical works (180m north)	c1896	Heavy metals, arsenic, boron, selenium, nitrates, sulphates, sulphides, asbestos, PAHs, phenols, acetones, aromatic hydrocarbons, PCBs, dioxins, furans
	(b) Electricity works (180m north)	c1950-c1965	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons
	(c) Works (180m north)	c1965-c1986	Heavy metals, arsenic, boron, free cyanide, nitrates, sulphates, sulphides, asbestos, aromatic hydrocarbons, PAHs, PCBs, chlorinated aliphatic hydrocarbons

** refers to the main site.*

On-site

F.1.12 The historical mapping has identified on-site contaminative uses to comprise the sewage pumping station and electrical substation.

F.1.13 Mapping from 1869 shows the southern section of the site was occupied by individual residential properties, and the northern section comprised undeveloped land.

F.1.14 Between c1896 and c1916 a small area of residential properties was demolished at the southwest corner of the site, this area had been redeveloped by c1920 and was identified as a pumping station on mapping from c1950. The rest of the site remained occupied with residential properties.

F.1.15 Between c1950 and c1963, all property on the site was demolished and between c1963 and c1973 the current Falconbrook Pumping Station and electrical substation were developed.

F.1.16 It is understood that the basement of the original pumping station was infilled when the site was redeveloped. The composition/quality of the fill materials is unknown.

Off-site

F.1.17 Within the 250m assessment area, the historic mapping shows that the area surrounding Falconbrook Pumping Station has also been subject to a

number of commercial and light industrial land-uses through the twentieth century. This has included a number of unspecified works, a candle works, sugar/saccharine works and a garage.

Geology

F.1.18 Data from the Thames Tideway Tunnel project ground investigation indicates the anticipated geological succession, as summarised in Vol 11 Table F.3 below.

Vol 11 Table F.3 Land quality – anticipated site geology

Geological unit/ strata	Description	Approximate depth below ground level (m)
Made Ground	Granular fill comprising sand and gravel or brick with some fragments of timber. Locally clay soils predominate.	0.0-2.6
Alluvium	Medium dense to dense sand and gravel (predominantly quartz sand and flint gravel).	2.6-3.4
River Terrace Deposits	Medium dense to dense sand and gravel (predominantly quartz sand and flint gravel).	3.4-8.9
London Clay Formation	Expected to be slightly sandy clay	8.9-45.90
Harwich Formation	Multi-coloured slightly calcareous clast supported conglomerate.	45.90-45.95
Lambeth Group (Upper Shelly Beds)	The Upper Shelly Beds is mainly a grey shelly clay, and occasionally sand dominated unit and shelly limestone.	45.95-48.50
Lambeth Group (Upper Mottled Beds)	The Upper Mottled Beds comprise mottled or multicoloured, stiff or very stiff fissured clay, compact silt, and dense or very dense sand	48.50-52.60

Unexploded ordnance

F.1.19 During both World War I and II, the London area was subject to bombing. In some cases bombs failed to detonate on impact. During construction works Unexploded Ordnance (UXO) are sometimes encountered and require safe disposal.

F.1.20 A desk based assessment for UXO threat was undertaken by 6 Alpha Associates Limited at the Falconbrook Pumping Station site (see Vol 11 Appendix F.3).

F.1.21 The assessment covered two areas within the Falconbrook Pumping Station site: Area A (main site) and Area B (highway works site, identified in the report as the secondary work area). The report reviews information

sources such as the Ministry of Defence (MoD), Public Records Office and the Port of London Authority (PLA).

F.1.22 The report identifies that no high explosive bomb strikes were recorded within Area A or B or their buffered site boundary. Bomb damage was not recorded within the areas themselves but was recorded within the buffered site boundary. The report further states that both areas have had significant redevelopment work and as a result it is possible that UXO items would have been removed during this work.

F.1.23 Taking into account the findings of this study and the known extent of the proposed works, it was considered that there is an overall low/medium threat from UXO within both the main site and the highway works site.

Thames Tideway Tunnel ground investigation data

F.1.24 There is currently no site-specific intrusive ground investigation data available for review.

F.1.25 Borehole locations for planned preliminary intrusive investigation are shown on Vol 11 Figure F.1.2 (see separate volume of figures).

Third party ground investigation data

F.1.26 No third party ground investigation was available for review for the Falconbrook Pumping Station site.

Other environmental records

F.1.27 Details of environmental records (hazard and waste sites) in the vicinity of the site held by the Environment Agency (EA) and other bodies have been obtained from the Landmark Information Group and are presented in Vol 11 Table F.4. Pertinent records are discussed in further detail below.

F.1.28 The location of these records is shown on Vol 11 Figure F.1.3 (see separate volume of figures).

Vol 11 Table F.4 Land quality – hazard and waste sites

Item	On site	Within 250m of site boundary
Active integrated pollution prevention and control	0	0
Control of major accident hazard sites	0	0
Historical landfill site	0	0
LA pollution prevention and control	0	2
Licensed waste management facility	0	1
Notification of installations handling hazardous substances	0	0
Past potential contaminated	0	There are a number of areas

Item	On site	Within 250m of site boundary
industrial uses		classified as past potential contaminated industrial uses 250m of the site.
Pollution incident to controlled water*	0	3
Registered waste transfer site	0	0
Registered waste treatment or disposal site	0	0

**Does not include regular combined sewer overflow (CSO) discharges*

F.1.29 Inspection of the data has identified that there are no records of hazards and waste sites present at the Falconbrook Pumping Station site.

F.1.30 Within 250m of the Falconbrook Pumping Stations site two local authority pollution prevention and control registers have been identified. One of the entries is located 20m to the west of the site on York Road and relates to the re-spraying of road vehicles. The other is located approximately 200m to the north and also to the re-spraying of vehicles.

F.1.31 A number of past potential contaminated industrial uses have been identified within 250m of the site. From an analysis of historical mapping data, the past industrial uses can be attributed to the various industries as shown on Vol 11 Figure F.1.1 (see separate volume of figures). Common contaminants associated with these land-uses are identified in Vol 11 Table F.2.

F.1.32 Three pollution incidents to controlled waters have been recorded to the west of the site, in the River Thames. Owing to their distance, these are not considered relevant to soil or groundwater quality at the Falconbrook Pumping Station site.

Thames Water operational records

F.1.33 Thames Water records of contaminating substance storage at the Falconbrook Pumping Station site within the last five years were reviewed.

F.1.34 No bulk storage of hydrocarbons or other potentially contaminating liquids are currently taking place at the site.

F.1.35 No spillages of any potentially contaminating substances to ground were recorded.

Land quality data from local authority

F.1.36 The London Borough (LB) of Wandsworth has been consulted with respect to land quality information held in relation to Falconbrook Pumping Station area (although the consultation was initially referenced as Bridges Court car park, the former preferred site to the west of Falconbrook Pumping Station). The information summarised below has been sourced from the Council's contaminated land database. Their response is given in full in Section F2.

F.1.37 Correspondence received from the council's Environmental Health Officer (EHO) concluded that it is unlikely that there is any substantial land contamination within the area of the proposed site, although there may be localised areas impacted by contaminants such as hydrocarbons or metals, at the site of the former petrol servicing/garage area located to the northwest.

Summary of contamination sources

F.1.38 Following the review of the baseline data, the following sources of on-site contamination which may impact on the construction of the proposed development have been identified:

a. current potentially contaminative activities associated with the site use as a sewage pumping station and electrical substation. The main potential contaminants of concern are likely to be, but not limited, elevated levels of metals, PAH, fuel and oil hydrocarbons, cyanide, sulphates, asbestos, VOCs, PCBs and pathogens

b. historic contamination of underlying soils and groundwater as a result of historic site use as a pumping station, and fill material used to backfill the former pumping station basement.

c. potential for UXO.

F.1.39 Off-site sources of contamination which may impact on the construction of the proposed development could arise from shallow groundwater contamination from historic industrial activities around the site, most notably: works, garages and factories.

F.2 Local authority consultation

WANDSWORTH COUNCIL
Technical Services Department
Environmental Services & Community Safety Division
PO Box 47095
London SW18 9AQ

Please ask for/reply to: Roy Fox
Telephone: 020 8871 7874
Fax: 020 8871 7661
Email:rfox@wandsworth.gov.uk
Minicom: 020 8871 8403

Our Ref: SR155942
Your ref:
Date: 09 May 2011

Lorna Brooks
Mott MacDonald Ltd
8-10 Sydenham Road
Croydon, CR0 2EE

Dear Ms Brooks

Re: Bridges Court Car Park site, London, SW15

I refer to your e-mail enquiry regarding the potential for land contamination at the above site. In order to respond to you I have examined our environmental data for the area, including historical mapping, aerial photographs, geological, hydrogeological and other environmental data, our premises database, the London Fire Brigade petroleum records and the Planning Register. The following points summarise our information relating to the site.

- The 1869 OS mapping shows that Battersea Creek runs east/west into the River Thames along the northern part of the area of concern. A corn mill is sited on the creek; a candle factory on the northside of the creek and a silk factory on the southern side. To the east is a mixture of housing and open land.
- The 1896 OS mapping shows the silk factory to have been replaced by a starch factory and small engineering works, while the candle works includes soap manufacture and has expanded across the line of the creek into the site area.
- The 1916 mapping shows a continuation of the uses of the earlier epoch. The area comprising the current car park is covered in building structures.
- Changes from the previous map epoch that are shown on the 1930s mapping is a pumping station to the east of York Road (NGR 526671, 175866), presumably Falconbrook. Also, there are large storage tanks and silos in place along the River Thames and Battersea Creek, serving the candle factory. This situation continues unchanged in the 1947 mapping.
- In the 1950s part of the creek was infilled such that it terminated less than 50m from the Thames. The area to the north of the creek had become warehousing and the eastern part of the candle factory became a garage. This was used for petrol sales between 1959 to 1968, then becoming used for car sales & servicing. The glucose works to the south was still operating, becoming redeveloped in the early 1990s. Terraced housing that had been located around the pumping station was demolished in the 1960s, replaced by parkland and council flats further east.

The factory area to the east of the current car park obtained planning permission for redevelopment to the current mixed business/residential flats in 1997. Relatively minor localized contamination with metals and hydrocarbons was remediated by excavation and off-site disposal. The storage tanks held waxes, which had low mobility within soil, and did not lead to significant contamination in their vicinity.

- The land in the area has Langley Silts interspersed with gravels as superficial deposits overlying a London Clay solid geology. The gravels are classified as a minor aquifer, but with no abstractions, and the silts as non-aquifer.
- Our premises database does not contain any events that may indicate that there is polluted land at the site, such as discoloration of soils or malodours.

Based on the information within our possession we conclude that it is unlikely that there is an issue of any significant land contamination within the area of concern although there may be localized areas impacted by contaminants such as hydrocarbons or metallic species in the site of the ex-petrol servicing/garage area.

I trust that this information is useful to you. If you would like to discuss any matter raised in this letter, please do not hesitate to contact me. I acknowledge the payment of the fee payable for carrying out this search. A receipt for the payment is being sent to you by our administration team (including five other search areas).

Yours sincerely,

R G Fox
Area Environmental Health Officer
Environmental Services and Community Safety Division

F.3 Detailed Unexploded Ordnance (UXO) risk assessment

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Detailed Unexploded Ordnance (UXO) Risk Assessment

Study Site: Work Area PWH8X – Falconbrook Pumping Station
Document Number: 336-RG-TPI-PWH8X-000001
Client Name: Thames Water
6 Alpha Project Number: P2853_R12_V1.0
Date: 12th June 2012

Originator: Max Chainey (31st May 2012)
Quality Review: Lisa Askham (8th May 2012)
Released by: Lee Gooderham (12th June 2012)

Contents

Figures

EXECUTIVE SUMMARY

Study Site	The Client has specified the Study Site as Work Area PWH8X, located at National Grid Reference "526625, 175825". For the purposes of this report, the Site has been divided into **AREA A** (Main Work Area) and **AREA B** (Secondary Work Area).
Key Findings	In light of the research for this report, 6 Alpha has assessed the threat on this Site based on these pertinent facts: • **AREA A and AREA B** are situated on what was predominantly developed residential land, and thus would have had a high footfall given that they were regularly in use during World War Two (WWII). • Numerous WWII bombing targets have been identified on and around **AREA A and B**, including several primary targets. • **BOTH AREAS** are located in the *Battersea Metropolitan Borough*, which experienced a bombing density of 214 High Explosive (HE) bombs per 1,000 acres. • No HE bomb strikes were recorded within the boundary or buffered Site boundary of **AREA A or B**. • Bomb damage was not recorded within **AREA A or B**, however a small but significant amount of bomb damage did occur in the buffered Site boundary. • Given the significant scale of redevelopment that has occurred within **AREA A and B**, it is possible that previous works would have removed Unexploded Ordnance (UXO) items, however this is largely dependent on the depth and extent of previous works. The risk assessment and risk mitigation outlined below are based on the indicative engineering drawings and proposed works provided by *Thames Water*, and therefore it should be noted that any changes to the engineering drawings or proposed works may affect the risk assessment.
Potential Threat Source	The threat is predominately posed primarily by WWII *German* HE bombs, with a secondary threat from Incendiary Bombs (IBs) and *British* Anti-Aircraft Artillery (AAA) projectiles.
Risk Pathway	Given the type of munitions that might be present on Site, all types of aggressive intrusive engineering activities may generate a significant risk pathway. Scale
Risk Level	**AREA A** **LOW/MEDIUM** | **AREA B** **LOW/MEDIUM**
Recommended Risk Mitigation	**The following actions are recommended before undertaking any activity on the Study Site:** **ALL AREAS** 1. **Operational UXO Risk Management Plan;** appropriate site management documentation should be held on site to plan for and guide upon the actions to be carried out in the event of a suspected or real UXO discovery. 2. **UXO Safety & Awareness Briefings;** the briefings are essential when there is a possibility of explosive ordnance encounter and are a vital part of the general safety requirement.

ASSESSMENT METHODOLOGY

Approach	6 Alpha Associates are independent, specialist risk management consultants and the UXO related risk on the Site has been assessed using the process advocated by both the *Construction Industry Research & Information Association* (CIRIA) best practice guide (C681) and by the *Health & Safety Executive* (HSE). Therefore, any risk levels identified in the assessments are objective, quantifiable and not simply designed to generate "follow on survey or contracting work"; any mitigation solution is recommended *only* because it delivers the Client a risk reduced to As Low As Reasonably Practicable (ALARP) at best value. Potential UXO hazards have been identified through investigation of Local and National archives covering the Site, *Ministry of Defence* (MoD) archives, local historical sources, historical mapping as well as contemporaneous aerial photography (as and if, it is available). Potential hazards have only been recorded if there is specific information that could reasonably place them within the boundaries of the Site. Key source material is referenced within this document, whilst data of lesser relevance (which may have been properly considered and discounted by 6 Alpha), is available upon request. The assessment of UXO risk is a measure of ***probability*** *of encounter* and ***consequence*** *of encounter*; the former being a function of the identified hazard and proposed development methodology; the latter being a function of the type of hazard and the proximity of personnel (and/or other "sensitive receptors"), to the hazard at the moment of encounter. Should a measurable UXO risk be identified, the methods of mitigation recommended are reasonably and sufficiently robust to reduce these to As Low As Reasonably Practicable (ALARP). We believe that the adoption of the legal ALARP principle is a key factor in efficiently and effectively ameliorating UXO risks. It also provides a ready means for assessing the Client's tolerability of UXO risk. In essence the principle states that if the cost of reducing a risk significantly outweighs the benefit, then the risk may be considered tolerable. Clearly this does not mean that there is no requirement for UXO risk mitigation, but any mitigation must demonstrate that it is beneficial. Any additional mitigation that delivers diminishing benefits **and** that consume disproportionate time, money and effort are considered *de minimis* and thus unnecessary. Because of this principle unexploded bomb (UXB) risks will rarely be reduced to zero (nor need they be).
Important Notes	Although this report is up to date and accurate, our databases are continually being populated as and when additional information becomes available. Nonetheless, 6 Alpha have exercised all reasonable care, skill and due diligence in providing this service and producing this report. The assessment levels are based upon our professional opinion and have been supported by our interpretation of historical records and third party data sources. Wherever possible, 6 Alpha has sought to corroborate and to verify the accuracy of all data we have employed, but we are not accountable for any inherent errors that may be contained in third party data sets (e.g. National Archive or other library sources), and over which 6 Alpha can exercise no control. The intention of this report is to provide the Client with a concise summary of the risks posed to the site investigation and construction works. The background risk has been established in a Threat & Preliminary Risk Assessment Report that will be provided separately. Whilst this document may be used in isolation, an overarching report is available that outlines the procedures, details and methodologies used to assess the UXO risk to this project.

STAGE ONE – SITE LOCATION AND DESCRIPTION

Study Site	The Client has specified the Study Site as Work Area PWH8X. The Site is located at National Grid Reference 526625, 175825. For the purposes of this study, a 50m assessment radius will be applied to the work area to provide flexibility should it need to be relocated. Additionally, the Site has been divided into **AREA A and B** for the purpose of this report. See *Figures 1* and *2* for the Site location and area divisions.
Location Description *(Figure 3)*	The Work Area is situated to the southwest of the *City of London* within the *Battersea Metropolitan Borough*. Current aerial photography has identified the following within each area: **AREA A:** Predominantly unidentified structures with "hard-standing" to the north and south. **AREA B:** A small area of a public highway identified as *York Road.*
Proposed Engineering Works	*Thames Water* have specified a summary of the proposed engineering works, including working draft plans with drawing no. 100-DA-CNS-PWH8X-249105_AI; 100-DA-CNS-PWH8X-249106_AG; and 100-DA-CVL-PWH8X-349020_AH. These works have been divided between **AREAS A and B**, however where not explicitly stated, 6 Alpha has made an assumption of which area the work will be carried out. **Area A** • Construction of a 9m internal diameter shaft, approximately 40m deep within western quadrant of the site. • Construction of an interception chamber immediately adjacent other existing pump station screen house. • A connection tunnel to convey flows from the new interception chamber to the Combined Sewer Overflow (CSO) shaft. This connection culvert will include penstock and flap valve chambers and will be at a depth of approximately 14m. • A 2.8m diameter (reducing to 2.4m) connection tunnel to link the CSO shaft with the main Thames Tunnel. • Construction of a permanent hard standing area to facilitate operational use of the shaft and associated control chambers / kiosks. • Construction of a 4m ventilation column within the existing pumping station compound area. • Construction of ventilation ducts. • Installation, maintenance and removal of a suitable temporary construction working area to facilitate the construction of the above. **Area B** • Construction of a new temporary bus stop, which may include a new lay-by. The construction site will include storage areas for shaft and connection tunnel lining materials, material handling facilities, grout batching and silo facilities, stockyard and spares storage facilities. Construction activities will require the creation of a temporary access to York Road.
Ground Conditions	Thames Water have indicated the following ground conditions for the Work Areas as:

Site Geology	Depth Below Ground Level (m)	Thickness (m)
Made Ground	0.00	4.50
River Terrace Deposits	4.50	4.50
London Clay	9.00	38.00
Lambeth Group	47.00	20.00
Thanet Sand	67.00	9.50
Seaford Chalk	76.50	Proven to 5.70

It is important to establish the ground conditions within this report to determine both the maximum bomb penetration depth (BPD) and the potential for other types of munitions to be buried on this Site.

STAGE TWO – REVIEW OF HISTORICAL DATASETS	
Sources of Information Consulted	The following primary information sources have been used in order to establish the background UXO threat: 1. Home Office WWII Bomb Census Maps; 2. WWII & post-WWII Aerial Photography; 3. Official Abandoned Bomb Register; 4. National Archives in Kew; 5. Internet based research; 6. Historic UXO information provided by 33 Engineer Regiment (Explosive Ordnance Disposal) at Carver Barracks, Wimbish.
Site History and Use	According to the County Series (CS) & Ordnance Survey (OS) historical mapping, the following site history can be recorded immediately prior to and post-WWII: **1938 CS mapping** **AREA A** is located on a fully developed "housing estate", which also contains an unidentified structure within the western aspect of the area. **AREA B** stretches across two fully developed "housing estates". **1948 OS mapping** The unidentified structure within the western aspect of **AREA A** is labelled as a "pumping station". No other noticeable or significant changes have been made.
1945 Aerial Photography ***(Figure 4)***	**BOTH AREAS:** The 1945 aerial photography confirms structural development on Site, and despite the lack of clarity in the aerial photography, we can infer that much of the Site is intact, given the buildings present on the photograph are concomitant with mapping from 1938.
WWII Luftwaffe Bombing Targets ***(Figure 5)***	**BOTH AREAS:** Primary bombing targets include *Wandsworth, Wimbledon and Epsom Gas* Works 1,000m to the southwest, *Fulham Power Station* located 400m to the west, "gas works" 750m to the northwest and *London Passenger Transport Board Power Station* 1,000m to the northwest. In addition, numerous "opportunistic" targets surrounded both areas and were located within a 1,000m radius of them, including an "electricity generating station" immediately adjacent to the buffered Site boundary, "works", "depots", "tanks", "railway stations and infrastructure" and "wharves".
WWII HE Bomb Strikes ***(Figure 6)***	Air Raid Precaution (ARP) reports indicate the following: **AREA A:** No bomb strikes. **AREA B:** No bomb strikes. No bomb strikes occurred within the buffered boundary, but six HE bomb strikes were recorded within 100m of the buffered boundary. Furthermore, two V1 rockets landed 70m and 80m to the west of **AREA A and B**.
WWII Bomb Damage ***(Figure 7)***	*London County Council* (LCC) bomb damage maps indicate the following: **AREA A:** No bomb damage. **AREA B:** No bomb damage. A small, but noteworthy amount of varied bomb damage occurred within the buffered Site boundary between **AREA A** and **B** ranging from "Blast damage; minor in nature" to "total destruction".
WWII HE Bomb Density ***(Figure 8)***	The Study Site is located in *Battersea Metropolitan Borough,* which recorded 214 HE bombs per 1,000 acres. This figure does not include incendiary devices, as they were often released in such large numbers that they were seldom recorded.
Abandoned Bombs	The Official Abandoned Bomb Register does not identify any abandoned bombs within 1,000m of the Site.

STAGE THREE – DATA ANALYSIS	
Was the ground undeveloped during WWII?	**AREA A:** No; the area was used predominantly for residential housing, however a "pumping station" was also located on Site. **AREA B:** No; the area was primarily residential housing.
Is there a reason to suspect that the immediate area was a bombing target during WWII?	**BOTH AREAS:** Yes; there are numerous bombing targets within the vicinity of the areas, including several primary targets such as "gas woks" "and power stations".
Is there firm evidence that ordnance landed on Site?	**BOTH AREAS:** No. However, given that both areas occupy previous housing developments, it is likely that any ordnance landing on Site would have been evidenced.
Is there evidence of damage sustained on Site?	**BOTH AREAS:** No; bomb damage mapping identifies no damage to any structures in either area. However, structural bomb damage of residential housing between **AREA A and B** was recorded.
Is there any reason to suspect that military training may have occurred at this location?	**BOTH AREAS:** No; there is no evidence to suggest that military training occurred within any of the areas.
Would an UXB entry hole have been observed and reported during WWII?	**BOTH AREAS:** Yes; given that both **AREA A and B** were previous housing developments, it can be assumed that there was a reasonably high footfall within these areas, and thus any UXB entry holes would have been observed and reported by the homeowners and/or neighbours.
What is the expected UXO contamination?	**BOTH AREAS:** The most likely source of UXO contamination is from *German* aerial delivered ordnance, which ranges from small IBs through to large HE bombs (of which the latter forms the principal threat).
Would previous earthworks have removed the potential for UXO to be present?	**AREA A:** Possibly; the area has undergone significant redevelopment since WWII, with the previous "housing estate" being demolished and new structures built in its place. There are portions of the area that have not been redeveloped, and are now either "hard-standing ground" or "recreational ground". Therefore the potential for UXO to be present is dependent on the depth and scale of redevelopment works that took place at this Site. **AREA B:** Possibly; the area no longer contains any housing from WWII, and has been redeveloped into *York Road*. The potential for UXO to be present in this area is dependent on the depth of works associated with the development of *York Road*.

STAGE FOUR – RISK ASSESSMENT		
Threat Items	The threat is predominately posed by WWII *German* HE bombs and Incendiary Bombs. Additionally, *British* AAA projectiles may also be present. However, AAA does not have the potential for deep burial, and thus is unlikely to be encountered at depths greater than 1m bgl.	
Maximum Penetration	Considering the general ground conditions (highlighted in Stage 1) within **AREA A and B**, including the made ground depth of 4.5m, the most likely Bomb Penetration Depth (BPD) for a 250kg bomb is assessed to be a maximum of 7m bgl. Whilst the *Luftwaffe* used larger bombs, their deployment was so few and only used against notable targets, to use them within this risk assessment would not be justified. Additionally, smaller items such as *German* IBs and *British* AAA projectiles would have a significantly reduced penetration capability and would not be expected to be encountered at depths greater than 1m.	
Risk Pathway	Intrusive engineering activities are likely to be in the form of excavations. Although for the purposes of this report 6 Alpha will use a range of generic construction activities for the risk assessment.	
Consequence	**Potential consequences of UXO initiation**	1. Kill and/or critically injure personnel 2. Severe damage to plant and equipment 3. Blast damage to nearby buildings 4. Rupture and damage underground services
	Potential consequences of UXO discovery	1. Delay the project 2. Disruption to local community/infrastructure 3. Incurring of additional costs
Site Activities	A number of construction methodologies have been identified for analysis on this Site. There is a large amount of variation in the probability of encountering, or initiating items of UXO when conducting different activities on Site. Additionally the consequences of initiating UXO vary greatly depending on how the item of UXO was initiated on Site.	

STAGE FOUR – RISK ASSESSMENT (…continued)

UXO RISK CALCULATION TABLE

Risk Rating Calculation	6 Alpha's Semi-Quantitative Risk Assessment identifies the Risk Rating posed by the most probable threat items when conducting a number of different construction activities on the Site. Risk Rating is determined by calculating the probability of encountering UXO and the consequences of initiating it.

Activity	AREA A		
	Probability (SHxEM=P)	**Consequence** (DxPSR=C)	**Risk Rating** (PxC=RR)
Enabling Works	1x1=1	3x2=6	1x6=6
Tunnelling	1x2=2	1x1=1	2x1=2
Shaft Installation	1x2=2	1x2=2	2x2=4
Open Excavations	1x2=2	2x2=4	2x4=8

Activity	AREA B		
	Probability (SHxEM=P)	**Consequence** (DxPSR=C)	**Risk Rating** (PxC=RR)
Enabling Works	1x1=1	3x2=6	1x6=6
Shallow Excavations (no more than 1m)	1x1=1	3x2=6	1x6=6

Abbreviations – Site History (SH), Engineering Methodology (EM), Probability (P), Depth (D), Consequence (C), Proximity to Sensitive Receptors (PSR) and Risk Rating (RR).

STAGE FIVE – RECOMMENDED RISK MITIGATION MEASURES WITH RESULTING RISK RATING	
If a geophysical survey is required are the ground conditions an issue?	**Non-Intrusive Methods of Mitigation** – The suitability for an effective non-intrusive method of mitigation is largely dependent on the depth (4.5m for this Site) and composition of made ground, as any magnetometer results are highly likely to be affected by ferro-magnetic contamination due to previous construction activities within the Study Site location. **Intrusive Methods of Mitigation** – Intrusive magnetometry is expected to be possible on this Site, however deep excavation of made ground is required prior to the use of this methodology. It should be noted that ferro-contamination of any made ground/fill material, particularly at the fill layer, is likely to adversely affect detection capability of the equipment.

MITIGATION MEASURES TO REDUCE RISK TO 'ALARP'		
Activity	**Risk Mitigation Measures**	**Final Risk Rating**
BOTH AREAS	**The following actions are recommended before undertaking any activity on the Study Site:** 1. **Operational UXO Risk Management Plan;** appropriate site management documentation should be held on site to plan for and guide upon the actions to be carried out in the event of a suspected or real UXO discovery. 2. **UXO Safety & Awareness Briefings;** the briefings are essential when there is a possibility of explosive ordnance encounter and are a vital part of the general safety requirement. All personnel working on the site should receive a general briefing on the identification of UXB, what actions they should take to keep people and equipment away from the hazard and to alert site management.	ALARP
This assessment has been conducted based on the information provided by the Client, should the proposed works change then 6 Alpha should be re-engaged to refine this risk assessment.		

Report Figures

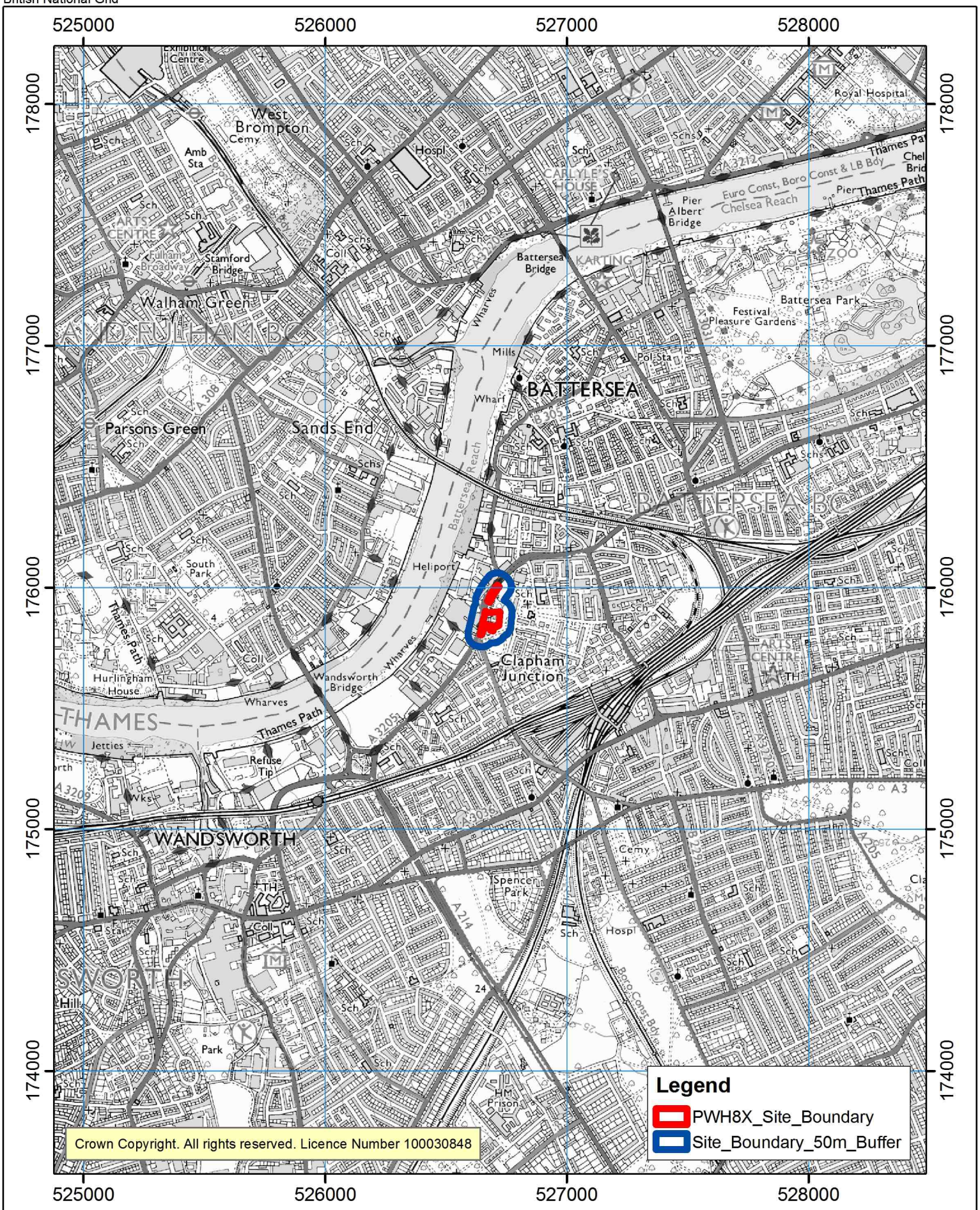
Figure One

Site Location

Thames Tideway Tunnel - Work Area PWH8X
Site Location

Figure 1

British National Grid



BOMB SEARCH

6 Alpha Associates Ltd.
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www.6alpha.com
0203 371 3900

0 100 200 400 600 800 1,000 Meters

N

Project Number: P2853_PWH8X
Drawn By: Dominique René
Checked by: Lee Gooderham
Date: 23rd May 2012

Figure Two

Site Plan

Thames Tideway Tunnel - Work Area PWH8X Site Boundary

Figure 2

British National Grid

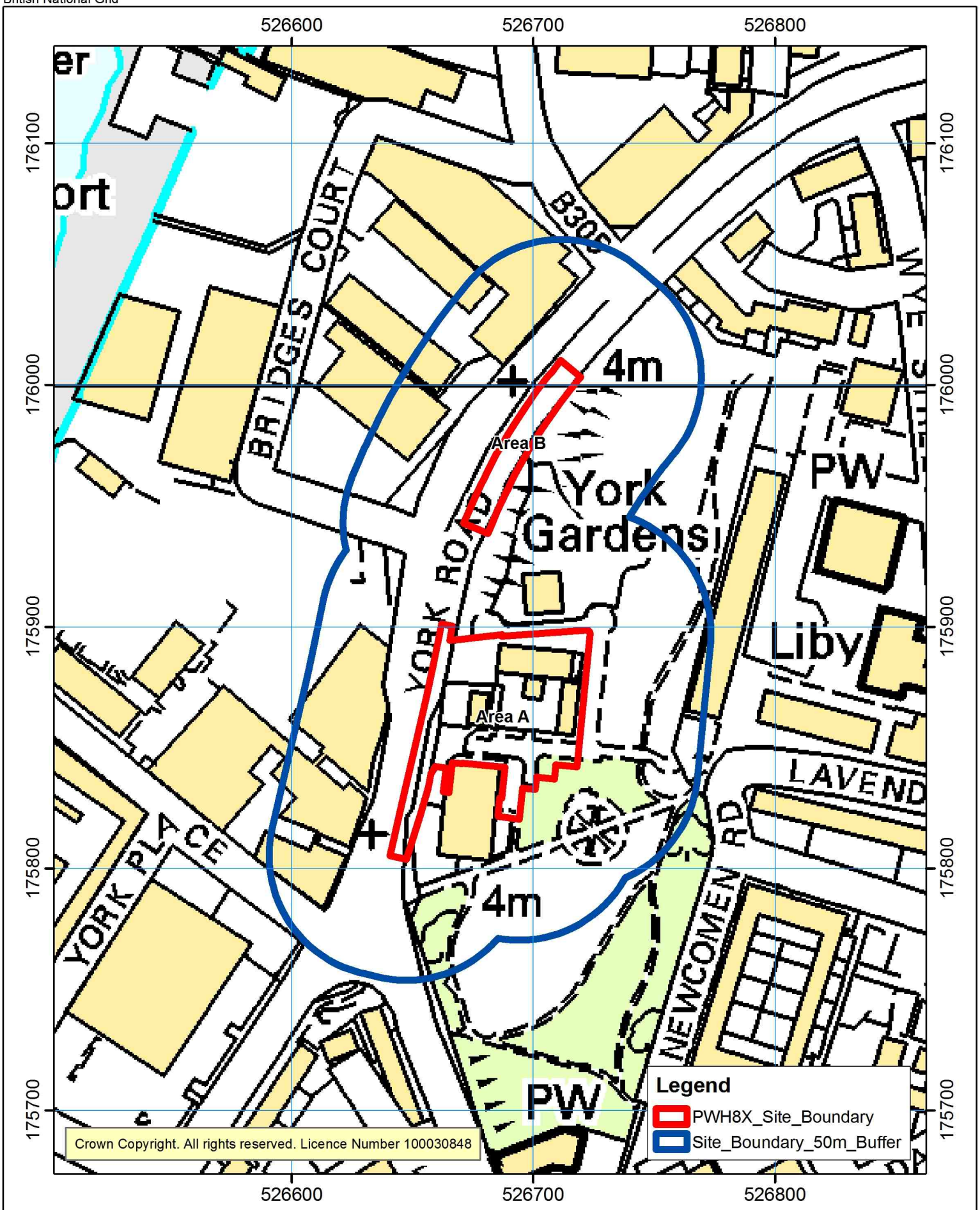

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Figure Three

Current Aerial Photography

Thames Tideway Tunnel - Work Area PWH8X
Current Aerial Photography

Figure 3

British National Grid

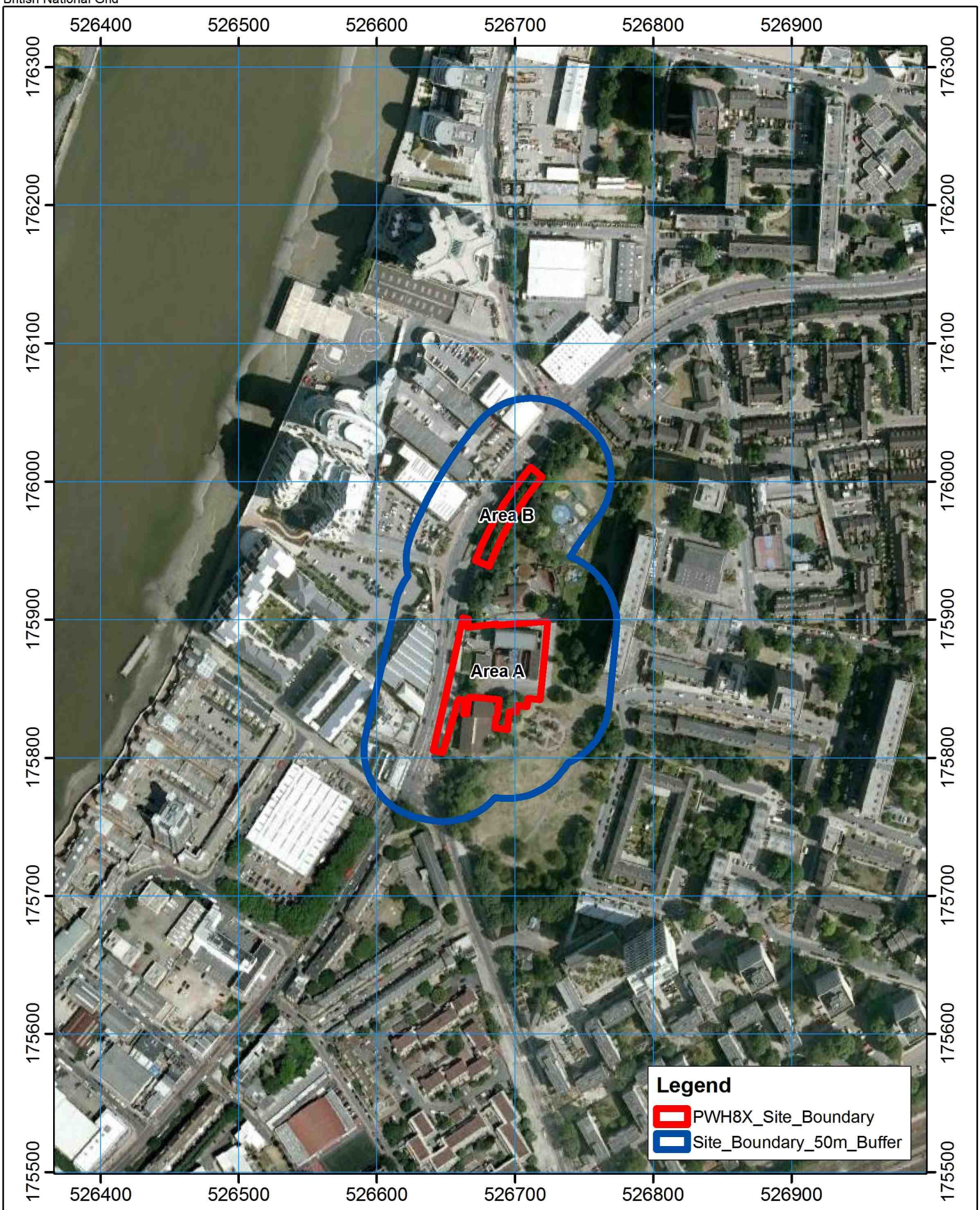

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Figure Four

1945 Aerial Photography

Thames Tideway Tunnel - Work Area PWH8X
1945 Aerial Photography

Figure 4

British National Grid

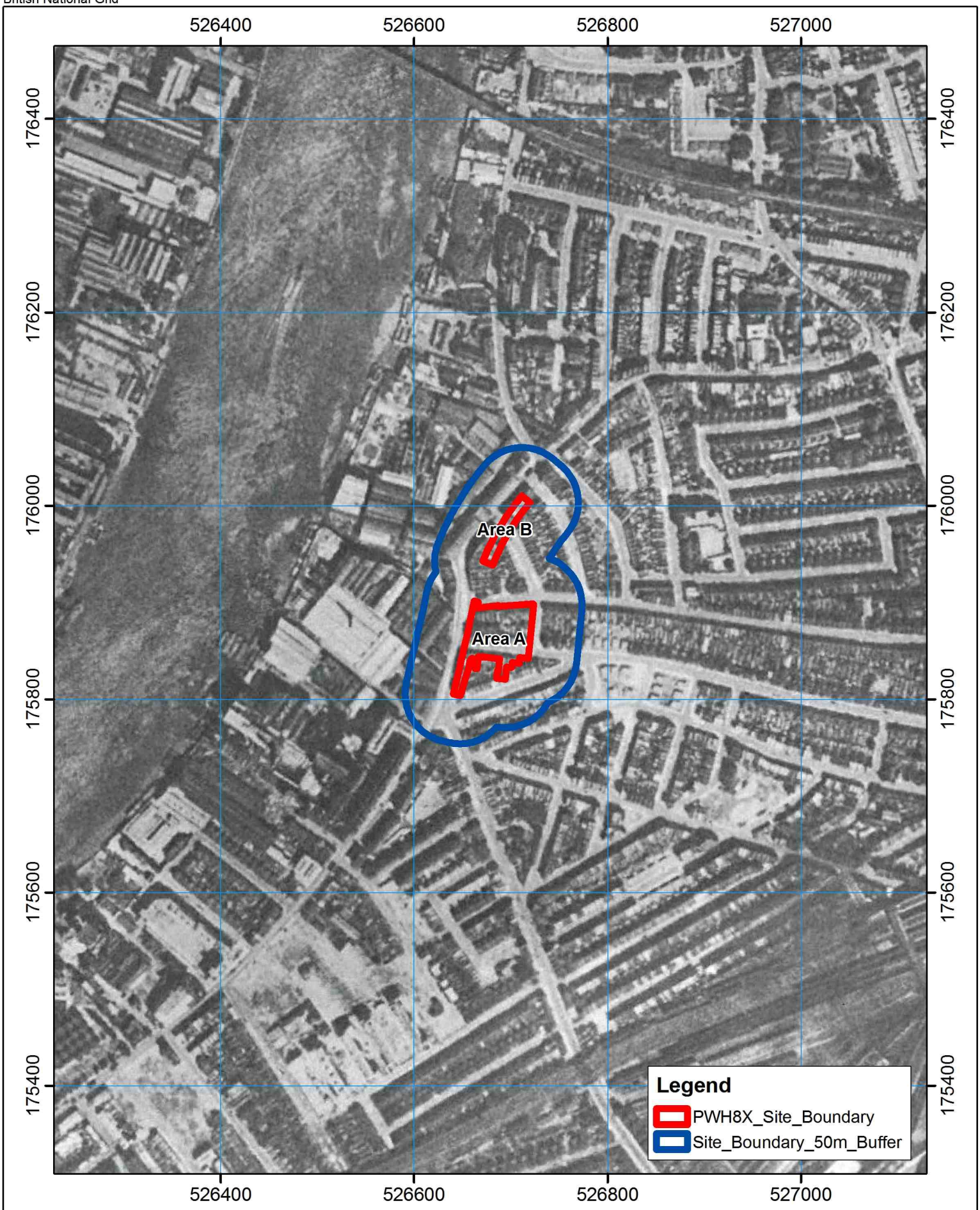

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Figure Five

WWII Luftwaffe Bombing Targets

Thames Tideway Tunnel - Work Area PWH8X
WWII Luftwaffe Bombing Targets

Figure 5

British National Grid

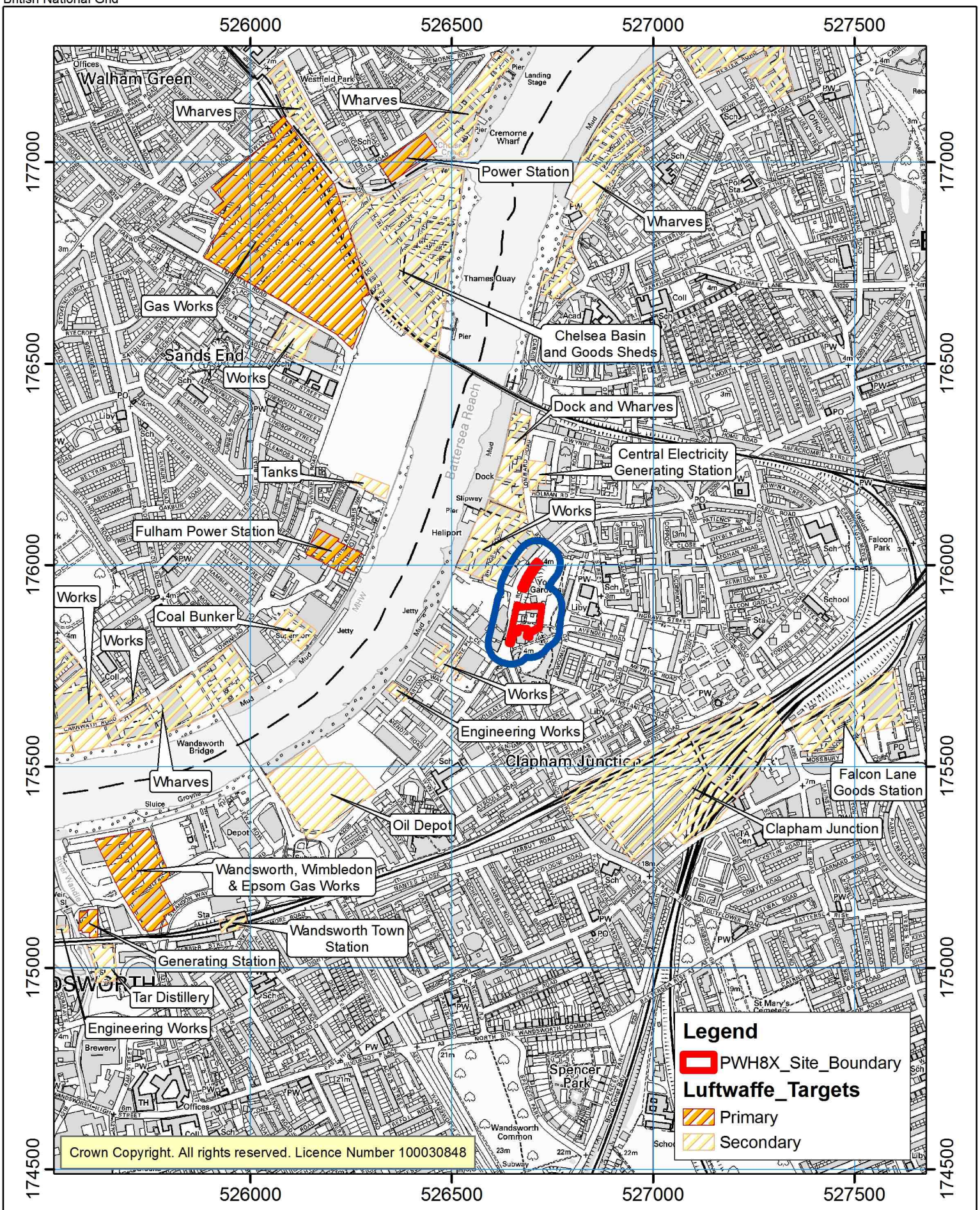

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Figure Six

WWII High Explosive Bomb Strikes

Thames Tideway Tunnel - Work Area PWH8X
WWII High Explosive Bomb Strikes

Figure 6

British National Grid

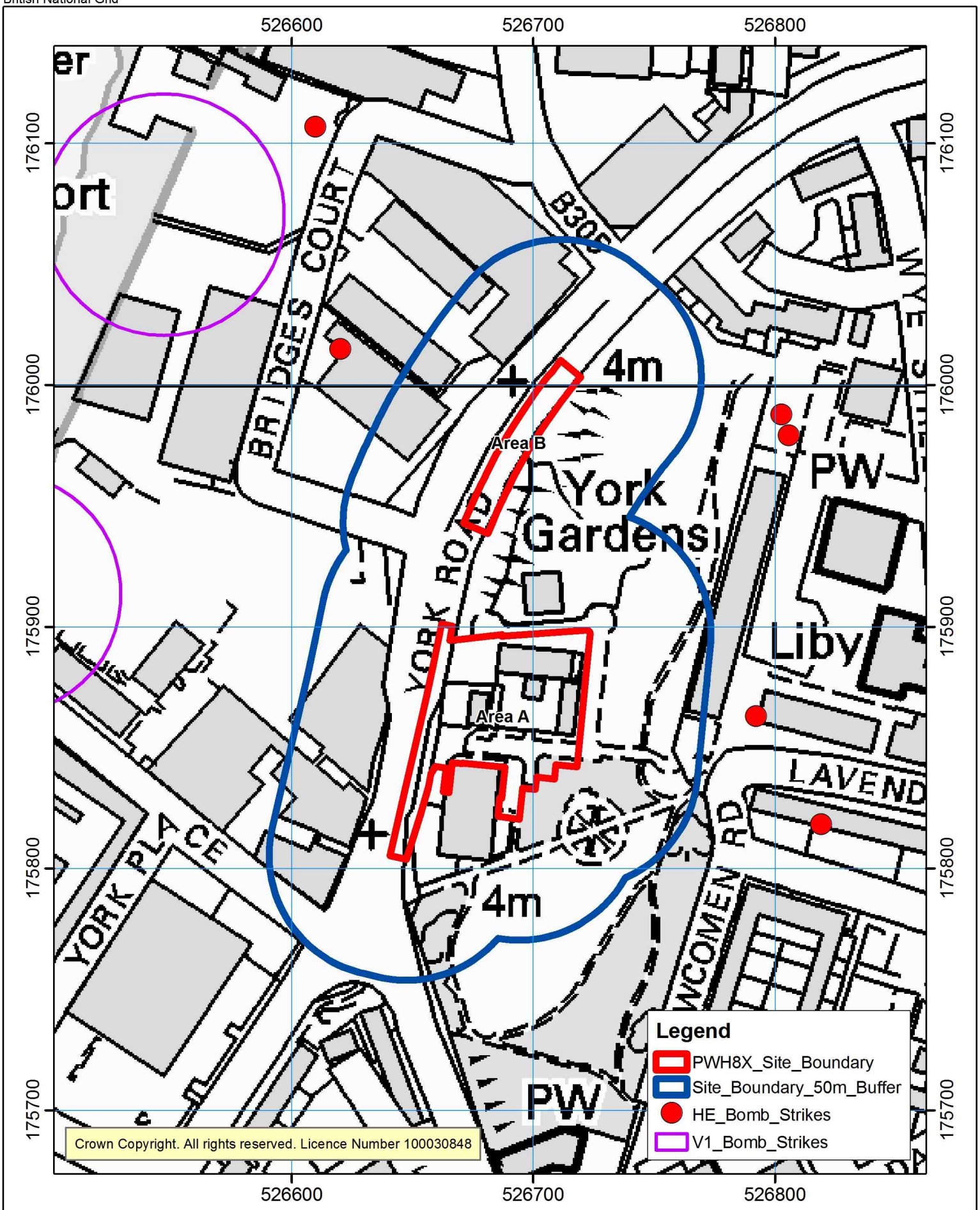

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Figure Seven

London County Council Bomb Damage Mapping

Thames Tideway Tunnel - Work Area PWH8X
London County Council Bomb Damage Map

Figure 7

British National Grid

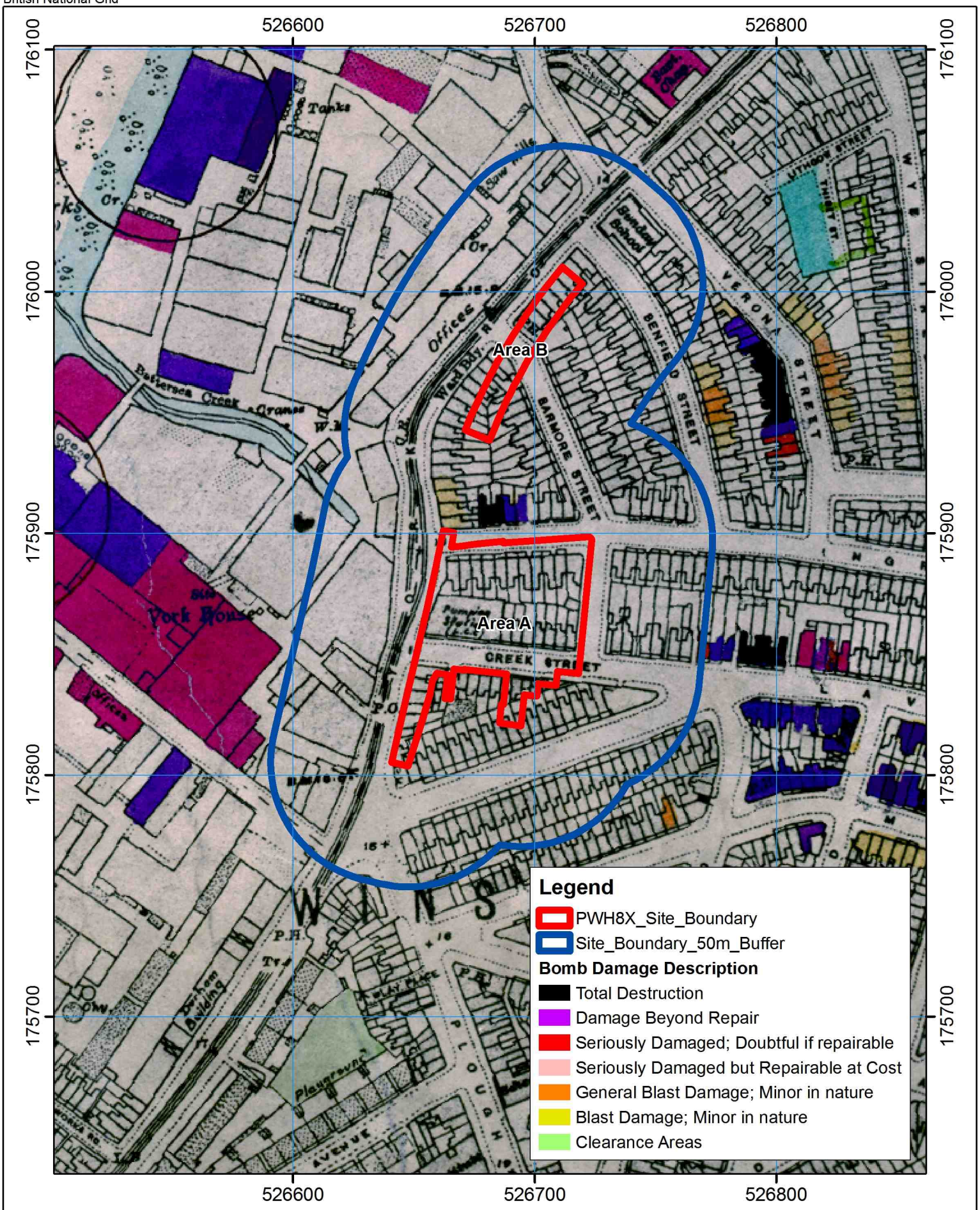

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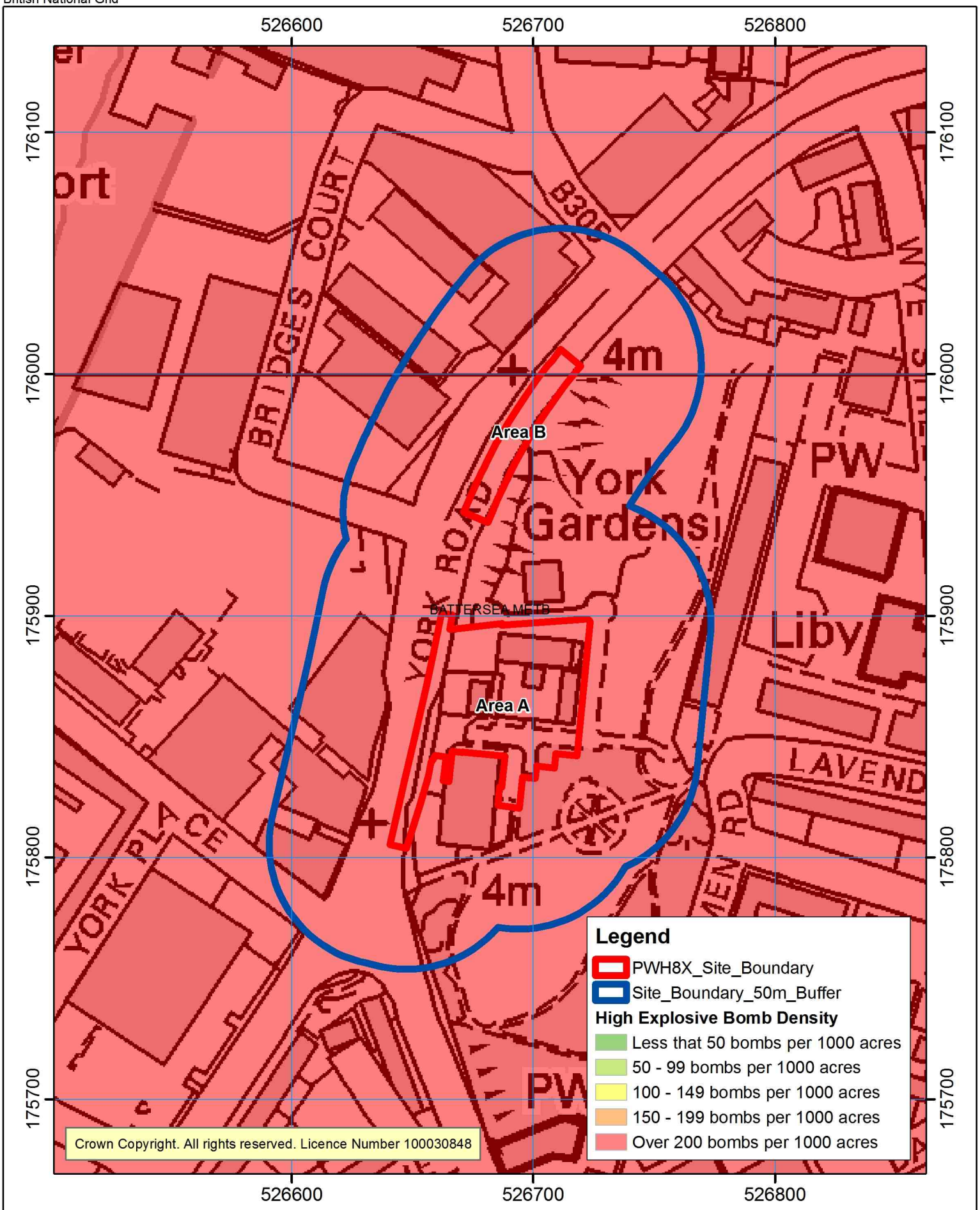
Figure Eight

WWII High Explosive Bomb Density

Thames Tideway Tunnel - Work Area PWH8X
WWII High Explosive Bomb Density

Figure 8

British National Grid



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Date: 23rd May 2012

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References

[1] Department for the Environment, Food and Rural Affairs (Defra) and The Environment Agency, *CLR8: Potential Contaminants for the assessment of land* (2002).

[2] Department of the Environment, Industry Profiles (various), available from http://www.environment-agency.gov.uk/research/planning/33708.aspx, accessed 25th March 2011.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix G: Noise and vibration

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix G: Noise and vibration

List of contents

Page number

List of plates

Page number

List of tables

Page number

Appendix G: Noise and vibration

G.1 Baseline noise survey

Introduction

G.1.1 As described in Volume 2 Environmental assessment methodology, the main purpose of the noise survey has been to determine representative ambient and background noise levels at a number of different types of noise sensitive receptor.

G.1.2 The nearest identified noise sensitive receptors to Falconbrook Pumping Station are the high rise flats (Pennethorne House) located directly east of the proposed development, and Arthur Newton House located to the southeast on Lavender Road. Further away from the site to the south, east and north, the area is comprised largely of residential buildings, of two and three storeys. Immediately on the northern perimeter of the site is York Gardens Children's Centre and adventure playground, whilst to the south is York Gardens library and community centre.

Survey methodology

G.1.3 The London Borough (LB) of Wandsworth has been consulted regarding the noise assessment and monitoring locations, prior to completing the surveys.

G.1.4 An initial baseline noise survey was completed on 1st and 3rd-5th July, 2011. The baseline survey comprised short term attended measurements taken during the daytime, evening and night-time. Continuous unattended monitoring was also completed over a four day period (22nd-25th July, 2011) at one location.

G.1.5 Short term attended noise monitoring was completed at three locations. Measurements were undertaken during the interpeak periods of 10:00-12:00, 14:00-16:00, 20:00-22:00 and 00:00-04:00 on a typical weekday, and 14:00-18:00 and 00:00-04:00 on a typical weekend day, so that the baseline data is representative of the quieter periods where any disturbance from construction would be most noticeable.

G.1.6 Vol 11 Table G.1 describes the survey equipment that was used to collect the baseline data at the site.

Vol 11 Table G.1 Noise – survey equipment

Item	Type	Manufacturer	Serial number(s)	Laboratory calibration date*
Attended baseline survey: 1st, 3rd-5th July, 2011				
Hand-held analyser(s)	2250	Brüel & Kjær	2626231	20/01/2010
½	4189	Brüel & Kjær	2621208	19/01/2010

Item	Type	Manufacturer	Serial number(s)	Laboratory calibration date*
microphone(s)				
B&K sound calibrator(s)	4231	Brüel & Kjær	2619372	13/01/2011
Continuous unattended monitoring: 22nd - 25th July, 2011				
Hand-held analyser(s)	2250	Brüel & Kjær	2506359	14/03/2011
½ microphone(s)	4189	Brüel & Kjær	2441062	10/03/2011
B&K sound calibrator(s)	4231	Brüel & Kjær	2445811	14/10/2010

**Hand-held analyser(s), ½" microphone(s) and calibrator(s) valid for one year from the date listed.*

G.1.7 Prior to and on completion of the surveys, the sound level meters and microphone calibration was checked using a Brüel and Kjær sound level meter calibrator. On-site calibration checks were performed before and after all measurements with no significant deviation being observed. The sound level meters and calibrators have valid laboratory calibration certificates.

G.1.8 For the attended measurements, the sound level meters were tripod-mounted with the microphone approximately 1.3m above ground level. A windshield was fitted over the microphone at all times during the survey period to minimise the effects of any wind induced noise.

G.1.9 For the unattended measurement, the environmental case used for the continuous data logging was locked to avoid any potential tampering. The microphone was tripod-mounted approximately 1.3m above ground level. A windshield with bird spikes was fitted over the microphone at all times during the survey period to minimise the effects of any wind induced noise, and also to prevent birds from perching on the equipment.

G.1.10 The prevailing weather conditions observed during the attended baseline survey are described in Vol 11 Table G.2.

G.1.11 Contemporary weather data recorded at Heathrow Airport (EGLL) has been summarised in Vol 11 Table G.3. This is deemed to be representative of the prevailing weather conditions for the continuous unattended monitoring kit.

Vol 11 Table G.2 Noise – weather conditions during baseline noise surveys

Wind Speed (ms^{-1})	Wind Direction	Temperature (°C)	Precipitation?	Description
Baseline survey – 1st July, 2011 (daytime, 10:00-12:00)				
3.1-4.1	NNW; NW	16-18	No	Partly cloudy, dry and breezy
Baseline survey – 1st July, 2011 (daytime, 14:00-16:00)				
2.6-3.1	NW; WNW	18-20	No	Clear, dry and breezy
Baseline survey – 3rd July, 2011 (daytime, 14:00-18:00)				
Maximum: 1.2-2.7 Average: 0.4-1.0	Variable (predominantly NW)	22-23	No	Clear, dry and breezy
Baseline survey – 4th July, 2011 (night-time, 00:00-04:00)				
Maximum: 0.5-2.1 Average: 0.2-0.7	Variable (predominantly SE and SSE)	15-18	No	Clear, dry and breezy
Baseline survey – 4th July, 2011 (evening, 20:00-22:00)				
Maximum: 1.1-2.9 Average: 0.3-1.1	Variable	21-22	No	Mainly clear and calm
Baseline survey – 5th July, 2011 (night-time, 00:00-04:00)				
Maximum: 0-1.7 Average: 0-0.6	SSE; SE	14-18	No	Mainly clear and calm

Vol 11 Table G.3 Noise – contemporary weather data for Heathrow Airport

Wind Speed (ms^{-1})	Wind Direction	Temperature (°C)	Precipitation?	Description
Friday 22nd July, 2011 (10:00 onwards) [a]				
1.6-3.6	N; NE	16-20	No	Cloudy, dry and breezy
Saturday 23rd July, 2011 [b]				
1-5.7	Variable (Predominantly NW)	11-19	Yes (Light rain at midnight and again at 6AM)	Cloudy and dry for majority of day, breezy
Sunday 24th July, 2011 [c]				
2-5.1	Variable (Predominantly W and WNW)	10-23	No	Mainly clear, dry and breezy
Monday 25th July, 2011(until 23:59) [d]				
2.1-5.1	Variable (Predominantly W; WNW and NW)	10-23	No	Cloudy dry and breezy

a. *http://www.wunderground.com/history/airport/EGLL/2011/7/22/DailyHistory.html*
b. *http://www.wunderground.com/history/airport/EGLL/2011/7/23/DailyHistory.html*
c. *http://www.wunderground.com/history/airport/EGLL/2011/7/24/DailyHistory.html*
d. *http://www.wunderground.com/history/airport/EGLL/2011/7/25/DailyHistory.html*

Measurement locations

G.1.12 The table below details the measurement locations which are also presented in Vol 11 Figure G.1 Noise – measurement locations (see separate volume of figures), and shown in Vol 11 Plate G.1 to Vol 11 Plate G.4.

Vol 11 Table G.4 Noise – measurement locations

Measurement location number	Description	Co-ordinates	
		X	Y
FPS01	Within southern corner of Bridges Court private car park	526575	175909
FPS02	On public footpath adjacent to Bridges Court, near to commercial garage	526595	175965
FPS03	On eastern edge of York Gardens public amenity, near Falconbrook Primary School)	526743	175843
FPS04	Within private grounds of Falconbrook Pumping Station	526693	175869

Results

G.1.13 The range of values for each of the parameters collected during the baseline surveys are summarised in Vol 11 Table G.5 to Vol 11 Table G.8.

Vol 11 Table G.5 Noise – sampled noise survey results

Location Detail: FPS01, within southern corner of Bridges Court private car park, opposite Prices Court						
Measurement period	**Noise level (dB(A) free-field)**			**Averaged ambient noise level, $dBL_{Aeq,15min}$**		**$dBL_{Aeq,15min}$ (rounded to nearest 5dB)**
	L_{AFmax}	**$L_{A90,15min}$**	**$L_{Aeq,15min}$**	**Free field**	**Façade**	**Façade**
Daytime (10.00-12.00, 14.00-16.00)	82	49	59-62	61	64*[i]	65
Evening (20.00-22.00)	77	45	51-58	56	59*[vi]	60
Night (00.00-04.00)	69	40	43-49	46	49*[vi]	50
Weekend day (14.00-18.00)	81	47	58-59	58	61*[vi]	60
Weekend night (00.00-04.00)	72	38	41-46	44	47*[vi]	45

[i] The measurement position was more than 3.5m from the nearest reflecting surface therefore these represent free-field measurements. An approximation of the averaged ambient façade noise level has been obtained by adding 3dB to the calculated averaged ambient free-field level, as recommended in BS 7445-2:1991 (paragraph 5.3.2, page 3)

** An approximation of the averaged ambient façade noise level has been obtained by adding 3dB to the calculated averaged ambient free-field level*

Vol 11 Table G.6 Noise – sampled noise survey results

Location Detail: FPS02, on public footpath adjacent to Bridges Court, near to commercial garage						
Measurement period	**Noise level (dB(A) free-field)**			**Averaged ambient noise level, $dBL_{Aeq,15min}$**		**$dBL_{Aeq,15min}$ (rounded to nearest 5dB)**
	L_{AFmax}	**$L_{A90,15min}$**	**$L_{Aeq,15min}$**	**Free field**	**Façade**	**Façade**
Daytime (10.00-12.00, 14.00-16.00)	85	51	60-64	62	65*[vi]	65
Evening (20.00-22.00)	76	48	55-59	57	60*[vi]	60
Night (00.00-04.00)	74	45	50-51	51	54*[vi]	55
Weekend day (14.00-18.00)	79	52	57-63	60	63*[vi]	65
Weekend night (00.00-04.00)	74	43	49-51	50	53*[vi]	55

** An approximation of the averaged ambient façade noise level has been obtained by adding 3dB to the calculated averaged ambient free-field level*

Vol 11 Table G.7 Noise – sampled noise survey results

Location Detail: FPS03, within eastern boundary of York Gardens public amenity, near Falconbrook Primary School						
Measurement period	**Noise level (dB(A) free-field)**			**Averaged ambient noise level, $dBL_{Aeq,15min}$**		**$dBL_{Aeq,15min}$ (rounded to nearest 5dB)**
	L_{AFmax}	**$L_{A90,15min}$**	**$L_{Aeq,15min}$**	**Free field**	**Façade**	**Façade**
Daytime (10.00-12.00, 14.00-16.00)	88	51	59-65	63	66*[vi]	65
Evening (20.00-22.00)	86	47	52-57	55	58*[vi]	60

Location Detail: FPS03, within eastern boundary of York Gardens public amenity, near Falconbrook Primary School						
Measurement period	**Noise level (dB(A) free-field)**			**Averaged ambient noise level, $dBL_{Aeq,15min}$**		**$dBL_{Aeq,15min}$ (rounded to nearest 5dB)**
	L_{AFmax}	**$L_{A90,15min}$**	**$L_{Aeq,15min}$**	**Free field**	**Façade**	**Façade**
Night (00.00-04.00)	68	40	43-46	44	47*[vi]	45
Weekend day (14.00-18.00)	80	50	57-61	60	63*[vi]	65
Weekend night (00.00-04.00)	71	41	45-51	49	52*[vi]	50

** An approximation of the averaged ambient façade noise level has been obtained by adding 3dB to the calculated averaged ambient free-field level*

Vol 11 Table G.8 Noise – continuously logged noise survey results

Location Detail: FPS04, within private overspill car park of the London Wetland Centre							
Day	**Period**	**Period noise level (dB(A) free-field)**			**Period noise level (dB(A) façade)**		
		L_{AFmax}	**L_{A90}**	**L_{Aeq}**	**L_{AFmax}**	**L_{A90}**	**L_{Aeq}**
Weekday	07.00-08.00	76	52	61	79	55	64
	08.00-18.00	86	50	59	89	53	62
	18.00-19.00	76	51	59	79	54	62
	19.00-22.00	78	49	58	81	52	61
	22.00-07.00	82	45	55	85	48	58
Saturday	07.00-08.00	73	49	56	76	52	59
	08.00-13.00	83	50	58	86	53	61
	13.00-14.00	71	50	56	74	53	59
	14.00-	81	50	61	84	53	64

Location Detail: FPS04, within private overspill car park of the London Wetland Centre							
Day	Period	Period noise level (dB(A) free-field)			Period noise level (dB(A) façade)		
		L_{AFmax}	L_{A90}	L_{Aeq}	L_{AFmax}	L_{A90}	L_{Aeq}
	22.00						
	22.00-07.00	78	45	55	81	48	58
Sunday	07.00-21.00	80	50	59	83	53	62
	21.00-07.00	81	43	56	84	46	59

Baseline condition photographs specific to topics

Vol 11 Plate G.1 Noise – measurement location FPS01

Note: Within private car park opposite Bridges Court, looking west towards residential dwellings (Prices Court)

Vol 11 Plate G.2 Noise – measurement location FPS02

Note: On public footpath alongside Bridges Court, looking northwest towards Orbis Wharf

Vol 11 Plate G.3 Noise – measurement location FPS03

Note: Within eastern boundary of York Gardens, looking northwest towards Falconbrook Pumping Station

Vol 11 Plate G.4 Noise – measurement location FPS04

Note: Within private grounds of Falconbrook Pumping Station, looking north at main building

G.2 Construction noise prediction results

G.2.1 The construction noise prediction methodology follows the methodology provided in Vol 2 Section 9.

G.2.2 The assessment has been carried out based on a typical construction programme which has been used to calculate the average monthly noise levels.

G.2.3 Construction plant assumptions used in the assessment are presented in Vol 11 Table G.9.

G.2.4 Time histories of the predicted daytime construction noise levels across the programme of construction works are shown in Vol 11 Plate G.5 to Vol 11 Plate G.10.

Vol 11 Table G.9 Noise – typical construction plant schedule

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
Hoarding **General site equipment NOT applicable during this phase**	Excavator digging post holes for hoarding	1	105	30	1. BS5228-1[1]: Table C.2, Item 2	Tracked excavator, 71 t
	Generator 35kVA	1	94	100	BS5228-1: Table C.4, Item 78	Diesel generator,
	Circular saw cutting timber	1	113	10	BS5228-1: Table C.4, Item 71	Circular bench saw,
	Cutting equipment (diamond saw)	1	108	10	BS5228-1: Table C.4, Item 93	Angle grinder (grinding steel), 4.7 kg
	Nail guns for erection of hoarding	2	101	10	BS5228-1: Table C.4, Item 95	Handheld cordless nail gun, 15 to 50 mm nails
	Compressor 250cfm	1	93	30	BS5228-1: Table C.5, Item 5	Compressor for hand-held pneumatic breaker, 1 t
	Hand-held percussive breaker	1	111	30	BS5228-1: Table C.1, Item 6	Hand-held pneumatic breaker,
	Waste collection via skip or tipper lorry	1	106	10	BS5228-1: Table C.8, Item 21	Skip wagon,
	Oxyaceteline cutting equipment	1	93	10	BS5228-1: Table C.3, Item 35	Hand-held gas cutter, 230 bar
Site set up and general	Oxyaceteline cutting equipment	1	93	10	BS5228-1: Table C.3, Item 35	Hand-held gas cutter, 230 bar

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
site	JCB with hydraulic breaker	1	116	20	BS5228-1: Table C.5, Item 1	Backhoe mounted hydraulic breaker,
	Cutting equipment (diamond saw)	1	108	10	BS5228-1: Table C.4, Item 93	Angle grinder (grinding steel), 4.7 kg
	Compressor 250cfm	1	93	50	BS5228-1: Table C.5, Item 5	Compressor for hand-held pneumatic breaker, 1 t
	Generator - 200 kVA	1	94	100	BS5228-1: Table C.4, Item 78	Diesel generator,
	Fuel delivery vehicle	1	104	5	BS5228-1: Table C.4, Item 15	Fuel tanker lorry,
	Telescopic Handler/FLT	1	99	30	BS5228-1: Table C.2, Item 35	Telescopic handler, 10 t
	Wheel wash	1	110	20	Measured	Jet wash,
	Hiab lorry/crane	1	105	5	BS5228-1: Table C.4, Item 53	Lorry with lifting boom, 6 t
	Water settling/treatment	1	104	100	Measured	Dirty water plant,
	Well drilling Rig	1	107	50	Manufacturer	Bauer BBA well drilling rig,
Demolition General site	Service Crane 25T mobile Crane	1	98	30	BS5228-1: Table C.4, Item 43	Wheeled mobile crane, 35 t

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
equipment also applicable during this phase	22T Excavator c/w hydraulic hammer	1	119	15	BS5228-1: Table D.2, Item 4	Tracked excavator fitted with breaker, 200 kg·m
	Site dumper	1	104	30	BS5228-1: Table C.4, Item 3	Dumper, 7 t
	Pneumatic breaker	1	111	20	BS5228-1: Table C.1, Item 6	Hand-held pneumatic breaker,
	Vibrating rollers	2	101	50	BS5228-1: Table C.2, Item 38	Roller, 18 t
	Concrete crusher	1	101	80	BS5228-1: Table C.2, Item 15	Tracked crusher, 32 t
Piling for shaft/culvert support General site equipment also applicable during this phase	100t crawler crane	1	103	50	BS5228-1: Table C.4, Item 52	Tracked mobile crane, 105 t
	25 tonne mobile crane	1	98	50	BS5228-1: Table C.4, Item 43	Wheeled mobile crane, 35 t
	Vibratory piling rig	1	116	80	BS5228-1: Table C.3, Item 8	Vibratory piling rig, 52 t
Shaft sinking	Concrete deliveries (agitating)	1	99	80	BS5228-1: Table C.4, Item 19	Cement mixer truck (idling),
	Concrete deliveries (discharging)	1	103	20	BS5228-1: Table C.4, Item 18	Cement mixer truck (discharging),
	12t excavator	1	97	80	BS5228-1: Table C.2, Item 25	Tracked excavator, 15 t

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
	100t crawler crane	1	103	80	BS5228-1: Table C.4, Item 52	Tracked mobile crane, 105 t
	25t mobile crane	1	98	20	BS5228-1: Table C.4, Item 43	Wheeled mobile crane, 35 t
	Vent fans	1	90	100	Measured	Ventilation fans,
	Sump pump	4	95	100	BS5228-1: Table D.7, Item 65	Draining trench water pump,
	25t excavator	1	105	50	BS5228-1: Table C.2, Item 19	Tracked excavator, 25 t
	Pneumatic breakers	4	111	20	BS5228-1: Table C.1, Item 6	Hand-held pneumatic breaker,
	400 cfm compressor	1	93	50	BS5228-1: Table C.5, Item 5	Compressor for hand-held pneumatic breaker, 1 t
	Waste collection via skip or tipper lorry	1	106	10	BS5228-1: Table C.8, Item 21	Skip wagon,
Connection tunnel drive General site equipment also applicable	Concrete deliveries (agitating)	1	99	80	BS5228-1: Table C.4, Item 19	Cement mixer truck (idling),
	Concrete deliveries (discharging)	1	103	20	BS5228-1: Table C.4, Item 18	Cement mixer truck (discharging),
	100t crawler crane	1	103	80	BS5228-1: Table C.4, Item 52	Tracked mobile crane, 105 t

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
during this phase	25t mobile crane	1	98	20	BS5228-1: Table C.4, Item 43	Wheeled mobile crane, 35 t
	Tunnel ventilation fans	1	90	100	Measured	Ventilation fans,
	25t excavator	1	105	50	BS5228-1: Table C.2, Item 19	Tracked excavator, 25 t
	400 cfm compressor	1	93	50	BS5228-1: Table C.5, Item 5	Compressor for hand-held pneumatic breaker, 1 t
	Waste collection via skip or tipper lorry	1	106	10	BS5228-1: Table C.8, Item 21	Skip wagon,
Shaft and connection tunnel secondary lining General site equipment also applicable during this phase	100t crawler crane	1	103	50	BS5228-1: Table C.4, Item 52	Tracked mobile crane, 105 t
	Service Crane 40T mobile Crane	1	98	25	BS5228-1: Table C.4, Item 43	Wheeled mobile crane, 35 t
	Fixed and portable concrete vibrators	4	106	20	BS5228-1: Table C.4, Item 33	Poker vibrator,
	Concrete deliveries (discharging)	1	103	20	BS5228-1: Table C.4, Item 19	Cement mixer truck (idling),
	Concrete pump	2	95	20	BS5228-1: Table C.4, Item 24	Concrete pump + cement mixer truck (discharging), 8 t / 350 bar
Culvert and chamber	Service crane - 100T mobile crane	1	99	50	BS5228-1: Table C.4, Item 41	Mobile telescopic crane, 100 t

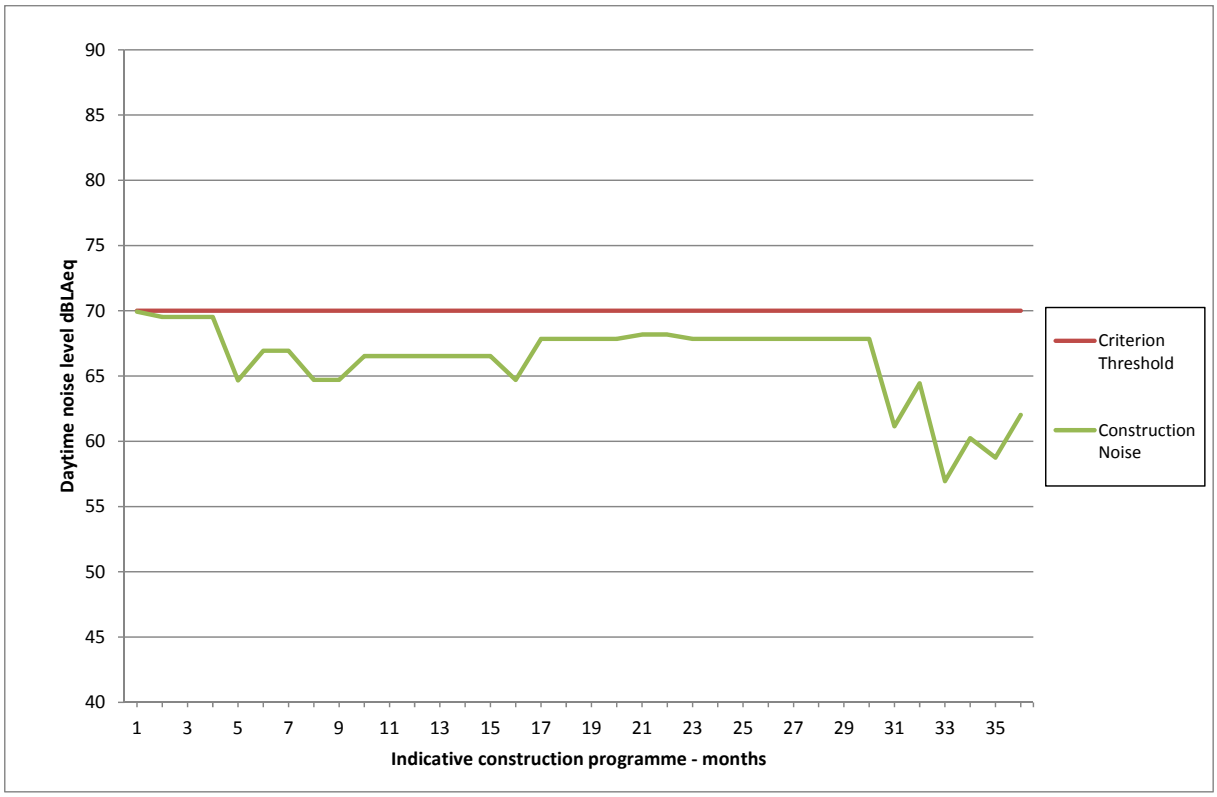
Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
works General site equipment also applicable during this phase	25t excavator	1	105	50	BS5228-1: Table C.2, Item 19	Tracked excavator, 25 t
	Dumper	1	104	50	BS5228-1: Table C.4, Item 3	Dumper, 7 t
	Concrete deliveries (discharging)	1	103	20	BS5228-1: Table C.4, Item 18	Cement mixer truck (discharging),
	Concrete boom pump	1	108	20	BS5228-1: Table C.4, Item 29	Truck mounted concrete pump + boom arm, 26 t
	Fixed and portable concrete vibrators	4	106	20	BS5228-1: Table C.4, Item 33	Poker vibrator,
Landscaping General site equipment NOT applicable during this phase	25t excavator	1	105	50	BS5228-1: Table C.2, Item 19	Tracked excavator, 25 t
	Dumper	1	104	70	BS5228-1: Table C.4, Item 3	Dumper, 7 t
	Telescopic Handler/FLT	1	99	30	BS5228-1: Table C.2, Item 35	Telescopic handler, 10 t
	Hiab lorry/crane	1	105	5	BS5228-1: Table C.4, Item 53	Lorry with lifting boom, 6 t
	Compressor for hand-held breaker	1	93	10	BS5228-1: Table C.5, Item 5	Compressor for hand-held pneumatic breaker, 1 t
	Hand-held percussive breaker	1	111	10	BS5228-1: Table C.1, Item 6	Hand-held pneumatic breaker,

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
	Plate compactors	2	108	10	BS5228-1: Table C.2, Item 41	Vibratory plate (petrol) ,
	Vibrating rollers	1	101	70	BS5228-1: Table C.2, Item 38	Roller, 18 t

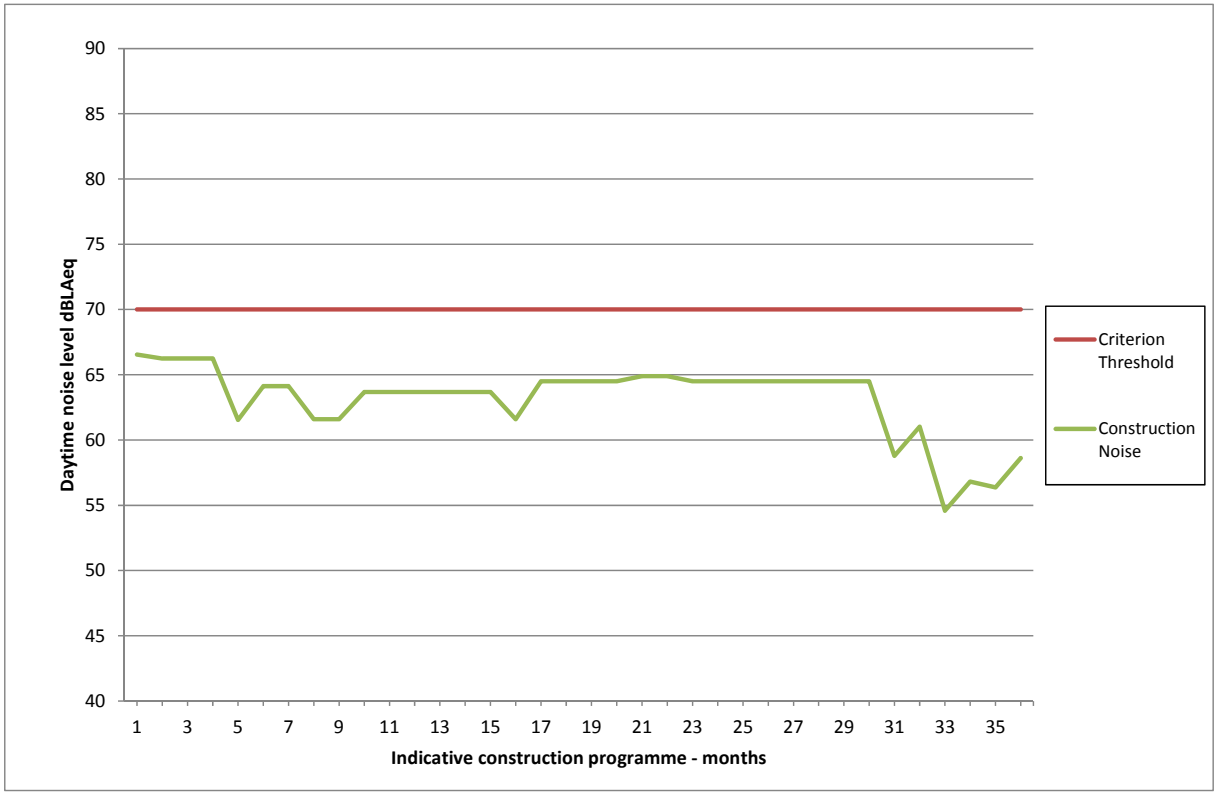
Note: This schedule provides an illustration of typical plant that could be used in the construction of the Thames Tideway Tunnel at this site. The appointed Contractor must comply with section 6 of the CoCP but may vary the method and plant to be used. This schedule therefore represents the most reasonable assumption for the assessment that can be made at this stage.

G.2.5 The predicted construction noise over time at each receptor is shown in the plates below. It should be noted that these representations are for the worst-case scenarios for noise exposure at the upper floors. For comparison with the construction noise, the plates also show either the potential significance criterion threshold for residential receptors, or the ambient noise level. This comparison is discussed in the main assessment text (see Vol 11 Section 9). The night-time noise levels have also been assessed for the short period of night-time works, these results are described in the main assessment text but not presented here.

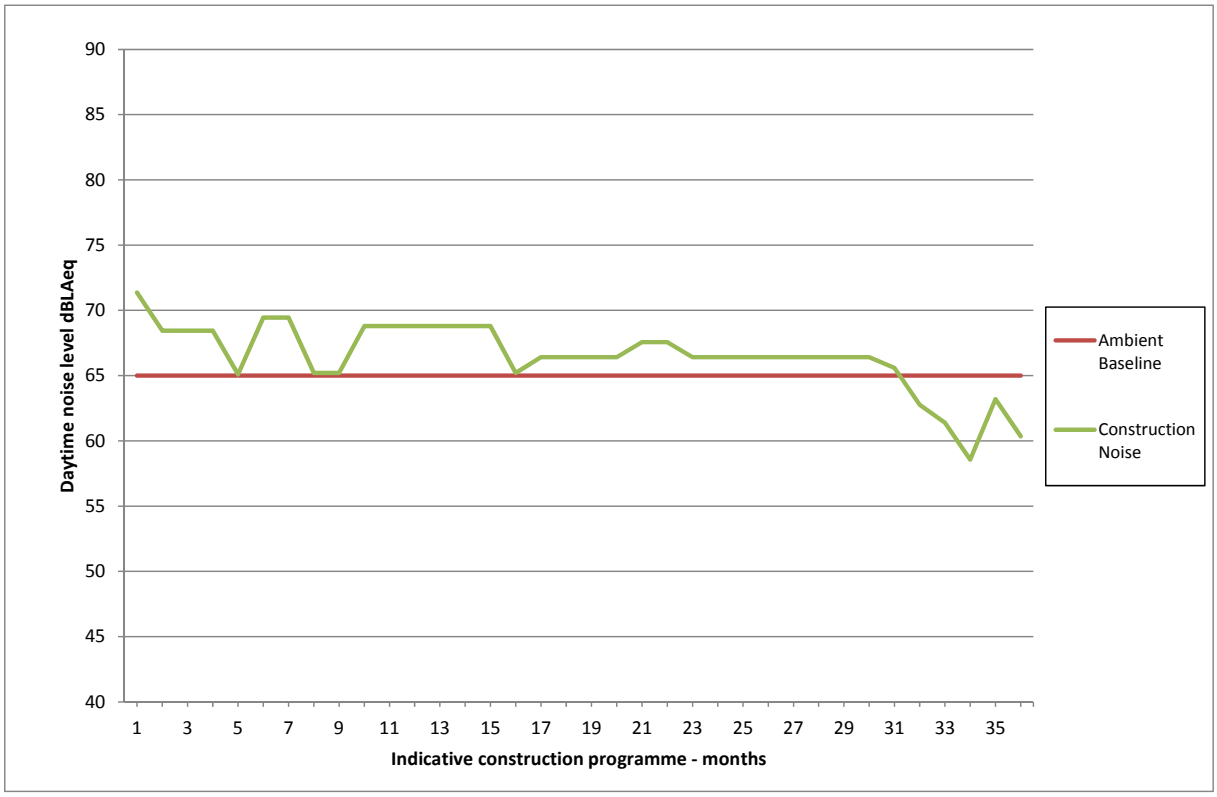
Vol 11 Plate G.5 Noise – Average monthly daytime noise level over duration of construction – Pennethorne House (FP1)



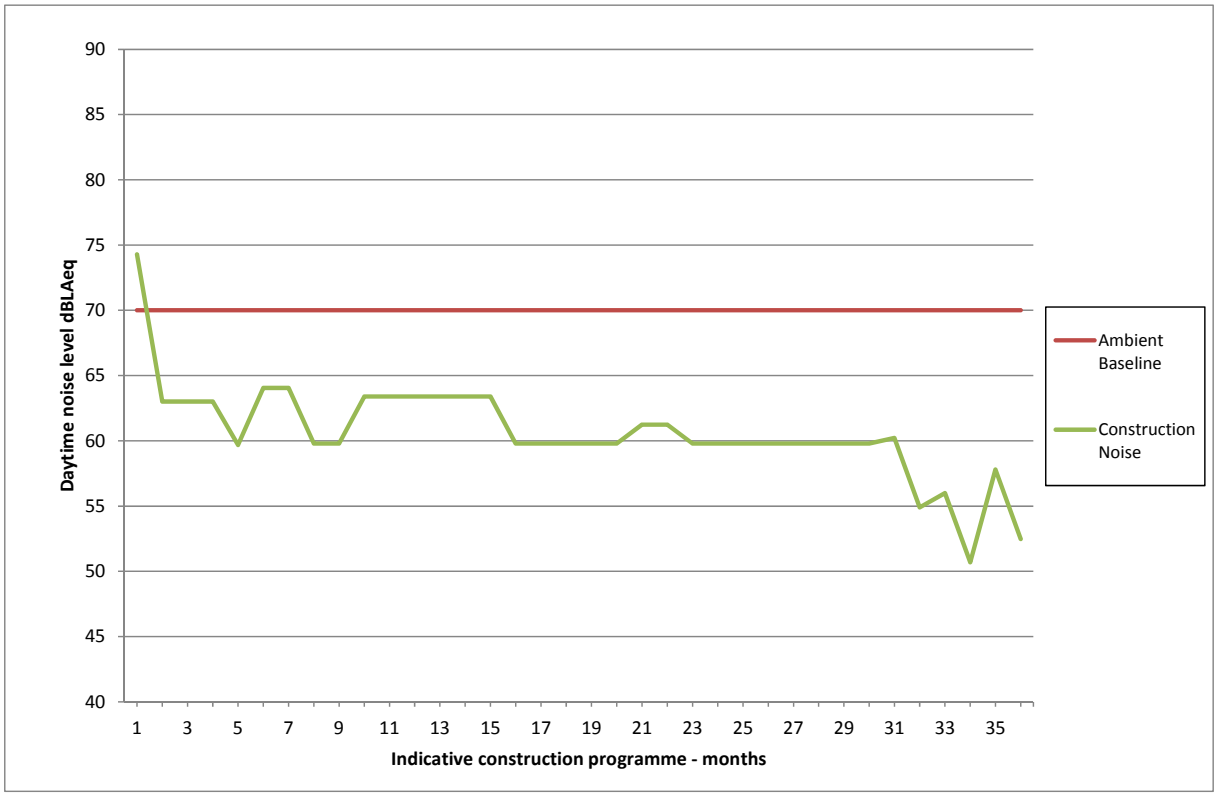
Vol 11 Plate G.6 Noise – Average monthly daytime noise level over duration of construction – Arthur Newton House (FP2)



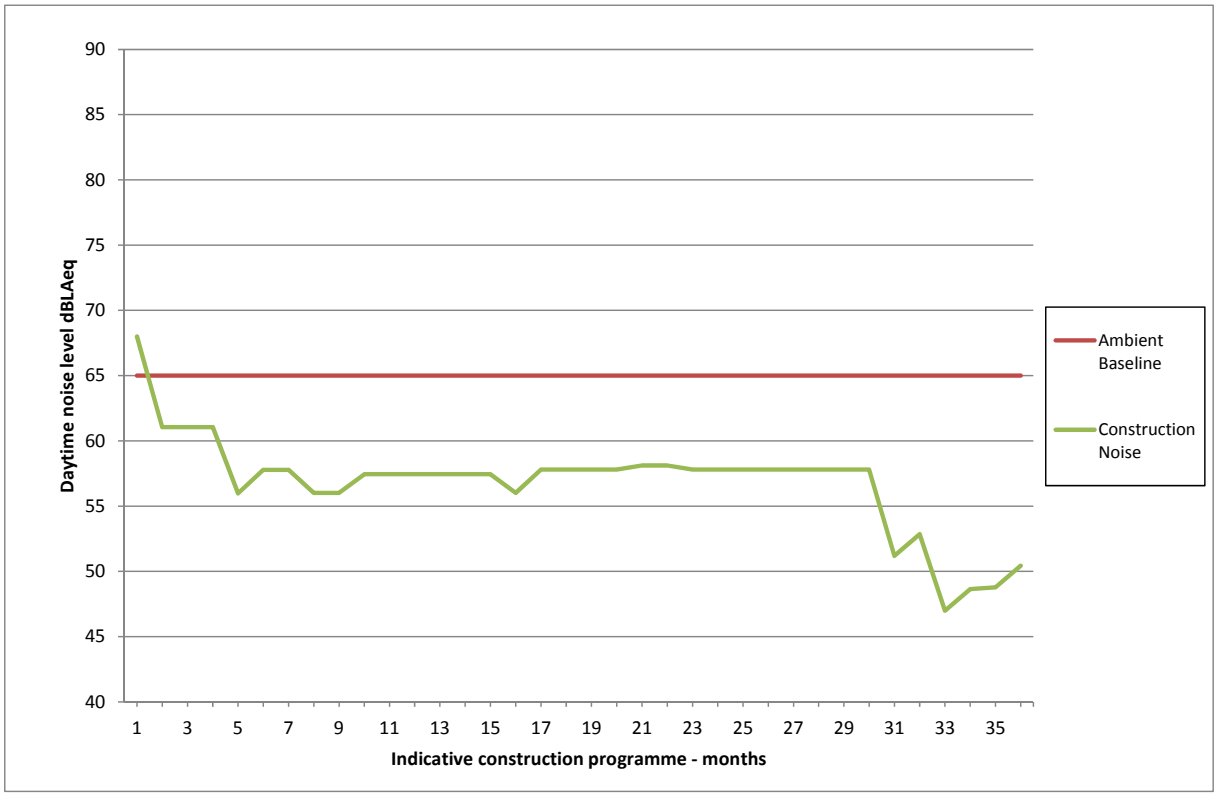
Vol 11 Plate G.7 Noise – Average monthly daytime noise level over duration of construction – York Gardens Community Centre and Library (FP3)



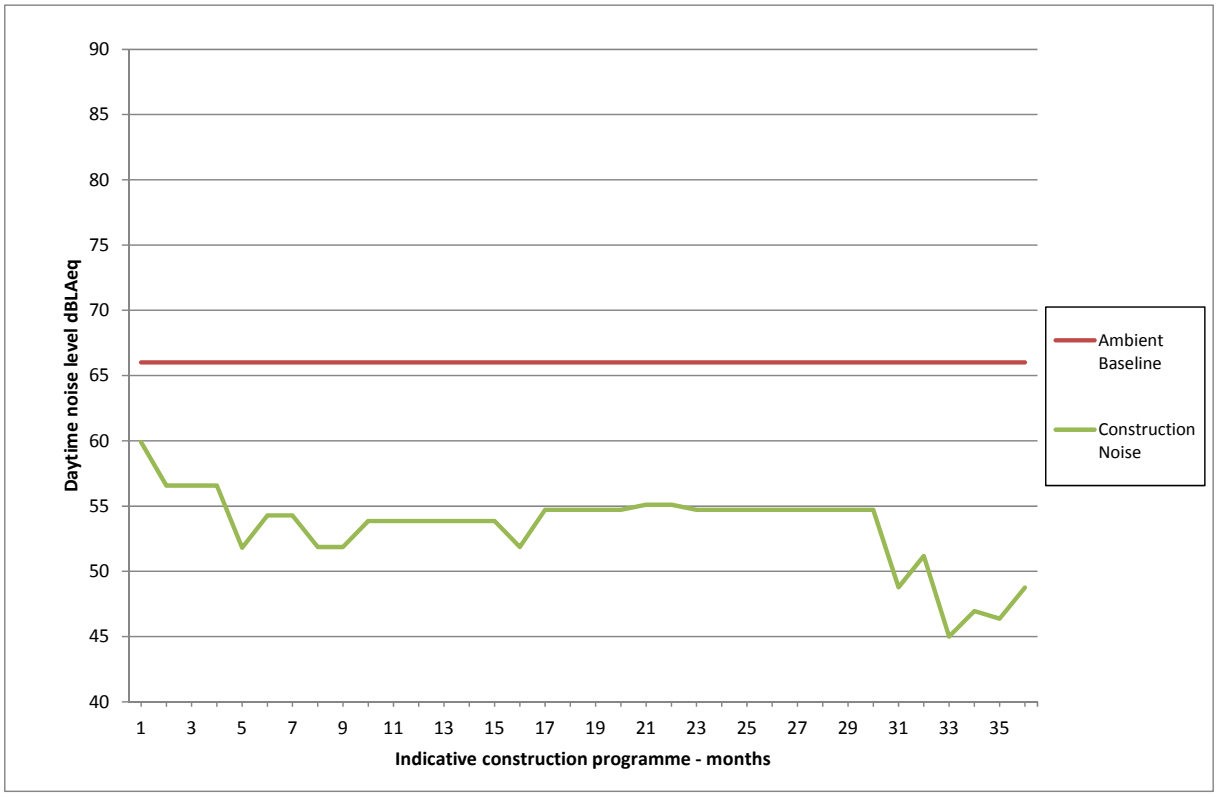
Vol 11 Plate G.8 Noise – Average monthly daytime noise level over duration of construction – Candle Maker (FP4)



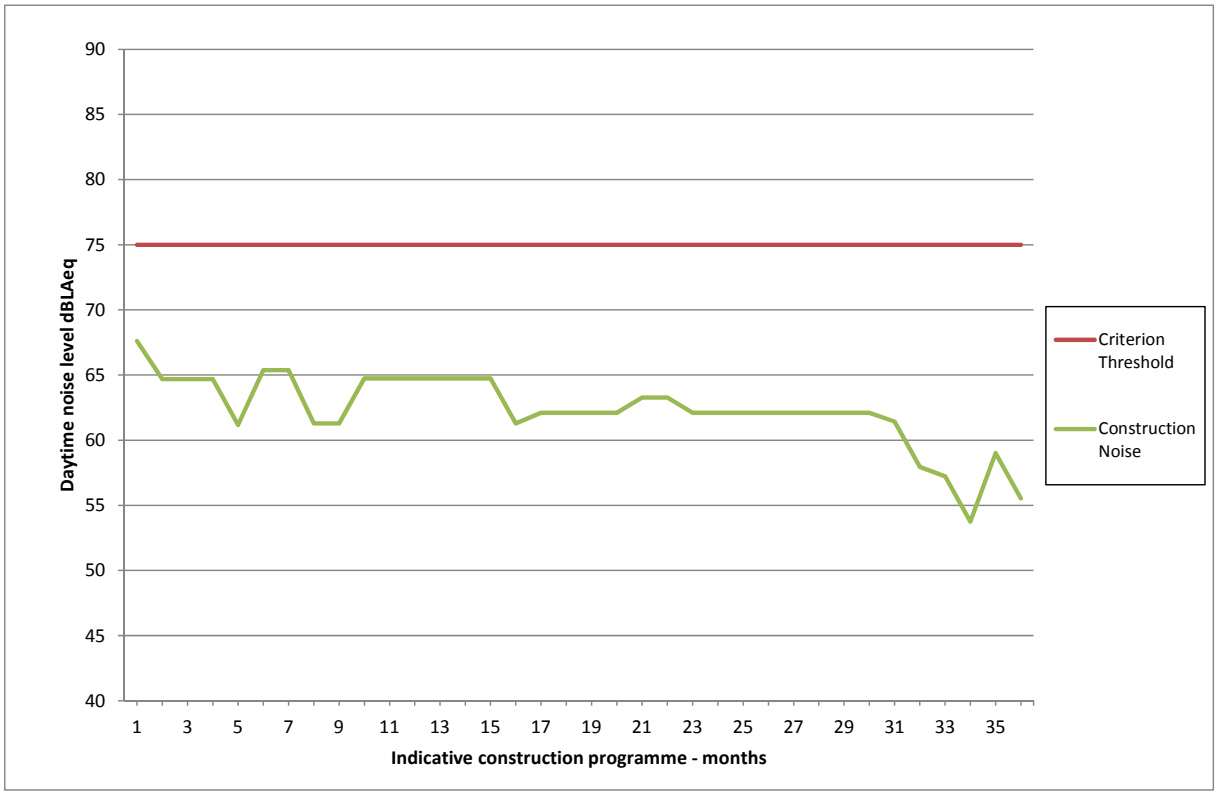
Vol 11 Plate G.9 Noise – Average monthly daytime noise level over duration of construction – Children's Centre and Adventure Playground (FP5)



Vol 11 Plate G.10 Noise – Average monthly daytime noise level over duration of construction – 20 Lavender Road Surgery (FP6)



Vol 11 Plate G.11 Noise – Average monthly daytime noise level over duration of construction –Candlemakers Apartments (FP7)



References

[1] British Standards Institution, *BS 5228 Code of Practice for Noise and Vibration Control on Open Construction Sites*, British Standards Institution (2009)

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix H: Socio-economics

APFP Regulations 2009: Regulation **5(2)(a)**

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Volume 11 Falconbrook Pumping Station appendices

Appendix H: Socio-economics

List of contents

Page number

List of tables

Page number

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Appendix H: Socio-economics

H.1 Baseline community profile

H.1.1 The community profile is based on both Output Area (OA) and local authority level data from the Office of National Statistics (ONS). The data have been obtained from four sources: Census 2001[1] (the last census for which data are available[i]), Department of Communities and Local Government Deprivation Indices 2010[2], London Public Health Observatory 2012[3], and the Network of Public Health Observatories 2011[4] (see Volume 2 Methodology). Data is grouped according to those 'protected characteristics'[ii] or groups which are relevant for consideration in relation to this socio-economic impact assessment. This baseline community profile provides context for this socio-economic assessment.

H.1.2 On the basis of likely impacts on receptors identified in this socio-economic assessment, the community profile examines the 'immediate area' surrounding the construction site (ie, within an assessment area of 250m), the 'wider local area' (ie, within an assessment area of 1km) and the overall borough level (which in this case is the London Borough [LB] of Wandsworth).

H.1.3 The main protected characteristic groups concentrated[iii] within 250m of the proposed construction site are:

a. persons aged under 16 years old
b. persons of Black and Mixed ethnicity
c. persons suffering from a long term or limiting illness or a disability
d. persons who do not own a car
e. persons suffering from income deprivation and overall deprivation.

H.1.4 The main protected characteristic groups concentrated within 1km of the site are:

a. persons of Black and Other ethnicity
b. persons suffering from a long term or limiting illness or a disability
c. persons who do not own a car
d. persons suffering from income deprivation and overall deprivation.

Resident population

H.1.5 The resident population was approximately 2,550 within 250m of the site and approximately 31,175 within 1km at the time of the last census.

[i] Census 2001. This type of data for the 2011 Census had not been released at the time of the assessment.

[ii] The Equalities Act 2010 defines 'protected characteristics' as: age, disability, gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex, and sexual orientation. Of these characteristics, age, disability, race and religion are relevant for consideration.

[iii] In this instance 'concentrated' refers to the occurrence of a particular protected characteristic group, the proportion of which is much higher than borough wide proportions.

Gender and age

H.1.6 Of the total population within 250m of the site 53.9% of residents are female, broadly in line with the proportion within 1km (52.6%), the LB Wandsworth (52.5%) and Greater London (51.6%) levels.

H.1.7 Vol 11 Table H.1 outlines age breakdown by assessment area, it illustrates that the proportion of under 16 year olds within 250m (23.5%) is much higher than the proportion of under 16 year olds within 1km (16.2%) and within LB of Wandsworth (16.3%), and is somewhat higher than the Greater London average (20.2%).

H.1.8 Within 250m and 1km, the proportion of over 65 year olds (8.7% and 9.1% respectively) is broadly in line with each other, and moderately lower than the Greater London average (12.4%).

Vol 11 Table H.1 Socio-economics – age breakdown by assessment area

Age group	Assessment area			
	Immediate area (250m)	Wider local area (1km)	Borough wide (LB of Wandsworth)	Greater London
Under 16 years old	23.5%	16.2%	16.3%	20.2%
Over 65 years old	8.7%	9.1%	10.4%	12.4%

Ethnicity

H.1.9 Vol 11 Table H.2 outlines ethnicity by assessment area, showing that within 250m of the site, White residents comprise over half of the population (54.2%), with Black and Minority Ethnic (BME) residents comprising the remaining 44.8%.

H.1.10 The proportion of White residents within 250m (54.2%) is moderately lower than within 1km (73.8%) and within Greater London (71.2%). The proportion of White residents within the LB of Wandsworth (78.0%) is considerably higher than within 250m (54.2%).

H.1.11 The proportion of Black residents within 250m (33.7%) is approximately twice as high as within 1km (16.3%) and higher still than the proportion of Black residents within the LB of Wandsworth and Greater London (9.6% and 10.9% respectively).

H.1.12 Within 1km, the proportion of Asian residents (3.8%) is somewhat lower than within 250m (5.5%). By contrast, the proportion of Asian residents within the LB of Wandsworth (7.0%) and Greater London level (12.1%) is considerably higher than within 1km (3.8%).

Vol 11 Table H.2 Socio-economics – ethnicity by assessment area

Ethnicity	Assessment area			
	Immediate area (250m)	Wider local area (1km)	Borough wide (LB of Wandsworth)	Greater London
White	54.2%	73.8%	78.0%	71.2%
BME	44.8%	26.2%	22.1%	28.8%
Asian	5.5%	3.8%	7.0%	12.1%
Black	33.7%	16.3%	9.6%	10.9%
Other	2.1%	2.2%	2.1%	2.7%
Mixed	4.5%	3.9%	3.4%	3.2%

Note: The figure for BME data presented in Vol 11 Table H.2 is the sum of data for Asian, Black, Other and Mixed ethnicities.

Religion and belief

H.1.13 Within 250m and 1km of the site and at a borough wide level, people identifying as Christians make up the largest religious grouping at 60.3%, 63.8% and 61.8% of the population respectively. The proportion of Christians within the above assessment areas is slightly higher than the Greater London average (58.2%). Muslims are the second largest religious grouping accounting for 6.9% of residents within 250m, 4.8% within 1km and 5.2% of residents within the LB of Wandsworth. The proportion of Muslims within the above assessment areas is somewhat lower than the Greater London average (8.5%).

H.1.14 Within 250m, 30.9% of residents do not follow or state a religion, broadly in line with the proportion that live within 1km (29.3%) and slightly higher than the Greater London average (24.3%).

Health indicators

H.1.15 Vol 11 Table H.3 outlines health indicators by assessment area, noting that within 250m of the site, those residents suffering from a long term or limiting illness (15.9%) is broadly in line with the Greater London level (15.5%), slightly higher than for those residents within 1km (14.1%) and higher still than those residents within the LB of Wandsworth (13.4%). The proportion of residents who claim disability living allowance within 250m (6.6%) is almost twice as high as the proportion within the LB of Wandsworth (3.9%) and moderately higher than within 1km (4.9%) and Greater London (4.5%).

Vol 11 Table H.3 Socio-economics – health indicators by assessment area

Health indicator	Assessment area			
	Immediate area (250m)	Wider local are (1km)	Borough wide (LB of Wandsworth)	Greater London
Long term limiting sick	16.5%	14.1%	13.4%	15.5%
Disability living allowance	6.7%	4.8%	3.9%	4.5%

H.1.16 In the Middle Layer Super Output Area (MSOA)[iv] (Office of National Statistics, 2012)[5] in which the site is located, adult obesity falls in the second highest quintile (ie, the highest being the worst) relative to Greater London. Levels of child obesity fall within the middle quintile relative to Greater London.

H.1.17 In terms of the rates of adults undertaking physical activity, as measured borough wide, LB of Wandsworth ranks within the highest quintile (ie, the highest being the best) relative to Greater London. By contrast, the proportion of children undertaking physical activity falls within the lowest quintile, relative to Greater London.

H.1.18 Deaths caused by respiratory disease within the MSOA in which the site is located are in the lowest quintile (ie, the lowest being the best) relative to Greater London; however the site borders on an MSOA which ranks in the highest quintile for death rates from respiratory disease relative to Greater London. Deaths caused by stroke fall within the middle quintile relative to Greater London. Deaths caused by heart disease and cancer fall within the second highest quintile and death caused by circulatory disease fall within the highest quintile, again relative to Greater London.

H.1.19 Male and female life expectancy rates within the MSOA in which the site is located are both within the lowest quintile (ie, the lowest being the worst) relative to Greater London. Average life expectancy for both male and female residents is 74.6 to 80.3 years old.

Lifestyle and deprivation indicators

H.1.20 Vol 11 Table H.4 outlines lifestyle and income deprivation indicators by assessment area, showing that within 250m of the site, 56.8% of all households do not own cars, much higher than the Greater London average (37.5%). Within 1km, the proportion of households that do not own cars (47.4%) is somewhat higher than the Greater London average.

[iv] MSOAs are areas determined by the Office of National Statistics (ONS) to collect local area statistics. MSOAs have a minimum size of 5,000 residents and 2,000 households. MSOAs have an average population size of 7,200 residents.

H.1.21 The incidence of income deprivation[v] within 250m (79.0%) is proportionately twice as high as that within 1km (41.3%) and considerably higher than the LB of Wandsworth (15.4%) and Greater London averages (30.8%). Similarly, overall deprivation within 250m (79.0%) is considerably higher than within 1km (28.3%), the LB of Wandsworth (10.1%) and the Greater London (24.5%) level. Within the LB of Wandsworth, the incidence of income and overall deprivation is considerably lower than in all of the above assessment areas, comparing favourably with the Greater London average.

Vol 11 Table H.4 Socio-economics – lifestyle and income deprivation levels by assessment area

Indicator	Assessment area			
	Immediate area (250m)	Wider local area (1km)	Borough wide (LB of Wandsworth)	Greater London
No car households	56.8%	47.4%	40.7%	37.5%
Income	79.0%	41.3%	15.4%	30.8%
Overall	79.0%	28.3%	10.1%	24.5%

v Income deprivation and overall deprivation in this instance both refer to the percentage of the population which fall within the top 20% of deprived areas nationally. Percentages therefore refer to the proportion of residents within each assessment area who fall within the highest quintile of deprivation within England.

H.2 Baseline economic profile

H.2.1 This section presents a profile of the economy local to the proposed construction site at Falconbrook Pumping Station.

H.2.2 Data are presented for the geographical area within a radius or 'catchment' of approximately 250m from the boundary of the Limits of land to be acquired or used (LLAU) of the project site. Data are also provided at the overall borough level (which in this case is the London Borough [LB] of Wandsworth) and for Greater London.

H.2.3 Data are sourced from Experian's National Business Database (2012)[6] which draws primarily on regularly updated records from Companies House[vi].

Employment and businesses

H.2.4 Within approximately 250m of the site there are approximately 2,900 jobs.[vii] Vol 11 Table H.5[viii] below illustrates the breakdown of employment by sector based on the UK Standard Industrial Classification (SIC) 2007[7]. It presents data for those sectors which account for more than 5% of total employment within 250m. It can be seen that:

a. Accommodation and Food Service Activities account for 22% of employment within 250m, more than double that within both the LB of Wandsworth (9%) and Greater London (8%).

b. Wholesale and Retail Trade / Repair of Motor Vehicles and Motorcycles accounts for 17% of employment within 250m, somewhat more than within the LB of Wandsworth (14%) and slightly more than within Greater London (16%).

c. Professional, Scientific and Technical Activities account for 8% of employment within 250m, slightly less than within the LB of Wandsworth (9%) and somewhat less than within Greater London (11%).

d. Real Estate Activities account for 7% of employment within 250m of the site, more than double that within the LB of Wandsworth and Greater London (both 3%).

e. Construction accounts for 7% of employment within 250m, considerably more than within the LB of Wandsworth (4%) and somewhat more than within Greater London (5%).

f. Information and Communication accounts for 5% to 7% of employment at all three geographical levels.

[vi] Information on employees and businesses reflects aggregated data for seven digit post-code units falling wholly or partially within a 250m boundary of the LLAU. This includes post code units on the opposite side of the River Thames, if relevant. Please refer to Volume 2 Appendix H for further details.

[vii] Employees data reflect a head count of workers on-site rather than Full Time Equivalent (FTE) jobs . While employee figures are mostly based on actual reported data, a proportion is based on modelled data.

[viii] Data in tables rounded to nearest whole percentage and do not always sum due to rounding.

g. Administrative and Support Service Activities account for 6% of employment within 250m, somewhat less than within both the LB of Wandsworth and Greater London (both 8%).

h. Transportation and Storage accounts for 3% to 5% of employment at all three geographical levels.

Vol 11 Table H.5 Socio-economics – employment by top eight sectors (2012)

	Assessment area		
Sector (Standard Industrial Code 2007)	**Immediate area (250m)**	**Borough wide (LB of Wandsworth)**	**Greater London**
Accommodation and Food Service Activities	22%	9%	8%
Wholesale and Retail Trade / Repair of Motor Vehicles and Motorcycles	17%	14%	16%
Professional, Scientific and Technical Activities	8%	9%	11%
Real Estate Activities	7%	3%	3%
Construction	7%	4%	5%
Information and Communication	6%	5%	7%
Administrative and Support Service Activities	6%	8%	8%
Transportation and Storage	5%	3%	4%
Other (including unclassified)	23%	45%	39%

H.2.5 Within approximately 250m of the site there are approximately 400 businesses (defined here as business locations[ix]). The split of businesses by sector within 250m differs slightly from the breakdown of employment by sector as set out within Vol 11 Table H.5. Whilst the Accommodation and Food Service Activities sector represents the highest employment level, it accounts for a relatively low proportion of the total number of business locations within 250m (4%). A relatively high proportion of businesses within 250m are engaged in Professional, Scientific and Technical Activities (11%), Real Estate Activities (10%), Administrative and Support Service Activities (9%), Information and Communication (8%). However, Wholesale and Retail Trade / Repair of Motor Vehicles and Motorcycles only accounts for 5% of businesses, despite generating 17% of employment.

[ix] This count relates to business 'locations' or 'units'; an enterprise may have a number of business locations / units. It includes private sector, public sector and voluntary sector / charitable entities.

H.2.6 Vol 11 Table H.6 illustrates the size of businesses in terms of the number of employees at each business location / unit. At all geographical levels, businesses within the smallest size band (1 to 9 employees) account for the greatest proportion. Within approximately 250m of the site, 85% of business units have 1 to 9 employees, compared to 90% within the LB of Wandsworth and 88% within Greater London. Within 250m there are somewhat more businesses employing 10 to 24 employees (11%) when compared to the LB of Wandsworth (7%) and Greater London (8%).

H.2.7 For the sectors accounting for the greatest proportion of businesses within approximately 250m, the size banding profile of businesses is generally similar. Within the Professional, Scientific and Technical Activities sector 87% of businesses employ one to nine employees, comparable to both Real Estate Activities and Administrative and Support Service Activities businesses of this size (91% and 89% respectively). Across all three sectors, 9% to 11% of firms employ ten to 24 employees which is comparable to the average across all sectors (11%).

Vol 11 Table H.6 Socio-economics – businesses by size band (number of employees)

Assessment area / sector	Size band (number of employees)					
	1-9	10-24	25-49	50-99	100-249	250+
Immediate area (250m)	85%	11%	3%	0%	0%	0%
Professional, Scientific and Technical Activities	87%	11%	2%	0%	0%	0%
Real Estate Activities	91%	9%	0%	0%	0%	0%
Administrative and Support Service Activities	89%	9%	3%	0%	0%	0%
Borough wide (LB of Wandsworth)	90%	7%	2%	1%	0%	0%
Greater London	88%	8%	2%	1%	1%	0%

H.3 Baseline usage surveys

H.3.1 Please refer to Vol 2 Appendix H for details on the methodology used for the open space usage surveys and subsequent analysis.

Survey dates and times

H.3.2 Surveys were undertaken within the neighbouring York Gardens open space, as follows.

Summer

a. Tuesday 7th August 2011, 7am to 1pm (partly sunny, 16 to 20^{O}C).

b. Tuesday 14th August 2011, 1pm to 7pm (cloudy with sunny spells, 19^{O}C).

c. Saturday 27th August 2011, 10am to 4pm (sunshine and showers, 17^{O}C).

d. Monday 28th May 2012, 2pm to 5pm (sunny, 26^{O}C).

e. Sunday 22nd July 2012, 2pm to 5pm (sunny, 23^{O}C).

Autumn

f. Friday 7th October 2011, 7.30am to 10.30am (cloudy, 9^{O}C) and 1pm to 4pm (cloudy, 11^{O}C).

g. Saturday 22nd October 2011, 10am to 3pm (sunny, 12^{O}C).

Survey zones

H.3.3 Vol 11 Figure H.1 (see separate volume of figures) shows the location of the survey areas listed in Vol 11 Table H.7 below.

Vol 11 Table H.7 Socio-economics – survey zones and duration of survey period

Name	Location	Survey times	Frequency
Survey zone 1	Northern lawn area	10 minutes (15 minutes on Saturday 22nd October)	Hourly
Survey zone 2	Playground (unsupervised)	15 minutes	Hourly
Survey zone 3	Central seating area and paths	15 minutes (10 minutes on Friday 7th October 1pm to 4pm)	Hourly
Survey zone 4	Southern lawn area and paths	15 minutes	Hourly
Survey zone 5	Adventure playground	Moment in time observations	Hourly

Site specific considerations

H.3.4 The survey on Tuesday 7th August 2011 was conducted the morning after the Monday night riots in London. As conditions were quiet, the decision was taken during the morning to complete the afternoon survey (scheduled for 1pm to 7pm) on a different date, which then took place on Wednesday 15th August 2011.

H.3.5 On Saturday 27th August 2011, the survey was interrupted by two short rain showers lasting approximately 10 minutes each in duration. There were sunny intervals during the remainder of the day.

Key findings and observations

Survey zone 1 – northern lawn area

H.3.6 This zone was generally lightly used. Average usage was highest during the 2012 weekday summer afternoon survey when on average 84 users per hour were recorded. Seating along the pathway was used on only six occasions during the surveys.

H.3.7 The pathways were noted as being thoroughfares to and from the remainder of the park and its facilities, including the adjacent playground, as well as the housing estate to the east.

H.3.8 See Vol 11 Table H.8 and Vol 11 Table H.9 below for further details.

Vol 11 Table H.8 Socio-economics – average usage levels and type of use at survey zone 1

	Time of survey	Average number of users during observation period					Estimated number of users per hour
		Walkers	Joggers	Dog walkers	Cyclists	Other recreation (passive unless stated)	
Summer							
Tuesday 7th August 2011	07:00 - 13:00	4	-	-	-	-	24
Tuesday 14th August 2011	13:00 - 19:00	4	-	1	1	1	42
Saturday 27th August 2011	11:00 - 17:00	4	-	1	-	-	30
Monday 28th May 2012	14:00 - 17:00	7	-	-	1	6	84
Sunday 22nd July 2012	14:00 - 17:00	5	-	-	-	7	72
Autumn							
Friday 7th October 2011 AM	07:30 - 10:30	2	-	1	1	-	24
Friday 7th October 2011 PM	13:00 - 16:00	1		1	-	-	12
Saturday 22nd October 2011	10:00 - 15:00	2	-	2	1	-	30

Vol 11 Table H.9 Socio-economics – demographic characteristics at survey zone 1

Date	Time of survey	Age (number of users)			Gender (approximate %)		Ethnicity (approximate %)			
		Children 0-17	Young Adults 18-39	Older Adults 40+	M	F	Black	E. Asian	S. Asian	White
Summer										
Tuesday 7th August 2011	07:10 - 07:20	-	7	-	57	43	-	-	57	43
	08:10 - 08:20	-	1	-	100	-	-	-	100	-
	09:10 - 09:20	-	5	2	71	29	86	-	-	14
	10:10 - 10:20	2	-	-	50	50	100	-	-	-
	11:10 - 11:20	-	2	2	50	50	100	-	-	-
	12:10 - 12:20	-	3	2	60	40	80	-	-	20
Tuesday 14th August 2011	13:00 - 13:10	1	8	1	50	50	50	-	-	50
	14:00 - 14:10	1	-	1	100	-	50	-	-	50
	15:00 - 15:10	-	5	1	33	67	67	-	-	33
	16:00 - 16:10	2	2	2	33	67	67	-	-	33
	17:00 - 17:10	-	2	1	67	33	-	-	-	100
	18:00 - 18:10	5	6	-	27	73	45	-	-	55
Saturday 27th August 2011	11:00 - 11:10	2	1	-	33	67	-	-	-	100
	12:00 - 12:10	2	3	-	60	40	60	-	20	20
	13:00 - 13:10	3	3	-	50	50	50	-	-	50
	14:00 - 14:10	4	2	-	50	50	-	-	-	100
	15:00 - 15:10	1	1	-	100	-	100	-	-	-
	16:00 - 16:10	8	5	-	54	46	8	-	8	85
Monday 28th May 2012	14:00 - 14:10	2	10	2	57	43	85	-	-	15
	15:00 - 15:10	-	12	-	50	50	50	-	-	50
	16:00 -	6	11	2	75	25	67	-	-	33

Date	Time of survey	Age (number of users)			Gender (approximate %)		Ethnicity (approximate %)			
		Children 0-17	Young Adults 18-39	Older Adults 40+	M	F	Black	E. Asian	S. Asian	White
	16:10									
Sunday 22nd July 2012	14:00 - 14:10	-	-	3	-	100	-	-	-	100
	15:00 - 15:10	6	-	-	11	89	100	-	-	-
	16:00 - 16:10	-	4	-	50	50	-	-	25	75
Autumn										
Friday 7th October 2011 AM	07:30 - 07:40	-	1	1	100	-	-	-	-	100
	08:30 - 08:40	-	6	-	50	50	50	-	-	-
	09:30 - 09:40	-	2	-	100	-	-	-	50	50
Friday 7th October 2011 PM	13:00 - 13:10	-	3	-	67	33	-	-	-	100
	14:00 - 14:10	-	3	-	33	67	100	-	-	-
	15:00 - 15:10	-	1	-	100	-	100	-	-	-
Saturday 22nd October 2011	10:00 - 10:15	1	5	2	63	37	12	-	25	63
	11:00 - 11:15	-	5	-	80	20	40	-	20	40
	12:00 - 12:15	-	-	-	-	-	-	-	-	-
	13:00 - 13:15	3	3	7	67	33	15	-	-	85
	14:00 - 14:15	1	1	1	33	67	-	-	-	100

Survey zone 2 – playground (unsupervised)

H.3.9 The publicly accessible playground was used intermittently by relatively low numbers of users, who were typically pre-school (0 to 4 years old) or primary (5 to 11 years old) aged children accompanied by parents or carers. The majority of users recorded were Black.

H.3.10 Usage was at its highest during the weekday summer school holiday afternoon survey (Tuesday 14th August) when 22 children were recorded during one period.

H.3.11 See Vol 11 Table H.10 for further details on the use of the playground.

Vol 11 Table H.10 Socio-economics – usage level and demographic characteristics at survey zone 2

Date	Time of survey	Age (number of playground users)		Gender (approximate %)		Ethnicity (approximate %)			
		Children*	Adults	M	F	Black	E. Asian	S. Asian	White
Summer									
Tuesday 7th August 2011	07:20 – 07:35	Playground was not open on this day until 10am							
	08:20 - 08:35								
	09:20 - 09:35								
	10:20 - 10:35	1	1	50	50	-	-	-	100
	11:20 - 11:35	7	6	46	54	54	-	-	46
	12:20 - 12:35	9	3	67	33	50	-	-	50
Tuesday 14th August 2011	13:10 - 13:25	12	2	71	29	57	-	-	43
	14:10 - 14:25	15	2	65	35	70	-	-	30
	15:10 - 15:25	2	4	67	33	83	-	-	17
	16:10 - 16:25	22	2	67	33	88	-	-	12
	17:10 - 17:25	14	5	89	11	79	-	-	21
	18:10 - 18:25	17	3	70	30	75	-	-	25
Saturday 27th August 2011	11:10 - 11:25	1	3	50	50	75	-	-	25
	12:10 - 12:25	-	-	-	-	-	-	-	-
	13:10 - 13:25	6	2	63	37	50	-	50	-
	14:10 - 14:25	2	2	25	75	-	-	-	100
	15:10 - 15:25	2	3	40	60	60	-	40	-
	16:10 - 16:25	10	4	50	50	71	-	-	29
Monday 28th May 2012	14:10 - 14:25	1	1	50	50	-	-	-	100
	15:10 - 15:25	1	1	50	50	100	-	-	-
	16:10 - 16:25	5	1	67	33	100	-	-	-
Sunday 22nd July 2012	14:10 - 14:25	4	-	100	-	50	-	-	50
	15:10 - 15:25	2	1	33	67	78	-	-	22
	16:10 - 16:25	7	4	55	45	50	-	-	50
Autumn									
Friday 7th October 2011 AM	07:45 - 08:00	2	-	100	0	100	-	-	-
	08:45 - 09:00	-	-	-	-	-	-	-	-
	09:45 - 10:00	-	-	-	-	-	-	-	-
Friday 7th October 2011 PM	13:10 - 13:25	-	-	-	-	-	-	-	-
	14:10 - 14:25	1	1	100	-	-	100	-	-
	15:10 - 15:25	-	-	-	-	-	-	-	-
Saturday 22nd October 2011	10:10 - 10:25	-	1	100	-	100	-	0	-
	11:10 - 11:25	3	1	50	50	-	-	100	
	12:10 - 12:25	3	1	-	100	-	-	100	-
	13:10 - 13:25	6	3	33	67	22	-	56	22
	14:10 - 14:25	-	-	-	-	-	-	-	-

** The majority of children were aged 0-11, with play equipment largely only suitable for children of this age*

Survey zone 3 – central seating area and path

H.3.12 The path was recorded to be well used, particularly as a thoroughfare to and from York Road to the west and the housing area to the east. The pathway was busiest in early mornings (8 to 9pm), lunchtimes (12 to 2pm) and late afternoons (5 to 7pm).

H.3.13 The majority of users of the seating area were either White or Black (together accounting for over 80% of users over all surveys) and were mostly young adults (18 to 39 years old). See Vol 11 Table H.11 for further details.

Vol 11 Table H.11 Socio-economics – usage level and type of user at survey zone 3

Date	Time of survey	Number of users traversing through				Estimated total number of users p/hr*	Other recreation (sitting unless stated)
		Walkers	Joggers	Dog walkers	Cyclists		
Summer							
Tuesday 7th August 2011	07:35 - 07:50	8	-	3	-	44	-
	08:35 - 08:50	28	-	4	2	136	-
	09:35 - 09:50	8	-	3	2	52	-
	10:35 - 10:50	9	-	1	1	44	3 (active – informal)
	11:35 - 11:50	11	-	-	-	44	1
	12:35 - 12:50	11	-	2	1	56	1
Tuesday 14th August 2011	13:30 - 13:45	15	-	-	-	60	11
	14:30 - 14:45	19	-	-	1	80	4
	15:30 - 15:45	10	-	-	3	52	9
	16:30 - 16:45	6	-	-	4	40	3
	17:30 - 17:45	14	-	-	1	60	3
	18:30 - 18:45	6	-	-	4	40	1
Saturday 27th August 2011	11:35 - 11:45	6	-	-	1	28	1
	12:35 - 12:45	21	1	2	-	96	1
	13:35 - 13:45	26	-	3	-	116	-
	14:35 - 14:45	19	-	4	2	100	3
	15:35 - 15:45	17	-	-	2	76	3
	16:35 - 16:45	12	-	1	1	56	12
Monday 28th May 2012	14:25 - 14:40	17	-	-	-	68	3
	15:25 - 15:40	23	-	-	-	92	12
	16:25 - 16:40	9	-	-	1	40	6
Sunday 22nd July 2012	14:25 - 14:40	10	-	-	-	40	9
	15:25 - 15:40	15	-	-	3	72	8
	16:25 - 16:40	12	-	1	2	60	12
Autumn							
Friday 7th October 2011 AM	08:00 - 08:15	10	-	-	1	44	1
	09:00 - 09:15	16	-	-	-	64	-
	10:00 - 10:15	8	-	-	-	32	-
Friday 7th October 2011 PM	13:30 - 13:40	8	-	-	-	48	1
	14:30 - 14:40	9	-	-	-	54	-
	15:30 - 15:40	-	-	-	6	36	-
Saturday 22nd October 2011	10:30 - 10:45	7	-	-	1	32	-
	11:30 - 11:45	15	-	-	-	60	1
	12:30 - 12:45	7	-	-	3	40	-
	13:30 - 13:45	8	-	-	3	44	4
	14:30 - 14:45	7	-	-	-	28	3

Survey zone 4 – southern lawn area and paths

H.3.14 This zone was generally moderately used. Seating along the pathways experienced low levels of usage in both the summer (averaging 6 users in afternoon observation periods) and autumn.

H.3.15 Observations show that the lawn area was used for seating on only two occasions. The gym and exercise equipment was used occasionally, by young adults, peaking at two users in a period on the summer weekday.

H.3.16 The pathway running east to west across the south of the lawn experienced medium to high levels of usage. A peak in user numbers was evident during the early morning and late afternoon / evening as commuters and small groups of older school children passed through. The two pathways running north to south were used more intermittently.

H.3.17 The majority of users of the lawn area were Black, with path users being of a more varied ethnic mix.

H.3.18 See Vol 11 Table H.12 for further details.

Vol 11 Table H.12 Socio-economics – average usage level and type of user at survey zone 4

Date	Time of survey	Average number of users during 10 minute observation periods						Estimated number of users per hour**
		Walkers	Joggers	Dog walkers	Cyclists	Active recreation	Other recreation*	
Summer								
Tuesday 7th August 2011	07:00 - 13:00	23	-	-	1	1	1	144
Tuesday 14th August 2011	13:00 - 19:00	18	-	1	1	1	6	120
Saturday 27th August 2011	11:00 - 17:00	13	-	2	1	-	3	96
Monday 28th May 2012	14:00 - 17:00	11	-	-	1	-	10	66
Sunday 22nd July 2012	14:00 - 17:00	13	-	6	3	3	14	132
Autumn								
Friday 7th October 2011 AM	07:30 - 10:30	24	-	1	2	-	1	162
Friday 7th October 2011 PM	13:00 - 16:00	11	-	-	2	-	2	78
Saturday 22nd October 2011	10:00 - 15:00	9	-	1	-	-	2	60

** Sitting on benches*

*** Walkers, joggers, dog walkers and cyclists*

Survey zone 5 – adventure playground

H.3.19 Although usage surveys of York Gardens included counts of users of the managed adventure playground, the facility is fenced off and it was therefore not possible to accurately assess levels of usage at all times during the survey.

H.3.20 The facility did however appear to be well used during the summer holiday afternoon survey periods. The facility was closed during the autumn weekend survey period.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix I: Townscape and visual

APFP Regulations 2009: Regulation **5(2)(a)**

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Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix I: Townscape and visual

List of contents

Page number

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Appendix I: Townscape and visual

I.1 Introduction

I.1.1 Construction and operational effects assessments at this site for this topic do not require the provision of any supporting information, so this appendix is intentionally empty.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

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Appendix J: Transport

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Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix J: Transport

List of contents

Page number

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Appendix J: Transport

J.1 Introduction

J.1.1 Construction and operational effects assessments at this site for this topic do not require the provision of any supporting information, so this appendix is intentionally empty.

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Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

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Appendix K: Water resources - groundwater

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Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix K: Water resources – groundwater

List of contents

Page number

List of tables

Page number

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Appendix K: Water resources – groundwater

K.1 Geology

K.1.1 A summary of the anticipated geological succession at the Falconbrook Pumping Station site is shown in Vol 11 Table K.1.

Vol 11 Table K.1 Groundwater – anticipated geological succession

Period	Series	Group	Formation
Quaternary	Holocene	Superficial deposits	Made ground
			Alluvium
	Pleistocene		River Terrace Deposits
Palaeogene	Eocene	Thames	London Clay

K.1.2 The superficial and solid geology in the vicinity of the site, as published by the British Geological Survey (BGS) (British Geological Survey, 2009)[1], is shown in Vol 11 Figure 13.4.1 and Vol 11 Figure 13.4.2 respectively (see separate volume of figures).

K.1.3 The ground investigation undertaken for the Thames Tideway Tunnel project has involved drilling boreholes both on the banks and within the main river channel for the purposes of understanding the geology and hydrogeology within the assessment area. The depths and thicknesses of geological layers are based on ground investigation boreholes drilled in the vicinity of the site; these are boreholes SA1099A, SR1099C, PR1099D and PR1100D, located at approximately 60m to the northwest. In addition, two overwater boreholes SR2079 and SR2080, located 250m to the northwest of the site, have been used to assess the lateral continuity of the site geology. The locations of boreholes around the site are shown in Vol 11 Figure 13.4.1 (see separate volume of figures). The depths and thicknesses of geological layers encountered at this site are summarised in Vol 11 Table K.2.

Vol 11 Table K.2 Groundwater – anticipated ground conditions

Formation	Top elevation* (mATD)**	Depth below ground level (m)	Thickness (m)
Made ground	104.49	0.0	2.6
Alluvium	101.89	2.6	0.8
River Terrace Deposits	101.09	3.4	5.5
London Clay B	95.59	8.9	13.83

Formation	Top elevation* (mATD)**	Depth below ground level (m)	Thickness (m)
A3ii	81.76	22.73	11.00
A3i	70.76	33.73	1.90
A2	68.86	35.63	11.07
Harwich Formation	57.79	46.70	0.05

** Based on an assumed ground level of 104.00mATD*
*** mATD = metres above tunnel datum. A commonly used term for sub-surface construction projects, which defines height above a temporary datum set at -100mAOD (metres above Ordnance Datum).*

K.1.4 The combined sewer overflow (CSO) drop shaft and base slab at the Falconbrook Pumping Station site would extend down to approximately 64.46mATD and 62.46mATD respectively and would pass through the Made Ground, Alluvium, River Terrace Deposits, London Clay Formation, units B, A3ii and A3i and into the London Clay Formation, unit A2.

K.1.5 The connection tunnel would be constructed within the London Clay Formation, unit A2.

K.1.6 The interception chamber and culvert approximately 17.4m deep, as assumed for the purpose of this assessment, would extend down to 87.4mATD into the London Clay Formation, unit B.

K.1.7 The Made Ground, containing gravelly sand, sandy gravel or sandy, gravely clay with cobbles, concrete, brick and flint, is expected to be 2.6m thick at the site.

K.1.8 The Alluvium, comprises soft clay, slightly sandy and slightly gravely in places, and is expected to be 0.8m thick at the site.

K.1.9 The River Terrace Deposits are formed of extensive alluvial sand and gravel deposits laid down in river terraces by a braided river system of approximately 5km width, in river terraces since the Anglian glaciation. The River Terrace Deposits are expected to be 5.5m thick at the site.

K.1.10 The London Clay, comprises firm to very stiff clay, slightly sandy and slightly gravely in places and fissured in places. The London Clay is divided into sub-units referred from oldest to youngest as A to E, with some of these sub-units dividing further, for example A2, A3i-iii, B in decreasing age order. The London Clay Formation is expected to be 37.8m thick at the Falconbrook Pumping Station site.

K.1.11 The Harwich Formation comprises fine-grained glauconitic sand and rounded black flinty pebble beds, commonly deposited in a series of superimposed channels. The thickness of Harwich Formation is 0.05m at the site.

K.1.12 The depth to the lower aquifer ((Upnor Formation, Thanet Sands and Chalk) would be over 25m below the base of the shaft (based on a borehole log from PR1100D), which is within the London Clay, unit A2.

The intervening thickness would comprise mainly Lambeth Group and a small amount of Harwich Formation (see para. above).

K.2 Hydrogeology

K.2.1 A summary of the anticipated hydrogeological conditions at the Falconbrook Pumping Station site is shown in Vol 11 Table K.3.

Vol 11 Table K.3 Groundwater – anticipated hydrogeological units

Group	Formation	Hydrogeology
Superficial deposits	Made ground Alluvium	Hydraulic continuity with upper aquifer
	River Terrace Deposits	Upper aquifer
Thames	London Clay Formation	Aquiclude[i] (USGS, 1989)[2]
	Harwich	Aquitard[ii] (EA, 2012)[3]

K.2.2 The Made Ground and Alluvium overlie the River Terrace Deposits or upper aquifer. The ground investigation boreholes drilled on site indicate that these units were drilled dry.

K.2.3 The upper aquifer (River Terrace Deposits) is defined by the Environment Agency (EA) as a secondary A aquifer. These deposits 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. These are generally aquifers formerly classified as minor aquifers" (EA, 2012)[4].

K.2.4 The lower aquifer, comprising of the Upnor Formation, the Thanet Sands and the Chalk, is not expected to be encountered by the Thames Tideway Tunnel project at the Falconbrook Pumping Station site.

K.2.5 The CSO drop shaft would pass through the upper aquifer and into the London Clay Formation (B, A3ii, A3i and A2 sub divisions). The London Clay Formation is generally acknowledged as an aquiclude between the upper and lower aquifers. Any groundwater present in a majority of the London Clay Formation is likely to consist of localised seepages and/or minor flows. It is anticipated that below the River Terrace Deposits the shaft would be excavated in predominantly dry London Clay Formation with the exception of minor seepage at various horizons, namely silt or claystone horizons. In unit A3ii, the presence of fine sand laminea/lenses

[i] *Aquiclude - a geological formation through which virtually no water moves (EA website, 2012).*

[ii] Aquitard - *a poorly-permeable geological formation that does not yield water freely, but may still transmit significant quantities of water to or from adjacent aquifers (EA website, 2012).*

at this horizon, may act as horizontal conduits for migration of groundwater from a nearby source.

K.3 Groundwater level monitoring

K.3.1 Groundwater level monitoring was undertaken at a number of ground investigation boreholes across the assessment area with a few exceptions. In addition, the EA has a regional network of monitoring boreholes, mainly within the lower aquifer, across London which records are available dating back over 50 years.

K.3.2 Information on groundwater levels for this assessment was collected from the nearby ground investigation boreholes (SA1099A and SR1099C). These boreholes have response zones[iii] (EA, 2006)[5] and monitor groundwater levels in the River Terrace Deposits. The response zone depths, the monitored strata and the frequency of monitoring are detailed in Vol 11 Table K.4. The manual dip data collected from these monitoring boreholes is shown in Vol 11 Table K.5.

Vol 11 Table K.4 Groundwater – monitoring boreholes

Borehole	Response zone depths mATD	Strata	Monitoring
SA1099A	100.40 - 96.40	River Terrace Deposits	Fortnightly dips
SR1099C	99.89 - 96.39	River Terrace Deposits	Fortnightly dips

Vol 11 Table K.5 Groundwater – summary level data

Borehole	Period of record	Maximum (October 2010)		Minimum (August 2010)		Average over period of record	
		mbgl	mATD	mbgl	mATD	mbgl	mATD
SA1099A	27/05/2009 – 12/07/2012	3.42	100.98	3.75	100.65	3.62	100.78
SR1099C	07/05/2009 – 01/08/2012	3.61	100.84	3.74	100.62	3.73	100.73

K.3.3 The recorded water levels in the River Terrace Deposits at SA1099A and SR1099C range between 100.62mATD and 100.98mATD. These water levels consistently remain below the top of the formation, which is at

[iii] Response zone -the section of a borehole that is open to the host strata (EA, 2006)

101.09mATD, indicating that this formation is not fully saturated at this location. The water levels show variation and fluctuate with the tidal cycle.

K.3.4 A plot of groundwater levels within the River Terrace Deposits in the vicinity of the site is shown in Vol 11 Figure 13.4.3 (see separate volume of figures). The data collected is all from boreholes to the west of the site and although it is not possible to accurately determine the direction of groundwater flow, it is likely that the direction of groundwater movement is south to north, towards the River Thames, in these shallow deposits.

K.3.5 There are no EA groundwater level monitoring boreholes sufficiently close enough to provide representative water levels in the upper aquifer for the site.

K.4 Groundwater abstractions and protected rights

Groundwater licensing policy

K.4.1 The London Catchment Abstraction Management Strategy (CAMS), (EA, 2006)[6] does not identify a condition status for the upper aquifer.

K.4.2 The status of the lower aquifer is not relevant to this assessment as the construction would not reach to this depth at the Falconbrook Pumping Station site.

K.4.3 No dewatering of the upper or lower aquifers is anticipated at the Falconbrook Pumping Station site. Any water entering the excavation from either the superficial deposits or from minor seepages through silt layers in the London Clay Formation would be pumped to the sewer via appropriate settlement tanks.

Licensed abstractions

K.4.4 The EA licences abstraction from groundwater within London for all sources in excess of 20m^3/d. A review of licensed groundwater abstractions identified that there are no licensed abstractions from the River Terrace Deposits within 1km of the site.

K.4.5 The licensed abstractions from the lower aquifer (Chalk) would be unaffected due to construction taking place entirely within the upper aquifer and the London Clay.

K.4.6 There are no unlicensed abstractions, other than those from the lower aquifer. These would remain unaffected.

K.5 Groundwater source protection zones

K.5.1 The EA defines Source Protection Zones (SPZ) around all major public water supply abstractions sources and large licensed private abstractions in order to safeguard groundwater resources from potentially polluting activities.

K.5.2 There are no SPZs for a Chalk source delineated within the vicinity of site. The nearest of these lies approximately 2.2km to the northeast.

K.6 Environmental designations

K.6.1 There are no environmental designations relevant to groundwater such as SSSI, SAC or SNCIs, within 1km of the Falconbrook Pumping Station site.

K.7 Groundwater quality and land quality assessment

K.7.1 Historical mapping at the Falconbrook Pumping Station site indicates the presence of a Sewage Pumping Station (1951-present) and an Electrical Substation (1973 - present) (Vol 11 Section 8). Land quality may impact on groundwater quality through the creation or promotion of preferential pathways for existing contamination during construction of the proposed development.

K.7.2 The groundwater quality data presented in Vol 11 Table K.6 has been sourced from the ground investigation and monitoring works undertaken as part of the Thames Tideway Tunnel project and includes data from monitoring boreholes located up to 1km of the site (SR1099C, SA1101 and SR1102A), these locations are shown in Vol 11 Figure 13.4.1 (see separate volume of figures). The origin of these boreholes and groundwater quality data is detailed in Vol 11 Table K.6. Any exceedances of the UK drinking water standards *(The Water Supply Regulations,* 2000*)*[7] or relevant Environmental Quality Standards (EQS) (Defra, 2010)[8] are shaded in blue in this table.

K.7.3 The data shows exceedances of the relevant standards for ammonia, nitrate, sulphate and turbidity in close proximity to the Falconbrook Pumping Station site at SA1099A and SR1099C (at approximately 70m from the site) and for hydrocarbons, pesticides and heavy metals further from site at SR1102A and SA1101 (at approximately 830m and 900m from the site respectively).

K.7.4 The EA monitors groundwater quality at a number of points across London, mainly the Chalk and Lower London Tertiaries (Lambeth Group) (EA, 2006)[5]. The water quality information provided from this network is not relevant to Falconbrook Pumping Station site, where construction would take place entirely with the London Clay.

K.7.5 The land quality data from the ground investigation boreholes used in the groundwater quality assessment show several exceedances of the human health screening values (EA, 2009)[9] (soil guideline values designed to be protective of human health) with respect to hydrocarbons, heavy metals within the Made Ground and the River Terrace Deposits. Further detail is provided in the land quality assessment (see Vol 11 Appendix F).

Vol 11 Table K.6 Groundwater – groundwater quality results

Source of data*				SI	SI	TT	TT	TT	TT	TT	SI	SI	TT	TT	TT	TT	TT
Name				SA1099A	SR1099C	SA1099A	SA1099A	SA1099A	SA1099A	SA1099A	SA1101	SR1102A	SR1102A	SR1102A	SR1102A	SR1102A	SR1102A
Hydrogeological unit**				RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD
Distance from site	EQS Criteria			72m	72m	72m	72m	72m	72m	72m	832m	896m	896m	896m	896m	896m	896m
Chemical	Value	Units	Source	2009	2009	15/8/2011	3/11/2011	9/1/2012	16/4/2012	1/6/2012	2009	2009	15/8/2011	3/11/2011	16/1/2012	16/4/2012	18/5/2012
1,1,1 - Trichloroethane	100	ug/l	SW Regs 98	-	-	<0.08	<0.08	<0.08	-	< 0.08	-	-	<0.08	<0.08	<0.08	-	< 0.08
1,1,2 - Trichloroethane	400	ug/l	SW Regs 98	-	-	<0.2	<0.2	<0.2	-	< 0.2	-	-	<0.2	<0.2	<0.2	-	< 0.2
1,2 - Dichloroethane {Ethylene Dichloride}	3	ug/l	WS Regs 20	-	-	<0.12	<0.12	<0.12	-	< 0.12	-	-	<0.12	<0.12	<0.12	-	< 0.12
2,3 - Dimethylphenol {2,3-Xylenol}	-	ug/l	None	-	-	-	-	-	<0.0500	-	-	-	-	-	-	<0.0500	-
2,3,5,6 - Tetrachloroaminobenzene {2,...Aniline}	-	ug/l	None	-	-	-	-	-	<0.00500	-	-	-	-	-	-	<0.00500	-
2,4 - Dichlorophenol	20	ug/l	WFD 2010	<0.4	<0.4	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
2,4 - Dimethylphenol {2,4-Xylenol}	-	ug/l	None	<0.4	<0.4	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
2,4,6 - Trichlorophenol	-	ug/l	None	<0.4	<0.4	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
2,6 - Dichlorophenol	-	ug/l	None	<0.4	<0.4	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
2,6 - Dimethylphenol {2,6 Xylenol}	-	ug/l	None	-	-	-	-	-	<0.0500	-	-	-	-	-	-	<0.0500	-
3,4 - Dimethylphenol {3,4 Xylenol}	-	ug/l	None	-	-	-	-	-	<0.0500	-	-	-	-	-	-	<0.0500	-
4 - Chloro - 3- Methylphenol {P-Chloro-M-Cresol}	40	ug/l	WFD 2010	<0.4	<0.4	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
4-Methylphenol {para-Cresol}	-	ug/l	None	-	-	-	-	-	<0.0500	-	-	-	-	-	-	<0.0500	-
Acenaphthene	-	ug/l	None	<0.01	<0.01	-	-	-	-	-	<0.01	170	-	-	-	-	-
Acenaphthylene	-	ug/l	None	<0.01	<0.01	-	-	-	-	-	<0.01	6.9	-	-	-	-	-
Acenapthene	-	ug/l	None	-	-	-	-	-	<0.01	-	-	-	-	-	-	16	-
Acenapthylene	-	ug/l	None	-	-	-	-	-	<0.01	-	-	-	-	-	-	0.53	-
Aliphatics >C10-C12	-	ug/l	None	3	1	-	-	-	-	-	<1	<0.1	-	-	-	-	-
Aliphatics >C12-C16 (Aqueous)	-	ug/l	None	6	3	-	-	-	-	-	3	<1	-	-	-	-	-
Aliphatics >C16-C21 (Aqueous)	-	ug/l	None	6	4	-	-	-	-	-	9	4	-	-	-	-	-
Aliphatics >C21-C35 (Aqueous)	-	ug/l	None	23	5	-	-	-	-	-	9	16	-	-	-	-	-
Aliphatics >C6-C8	-	ug/l	None	<0.1	<0.1	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
Aliphatics >C8-C10	-	ug/l	None	<0.1	<0.1	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
Aliphatics C5-C6	-	ug/l	None	<0.1	<0.1	-	-	-	-	-	<0.1	7.4	-	-	-	-	-
Alkalinity (Carbonate)	-	mg/l as CaCO3	None	-	-	-	<4	-	-	-	-	-	-	<4	-	-	-
Alkalinity Ph 4.5 - As CaCO3	-	mg/l as CaCO3	None	320	300	326	347	321	-	340	220	490	472	490	<4	-	< 4.00
Aluminium Dissolved	200	ug/l as Al	DWS 2010	-	-	-	-	-	0.012	-	-	-	-	-	-	0.013	-
Aluminium Total	200	ug/l as Al	DWS 2010	-	-	37	26	0.043	-	0.019	-	-	<5	28	0.028	-	0.016
Ammonia - As N	0.39	mg/l as N	WS Regs 20	-	-	<0.05	0.36	2.7	-	0.12	-	-	<0.05	4.2	4.3	-	4.34
Ammoniacal nitrogen	-	mg/l	None	0.1	1	-	-	-	-	-	0.14	7.9	-	-	-	-	-
Anthracene	0.1	ug/l	SW WFD	<0.01	<0.01	-	-	-	<0.01	-	<0.01	<0.01	-	-	-	0.1	-
Antimony Total	5	ug/l	DWS 2010	-	-	-	-	-	2	-	-	-	-	-	-	0.4	-
Aromatics >C7-C8	50	ug/l	WFD 2010	<0.1	<0.1	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
Aromatics >EC10-EC12	-	ug/l	None	4	6	-	-	-	-	-	4	<0.1	-	-	-	-	-
Aromatics >EC12-EC16 (Aqueous)	-	ug/l	None	6	4	-	-	-	-	-	7	2	-	-	-	-	-
Aromatics >EC16-EC21 (Aqueous)	-	ug/l	None	16	8	-	-	-	-	-	12	34	-	-	-	-	-
Aromatics >EC21-EC35 (Aqueous)	-	ug/l	None	25	9	-	-	-	-	-	19	64	-	-	-	-	-
Aromatics >EC8-EC10	-	ug/l	None	<0.1	<0.1	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
Aromatics C6-C7	1	ug/l	DWS 2010	<0.1	<0.1	-	-	-	-	-	<0.1	19	-	-	-	-	-
Arsenic Total	10	ug/l as As	DWS 2010	<1	<1	5.2	5.1	8.5	-	5.6	<1	11	41.2	36	38	-	31
Atrazine { }	0.1	ug/l	DWS 2010	-	-	<0.00300	<0.00300	<0.00300	-	<0.00800	-	-	<0.00300	<0.00300	<0.04000	-	<0.00800
Barium Dissolved	100	ug/l as Ba	SW Regs 96	-	-	-	-	-	43	-	-	-	-	-	-	160	-
Barium Total	100	ug/l as Ba	SW Regs 96	-	-	-	-	-	45	-	-	-	-	-	-	160	-
Bentazone	0.1	ug/l	DWS 2010	-	-	<0.00800	<0.00800	<0.00800	-	<0.00800	-	-	<0.08000	<0.03200	<0.00800	-	-

Source of data*				SI	SI	TT	TT	TT	TT	TT	SI	SI	TT	TT	TT	TT	TT
Name				SA1099A	SR1099C	SA1099A	SA1099A	SA1099A	SA1099A	SA1099A	SA1101	SR1102A	SR1102A	SR1102A	SR1102A	SR1102A	SR1102A
Hydrogeological unit**				RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD
Distance from site	EQS Criteria			72m	72m	72m	72m	72m	72m	72m	832m	896m	896m	896m	896m	896m	896m
Chemical	Value	Units	Source	2009	2009	15/8/2011	3/11/2011	9/1/2012	16/4/2012	1/6/2012	2009	2009	15/8/2011	3/11/2011	16/1/2012	16/4/2012	18/5/2012
Benz[a]-Anthracene	-	ug/l	None	-	-	-	-	-	<0.01	-	-	-	-	-	-	0.04	-
Benzene	1	ug/l	DWS 2010	<1	<1	<0.07	<0.07	<0.07	1.07	0.1	<1	110	0.31	<0.07	0.6	1.81	0.95
Benzene (Ethylbenzene)	20	ug/l	FW List II	-	-	-	-	-	0.06	-	-	-	-	-	-	<0.06	-
Benzo (a) anthracene	-	ug/l	None	<0.01	<0.01	-	-	-	-	-	<0.01	1.2	-	-	-	-	-
Benzo[a]Pyrene	0.01	ug/l	DWS 2010	<0.01	<0.01	<0.00500	<0.00500	<0.00500	<0.01	<0.00500	<0.01	0.05	0.00730	<0.00500	<0.02500	<0.01	<0.00500
Benzo[b]Fluoranthene	0.03	ug/l	WFD D 10	<0.01	<0.01	-	-	-	<0.01	-	<0.01	0.12	-	-	-	<0.01	-
Benzo[g,h,i]Perylene	0.002	ug/l	WFD D 10	<0.01	<0.01	-	-	-	<0.01	-	<0.01	0.01	-	-	-	<0.01	-
Benzo[k]Fluoranthene	0.03	ug/l	WFD D 10	<0.01	<0.01	-	-	-	<0.01	-	<0.01	0.06	-	-	-	<0.01	-
Bifenthrin	-	ug/l	None	-	-	-	-	-	<0.00500	-	-	-	-	-	-	<0.00500	-
Boron Dissolved	1000	ug/l as B	DWS 2010	-	-	-	-	-	230	-	-	-	-	-	-	420	-
Boron Total	1000	ug/l as B	DWS 2010	510	560	250	280	160	-	0.21	310	410	340	360	330	-	0.37
Bromate	10	ug/l as BrO3	DWS 2010	-	-	<0.5	<0.5	<0.5	-	< 0.5	-	-	<0.5	<0.5	<0.5	-	< 0.5
Cadmium Total	5	ug/l as Cd	DWS 2010	<2	<2	<1.5	<1.5	<1.5	<1.5	< 1.5	<2	<2	<1.5	<1.5	<1.5	<1.5	< 1.5
Calcium Total	250	mg/l as Ca	DWS 2010	-	-	170	180	170	-	200	-	-	180	190	180	-	200
Carbendazim / Benomyl	0.1	ug/l	FW List II	-	-	<0.00300	<0.00300	<0.00300	-	<0.00500	-	-	<0.00300	<0.00300	-	-	<0.00500
Carbetamide	-	ug/l	None	-	-	<0.00600	<0.00600	<0.00600	-	<0.01000	-	-	<0.00600	<0.00600	-	-	<0.01000
Carbon Dioxide	-	ug/l	None	-	-	-	-	-	4410	-	-	-	-	-	-	3500	-
Carbon Organic Dissolved	-	mg/l as C	None	-	-	-	-	-	4.9	-	-	-	-	-	-	4.9	-
Carbon tetrachloride	3	ug/l	DWS 2010	-	-	<0.07	<0.07	<0.07	-	< 0.070	-	-	<0.07	<0.07	<0.07	-	< 0.070
Chlorfenvinphos	0.1	ug/l	DWS 2010	-	-	<0.00900	<0.00900	<0.00900	-	<0.00900	-	-	<0.00900	<0.00900	<0.00900	-	<0.00900
Chloride	250	mg/l as Cl	DWS 2010	130	160	44.5	87.7	69.7	-	73.3	450	55	153	184	123	-	160
Chloroform	100	ug/l	WS Regs 20	-	-	<0.6	<0.6	<0.6	-	< 0.600	-	-	<0.6	<0.6	<0.6	-	< 0.600
Chlortoluron	2	ug/l	FW List II	-	-	<0.00400	<0.00400	<0.00400	-	<0.01000	-	-	<0.00400	<0.00400	<0.50000	-	<0.01000
Chromium Dissolved	50	ug/l as Cr	DWS 2010	-	-	-	-	-	16	-	-	-	-	-	-	15	-
Chromium Total	50	ug/l as Cr	DWS 2010	<5	<5	17	6	13	-	16	<5	<5	18	7	14	-	16
Chrysene	-	ug/l	None	<0.01	<0.01	-	-	-	<0.01	-	<0.01	0.03	-	-	-	0.03	-
Clopyralid	-	ug/l	None	-	-	<0.01900	<0.01900	<0.01900	-	<0.01900	-	-	<0.19000	<0.07600	<0.01900	-	-
Conductivity @ 20°C	2500	uS/cm	WS Regs 20	1550	1560	-	-	-	-	-	1880	1080	-	-	-	-	-
Copper Total	2000	ug/l as Cu	DWS 2010	3	<2	5.6	<5.5	13	-	16	7	<2	<5.5	<5.5	<5.5	-	< 5.5
Coumaphos	0.1	ug/l	DWS 2010	-	-	-	-	-	0.00930	-	-	-	-	-	-	<0.00500	-
Cresols	-	ug/l	None	<0.4	<0.4	-	-	-	-	-	<0.1	<0.1	-	-	-	-	-
Cyanazine	0.1	ug/l	DWS 2010	-	-	<0.00700	<0.00700	<0.00700	-	<0.00800	-	-	<0.00700	<0.00700	<0.06000	-	<0.00800
Cyanide (Free)	50	ug/l as CN	DWS 2010	<20	<20	-	-	-	-	-	<20	48	-	-	-	-	-
Cyanide (Total)	50	ug/l as CN	DWS 2010	<40	<40	-	-	-	-	-	<40	<40	-	-	-	-	-
Cypermethrin	0.0001	ug/l	WFD 2010	-	-	<0.1	<0.1	<0.1	-	< 0.100	-	-	0.13	<0.1	<0.1	-	< 0.100
Cypermethrin ID	-	Code	None	-	-	-	-	-	<5	-	-	-	-	-	-	<5	-
Dalapon	-	ug/l	None	-	-	<0.05000	<0.05000	0.07400	-	<0.05000	-	-	<0.05000	<0.05000	<0.05000	-	<0.05000
Diazinon	0.1	ug/l	DWS 2010	-	-	<0.00900	<0.00900	<0.00900	-	<0.00900	-	-	<0.00900	<0.00900	<0.00900	-	<0.00900
Dibenz-[A,H]-Anthracene	-	ug/l	None	<0.01	<0.01	-	-	-	<0.01	-	<0.01	0.3	-	-	-	<0.01	-
Dichloromethane	20	ug/l	WFD 2010	-	-	<3	<3	<3	-	< 3.0	-	-	<3	<3	<3	-	< 3.0
Dichlorprop	0.1	ug/l	DWS 2010	-	-	<0.01100	<0.01100	<0.01100	-	<0.01100	-	-	<0.11000	<0.04400	<0.01100	-	-
Diuron	0.1	ug/l	DWS 2010	-	-	<0.00500	<0.00500	<0.00500	-	<0.01000	-	-	<0.00500	<0.00500	<0.15000	-	<0.01000
Enterococci (Species)	-	Nr/100ml	None	-	-	-	-	-	>100	-	-	-	-	-	-	0	-
Escherichia coli (Confirmed)	0	Nr/100ml	WS Regs 20	-	-	-	-	-	>201	-	-	-	-	-	-	0	-
Ethofumesate	-	ug/l	None	-	-	-	-	-	<0.01	-	-	-	-	-	-	<0.100	-
Ethylbenzene	-	ug/l	None	<1	<1	-	-	-	-	-	<1	<1	-	-	-	-	-
Fenuron	-	ug/l	None	-	-	-	-	-	<0.01	-	-	-	-	-	-	<0.01	-

Source of data*				SI	SI	TT	TT	TT	TT	TT	SI	SI	TT	TT	TT	TT	TT
Name				SA1099A	SR1099C	SA1099A	SA1099A	SA1099A	SA1099A	SA1099A	SA1101	SR1102A	SR1102A	SR1102A	SR1102A	SR1102A	SR1102A
Hydrogeological unit**				RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD
Distance from site	EQS Criteria			72m	72m	72m	72m	72m	72m	72m	832m	896m	896m	896m	896m	896m	896m
Chemical	Value	Units	Source	2009	2009	15/8/2011	3/11/2011	9/1/2012	16/4/2012	1/6/2012	2009	2009	15/8/2011	3/11/2011	16/1/2012	16/4/2012	18/5/2012
Fluoranthene	0.2	ug/l	EEC MAC	<0.01	0.01	-	-	-	<0.01	-	<0.01	<0.01	-	-	-	1.2	-
Fluorene	-	ug/l	None	<0.01	<0.01	-	-	-	<0.01	-	<0.01	0.43	-	-	-	1	-
Fluoride	1.5	mg/l as F	DWS 2010	-	-	0.24	0.22	0.11	-	0.151	-	-	0.32	0.34	0.33	-	0.424
Glyphosate	-	ug/l	None	-	-	<0.01400	<0.01400	0.02700	-	<0.01400	-	-	<0.01400	<0.01400	0.04000	-	0.04600
Hardness Total - As CaCO3	-	mg/l as CaCO3	None	-	-	-	-	-	450	-	-	-	-	-	-	540	-
Indeno-[1,2,3-Cd]-Pyrene	0.002	ug/l	WFD D 10	<0.01	<0.01	-	-	-	<0.01	-	<0.01	0.36	-	-	-	<0.01	-
Iodide Ion	-	ug/l as I	None	-	-	-	-	-	8	-	-	-	-	-	-	7	-
Irgarol 1051	-	ug/l	None	-	-	-	-	-	<0.00500	-	-	-	-	-	-	<0.00500	-
Iron Dissolved	200	ug/l as Fe	DWS 2010	-	-	-	-	-	<0.018	-	-	-	-	-	-	5.1	-
Iron Total	200	ug/l as Fe	DWS 2010	-	-	-	-	-	<0.018	-	-	-	-	-	-	5	-
Isoproturon (Diip1,3Dithiolan-2-Ylidenemalonate)	0.1	ug/l	DWS 2010	-	-	<0.00300	<0.00300	<0.00300	-	<0.00800	-	-	<0.00300	<0.00300	<0.50000	-	<0.00800
Lambda Cyhalothrin	-	ug/l	None	-	-	-	-	-	<5.00	-	-	-	-	-	-	3.9	-
Lead Total	10	ug/l	WS Regs 20	<4	<4	<5	<5	<5	-	< 5	<4	<4	<5	<5	<5	-	< 5
Lithium Dissolved	-	ug/l as Li	None	-	-	-	-	-	0.0083	-	-	-	-	-	-	0.026	-
Lithium Total	-	ug/l as Li	None	-	-	-	-	-	0.01	-	-	-	-	-	-	0.025	-
Magnesium Dissolved	50	mg/l as Mg	EEC MAC	-	-	-	-	-	11	-	-	-	-	-	-	17	-
Magnesium Total	50	mg/l as Mg	EEC MAC	25	23	14	14	9.9	-	11	25	15	16	17	16	-	17
Manganese Dissolved	50	ug/l as Mn	DWS 2010	-	-	-	-	-	0.098	-	-	-	-	-	-	0.84	-
Manganese Total	50	ug/l as Mn	DWS 2010	-	-	-	-	-	0.1	-	-	-	-	-	-	0.82	-
MCPA {2-methyl-4-chlorophenoxyacetic acid }	0.1	ug/l	DWS 2010	-	-	<0.00900	<0.00900	<0.00900	-	<0.00900	-	-	<0.09000	<0.03600	<0.00900	-	-
Mecoprop { }	0.1	ug/l	DWS 2010	-	-	<0.01000	<0.01000	<0.01000	-	<0.01000	-	-	<0.10000	<0.04000	<0.01000	-	-
Mercury Total	1	ug/l Hg	WS Regs 20	<0.05	<0.05	0.054	0.006	0.023	-	0.077	<0.05	<0.05	0.015	0.006	<0.002	-	< 0.002
Metazachlor	-	ug/l	None	-	-	<0	<0	<0	-	< 0	-	-	<0	<0	<0	-	< 0
Methane	-	ug/l	None	-	-	-	-	-	<9	-	-	-	-	-	-	<9	-
Molybdenum Total	0	ug/l	GW Regs 98	-	-	-	-	-	<5	-	-	-	-	-	-	<5	-
MTBE {Methyl Tert-Butyl Ether}	-	ug/l	None	<1	<1	-	-	-	-	-	<1	<1	-	-	-	-	-
Multi Residual Scan	-	ug/l	None	-	-	-	-	-	-	<0.10000	-	-	-	-	-	-	<0.10000
Naphthalene	1.2	ug/l	WFD D 10	<0.01	<0.01	-	-	-	0.08	-	<0.01	<0.01	-	-	-	1.1	-
Nickel Total	20	ug/l as Ni	DWS 2010	<10	14	<4	<4	<4	-	< 4	<10	<10	5	<4	<4	-	31
Nitrate - N	11.3	mg/l as N	WS Regs 20	2.5	2	<0.043	8.12	17.7	-	10.3	34	<0.1	8.93	<0.043	<0.043	-	< 0.068
Nitrogen Total Oxidised	11.3	mg/l as N	WS Regs 20	-	-	-	-	-	11.2	-	-	-	-	-	-	16.8	-
Orthophosphate	-	mg/l as P	None	-	-	-	-	-	1.01	-	-	-	-	-	-	2.25	-
Oxamyl	-	ug/l	None	-	-	-	-	-	<0.00500	-	-	-	-	-	-	<0.00500	-
PAHs Total	0.1	ug/l	DWS 2010	-	-	-	-	-	0.08	-	-	-	-	-	-	21.3	-
Permethrin (Cis + Trans)	0.01	ug/l	WFD D 10	-	-	-	<0.10000	<0.10000	-	-	-	-	-	<0.10000	<0.10000	-	-
Petrol range organics	-	ug/l	None	-	-	-	-	-	-	-	-	210	-	-	-	-	-
pH	10	pH units	DWS 2010	7.1	7.2	-	-	-	-	-	7.4	7.4	-	-	-	-	-
Phenanthrene	-	ug/l	None	0.01	0.01	-	-	-	<0.01	-	<0.01	<0.01	-	-	-	0.03	-
Phenol	0.5	ug/l	EEC MAC	<0.4	<0.4	-	-	-	-	-	<0.1	<3.3	-	-	-	-	-
Phenol (Pentachlorophenol (PCP))	-	ug/l	None	-	-	<0.00900	<0.00900	<0.00900	-	<0.00900	-	-	<0.09000	<0.03600	<0.00900	-	-
Phenols Total For SWAD (7 Compounds)	-	ug/l	None	-	-	18.0	35.0	17.0	-	<2,500.0	-	-	34.0	11.0	<80.0	-	<2,500,000.0
Polynuclear Aromatic Hydrocarbons (Total)	0.1	ug/l	DWS 2010	<0.2	<0.2	-	-	-	-	-	<0.2	24	-	-	-	-	-
Potassium Dissolved	-	mg/l as K	None	-	-	-	-	-	25	-	-	-	-	-	-	18	-
Potassium Total	-	mg/l as K	None	-	-	20	25	24	-	25	-	-	17	19	17	-	18
Propazine	0.1	ug/l	DWS 2010	-	-	<0.00400	<0.00400	<0.00400	-	<0.00500	-	-	<0.00400	<0.00400	<0.04000	-	<0.00500
Propetamphos	0.1	ug/l	DWS 2010	-	-	<0.00500	<0.00500	<0.00500	-	<0.00500	-	-	<0.00500	<0.00500	<0.00500	-	<0.00500

Source of data*				SI	SI	TT	TT	TT	TT	TT	SI	SI	TT	TT	TT	TT	TT
Name				SA1099A	SR1099C	SA1099A	SA1099A	SA1099A	SA1099A	SA1099A	SA1101	SR1102A	SR1102A	SR1102A	SR1102A	SR1102A	SR1102A
Hydrogeological unit**				RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD	RTD
Distance from site	EQS Criteria			72m	72m	72m	72m	72m	72m	72m	832m	896m	896m	896m	896m	896m	896m
Chemical	Value	Units	Source	2009	2009	15/8/2011	3/11/2011	9/1/2012	16/4/2012	1/6/2012	2009	2009	15/8/2011	3/11/2011	16/1/2012	16/4/2012	18/5/2012
Pyrene	-	ug/l	None	<0.01	<0.01	-	-	-	<0.01	-	<0.01	2.3	-	-	-	1.3	-
Selenium	10	ug/l as Se	DWS 2010	<3	<3	-	-	-	1.8	-	<3	<3	-	-	-	<0.4	-
Silicate Reactive Dissolved - As SiO2	-	mg/l	None	-	-	-	-	-	25	-	-	-	-	-	-	21	-
Simazine	0.1	ug/l	DWS 2010	-	-	<0.00900	<0.00900	<0.00900	-	<0.00400	-	-	<0.00900	<0.00900	<0.04000	-	<0.00400
Sodium Total	200	mg/l as Na	DWS 2010	140	200	82	-	61	-	64	200	53	78	90	73	-	71
Strontium Dissolved	-	ug/l as Sr	None	-	-	-	-	-	0.5	-	-	-	-	-	-	0.8	-
Strontium Total	-	ug/l as Sr	None	-	-	-	-	-	0.51	-	-	-	-	-	-	0.8	-
Sulphate	250	mg/l as SO4	DWS 2010	350	330	46.4	234	184	-	198	120	51	70.9	65	75.5	-	946
Sulphide	-	ug/l	None	<250	<10	-	-	-	<29.0	-	<10	<10	-	-	-	<29.0	-
Terbutryn	0.1	ug/l	DWS 2010	-	-	<0.00300	<0.00300	<0.00300	-	<0.00500	-	-	<0.00300	<0.00300	<0.04000	-	<0.00500
Tetrachloroethylene	-	ug/l	None	-	-	<0.09	0.1	0.34	-	0.09	-	-	<0.09	<0.09	<0.09	-	< 0.09
Tetrachlorothioanisole	-	ug/l	None	-	-	-	-	-	<0.00500	-	-	-	-	-	-	<0.00500	-
Tin Total	0	ug/l as Sn	GW Regs 98	-	-	-	-	-	<5	-	-	-	-	-	-	<5	-
Titanium	0	ug/l as Ti	GW Regs 98	-	-	-	-	-	0.06	-	-	-	-	-	-	0.072	-
Toluene (Methylbenzene)	50	ug/l	WFD 2010	<1	<1	-	-	-	<0.55	-	<1	<1	-	-	-	0.72	-
Total Aliphatic TPH	-	ug/l	None	38	12	-	-	-	-	-	22	28	-	-	-	-	-
Total Aromatic TPH	-	ug/l	None	52	27	-	-	-	-	-	42	39	-	-	-	-	-
Total Chemical Oxygen Demand	-	mg/l	None	<10	<10	-	-	-	-	-	59	70	-	-	-	-	-
Total Petroleum Hydrocarbons (TPH)	-	ug/l	None	-	-	-	-	-	-	-	-	1700	-	-	-	-	-
Total Petroleum Hydrocarbons 10-20 (TPH)	-	ug/l	None	-	-	-	-	-	-	-	-	570	-	-	-	-	-
Total Petroleum Hydrocarbons 20-30 (TPH)	-	ug/l	None	-	-	-	-	-	-	-	-	950	-	-	-	-	-
Trichloroethene (Trichloroethylene)	10	ug/l	DWS 2010	-	-	<0.07	<0.07	0.12	-	< 0.07	-	-	<0.07	<0.07	<0.07	-	< 0.07
Trietazine	-	ug/l	None	-	-	<0.00600	<0.00600	<0.00600	-	<0.00800	-	-	<0.00600	<0.00600	0.06200	-	<0.00800
Trifluralin	0.1	ug/l	DWS 2010	-	-	<0.01000	<0.01000	<0.01000	-	<0.01000	-	-	<0.01000	<0.01000	<0.01000	-	<0.01000
Turbidity	1	FTU	WS Regs 20	-	-	0.25	0.32	1.25	-	0.95	-	-	22	20.6	33.6	-	31.9
Uranium	0	ug/l as U	GW Regs 98	-	-	-	-	-	2	-	-	-	-	-	-	0.3	-
Xylene (Meta & Para){1,3+1,4-Dimethylbenzene}	30	ug/l	WFD 2010	<1	<1	<0.09	<0.09	<0.09	<0.09	-	<1	12	0.27	0.1	<0.09	<0.180	0.46
Xylene (ortho)	30	ug/l	SW Regs 98	-	-	-	-	-	0.16	-	-	-	-	-	-	<0.09	-
Zinc Total	50	ug/l as Zn	DWS 2010	17	4	<5	<5	<5	-	< 5	5	<1	<5	<5	<5	-	< 5

Notes:

xx	GAC1 exceedance
' - '	Not tested
' < '	Less than MDL

** Origin of data: SI – Groundwater quality data collected during site investigation works by Thames Tideway Tunnel project (2009-2011), TT – Groundwater quality data collected during ongoing monitoring works by Thames Tideway Tunnel project (2009-2012)*

*** Hydrogeological unit: RTD – River Terrace Deposits*

K.8 Groundwater status

K.8.1 The EC Water Framework Directive (WFD) requires the status of groundwater management units (groundwater bodies) within each river basin to be determined as “good” or ”poor” by 2015. For groundwater there are two separate classifications for groundwater bodies; chemical status and quantitative status. The WFD aims to achieve good status by 2015, or, where this is not possible and subject to the criteria set out in the Directive, the WFD aims to achieve good status by 2021 or 2027.

K.8.2 The Thames River Basin Management Plan (RBMP) (EA, 2009)[10] shows no groundwater body designation for either the upper or lower aquifers within the area in which the Falconbrook Pumping Station site is located; therefore no baseline assessment of quantitative or chemical status is available.

K.8.3 The baseline assessment for groundwater status classification for the nearby Greenwich Chalk and Tertiaries (consisting of the Lambeth Group, Thanet Sands, Blackheath Formation and Chalk Formation) shows poor quantitative status and poor quality status for 2009. The predicted quantitative and chemical quality was poor for 2015 due to treatment or improvement being disproportionately expensive or technically infeasible.

K.8.4 The baseline assessment for groundwater status classification for the nearby Lower Thames Gravels is good quantitative status and poor quality status for 2009. The predicted chemical quality was poor for 2015 due to treatment or improvement being disproportionately expensive or technically infeasible.

K.8.5 Only eight out of forty-six groundwater bodies within the Thames River basin district are at good status overall; this is not expected to change by 2015 (EA, 2009)[10].

K.8.6 The key actions identified in the RBMP to achieve good status by 2021 or 2027, as follows (EA, 2009)[10]:

a. The control of pollution to groundwater that may arise from any development which takes place on land.

b. prevent input of nitrates to groundwater body

c. prevent inputs to and mitigate potential mobilisation of copper, other metals and hazardous substances in groundwater

d. Prevent and mitigate potential inflow of river water to groundwater due to dewatering/ abstraction by implementing working methods to protect surface and groundwater from impacts, including changes to flow, by producing site-specific water management plans and by monitoring where required.

e. prevent direct discharges of pollutants to groundwater.

K.9 Data sources

K.9.1 A list of data used for the Falconbrook Pumping Station assessment is given in Vol 11 Table K.7.

Vol 11 Table K.7 Groundwater – desk based baseline data sources

Source	Data	Date received	Notes
BGS	British Geological Survey (BGS) 1:50,000 scale digital geological data	February 2009	
EA	Licensed groundwater abstraction boreholes, their ownership and purpose	December 2010,February 2011 and March 2012	Licensed abstraction rates, aquifer, and status (active or dormant)
LB's*	Unlicensed groundwater abstraction boreholes and their details	June 2009	Contacted 14 London Boroughs along tunnel alignment
EA	Designated source protection zones	December 2010	
EA	Groundwater level records for EA observation boreholes	September 2009, June 2011, December 2011 and October 2012	
EA	Groundwater quality results for EA observation boreholes	August 2009 and May 2011	
EA	Ground Source Heat Pump (GSHP) schemes and their details	December 2010 and March 2012	
Thames Tideway Tunnel project	Ground Investigation (2009) borehole logs, construction details, monitoring regime and available water level records and water quality results from 2009 to 2012	Last updated September 2012	
Thames Tideway Tunnel project	Groundwater monitoring strategy	Draft strategy Feb 2012	
Thames	Land quality data	February 2011	

Source	Data	Date received	Notes
Tideway Tunnel project			
Individual licence holders	Letters sent out to 30 licence holders	December 2011 (last updated 15th October 2012)	

** LBs – London Boroughs*

References

[1] British Geological Survey. British geology onshore digital maps 1:50 000 scale. Received from Thames Tunnel (February 2009).

[2] United States Geological Survey (USGS). Office of Water Data Coordination. *Glossary of Hydrologic Terms in the Federal Glossary of Selected Terms: Subsurface-Water Flow and Solute Transport* (August 1989).

[3] Environment Agency. Environment Agency Website (Accessed April 2012). Available at: http://www.environment-agency.gov.uk/homeandleisure/117020.aspx.

[4] Environment Agency. See citation above.

[5] Environment Agency. *Guidance on the design and installation of groundwater quality monitoring points Science Report SC020093* (2006). Available at: http://publications.environment-agency.gov.uk/PDF/SCHO0106BKCT-E-E.pdf.

[6] Environment Agency. *The London Catchment Abstraction Management Strategy (CAMS). Final Strategy Document* (2006). Available at: http://publications.environment-agency.gov.uk/PDF/GETH0406BKRM-E-E.pdf.

[7] *The Water Supply (Water Quality) Regulations*, (2000). Available at: http://www.legislation.gov.uk/uksi/2000/3184/contents/made.

[8]Defra. *River Basin Districts Typology, Standards and Groundwater Threshold Values* (Water Framework Directive) (England and Wales) Direction (2010). Available at: http://www.defra.gov.uk/environment/quality/water/legislation/water-framework-directive/.

[9] Environment Agency. *Soil Guideline Value Reports* (2009). Available at: http://www.environment-agency.gov.uk/research/planning/64015.aspx.

[10] Environment Agency. *River Basin Management Plan, Thames River Basin District* (December 2009). Available at: http://publications.environment-agency.gov.uk/PDF/GETH0910BSWA-E-E.pdf.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix L: Water resources - surface water

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix L: Water resources – surface water

List of contents

Page number

.

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Appendix L: Water resources – surface water

L.1 Introduction

L.1.1 Construction and operational effects assessments at this site for this topic do not require the provision of any supporting information, so this appendix is intentionally empty.

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Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

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Appendix M: Water resources - flood risk

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix M: Water resources – flood risk

List of contents

Page number

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Appendix M: Water resources – flood risk

M.1 Policy considerations

M.1.1 The relevant planning document that would be used to assess the proposals is the National Policy Statement (NPS) for Waste Water (Defra, 2012)[1] which was published in February 2012.

M.1.2 The Waste Water NPS considers the Thames Tideway Tunnel project as 'nationally significant waste water infrastructure'.

M.1.3 General policy documents (eg, NPS) have been reviewed within Volume 2 Environmental assessment methodology. A summary of local and regional policy relevant to flood risk at Falconbrook Pumping Station is provided below.

Local policy

Strategic Flood Risk Assessment

M.1.4 The Falconbrook Pumping Station site lies within the London Borough (LB) of Wandsworth. LB of Wandsworth produced a Level 1 and Level 2 Strategic Flood Risk Assessment (SFRA) (Scott Wilson Ltd, 2009)[2]. These outline the main flood sources to the borough and present the outcomes of the hydraulic modelling completed as part of the Level 2 study to investigate the residual risk of breaches in the Thames Tideway Defences (Thames Barrier and Tidal flood defence walls) at a number of locations along the River Thames.

M.1.5 The SFRAs confirm that the Thames Tidal Defence network reduces the annual probability of flooding from the Thames to less than 0.1%. The risk of flooding is therefore a residual risk associated with a breach in the defences.

M.1.6 The SFRAs advocate the use of flood resilience and resistant measures.

M.1.7 According to the SFRAs:

a. The site overlies London Clay.

b. It is within the Wandsworth Tidal Flood Warning Area and the Environment Agency (EA) Flood Zone 3.

c. The site is situated within an area identified as having increased risk of surface water ponding based on topography, geology and historic flooding records.

d. In terms of emergency planning during the construction phase, rest and reception centres have been identified as Leisure Centres, Churches, Schools and Community Centres.

M.1.8 The SFRAs promote the use of Sustainable Drainage Systems (SuDS) suitable to specific site locations within the borough, depending on underlying geology.

Surface Water Management Plan

M.1.9 The Council, in partnership with the Greater London Authority (GLA), Thames Water and the EA produced a Surface Water Management Plan (SWMP) (GLA, 2011)[3] as part of the Drain London project. The SWMP sets out the preferred surface water management strategy for the borough.

M.1.10 According to the SWMP:

a. This identifies the land immediately adjacent to the Falconbrook Pumping Station site to be located within the Clapham Junction Critical Drainage Area (CDA)[i] which may be more susceptible to surface water flooding than other local areas. The southern section of the site may lie within this CDA.

b. The site lies within an area of low to high ('danger for some' to 'danger for all') surface water flood hazard rating for the 1% AEP + 30% climate change rainfall event.

c. 51-100 incidents of sewer flooding have been recorded in the post-code area in which the site is situated. In the area adjacent to (west of) the site, 21-50 incidents of sewer flooding have been recorded.

Regional policy

Thames Estuary 2100

M.1.11 The Falconbrook Pumping Station site lies within the Wandsworth to Deptford Policy Unit which has been assigned flood risk management policy 'P5' within the Thames Estuary 2100 (TE2100) Plan (EA, 2012)[4] meaning that further action will be taken to reduce flood risk beyond that required to keep pace with climate change.

M.1.12 The TE2100 Plan identifies the local sources of flood risk (relative to the Falconbrook Pumping Station site) as including:

a. tidal from the River Thames

b. pluvial (heavy rainfall) and urban drainage sources

c. a risk of groundwater flooding from superficial strata which is possibly connected to high water levels in the Thames.

M.1.13 Defences from these sources include:

a. the Thames Barrier and secondary tidal defences along the Thames frontage

b. combined sewer overflows (CSOs) for mitigation of urban drainage

c. flood forecasting and warning.

M.1.14 The TE2100 Plan seeks to promote, where possible, defence improvements that ensure views are maintained and impacts to river access/views are minimised. Where defence raising in the future to manage the consequences of climate change is not possible, secondary

[i] Area susceptible to surface water flooding.

defences and floodplain management should be introduced. There is also the vision to increase flood risk awareness within the area.

M.1.15 Further investigation is required into flood risk from pluvial and groundwater sources and these form part of the TE2100 Action Plan.

London Regional Flood Risk Appraisal

M.1.16 For the reach between Hammersmith Bridge and the Thames Barrier (City Reach) the London Regional Flood Risk Appraisal (RFRA) (GLA, 2009)[5] encourages small scale set back of development from the river walls where possible. The aim of this is to enable modification, raising and maintenance in a sustainable, environmentally acceptable and cost effective way. Development should be designed in such a way as to take opportunities to reduce flood risk and include resilience.

M.1.17 There is particular concern surrounding confluences of tributaries into the River Thames and the interactions between tidal and fluvial flows in the future due to climate change.

M.1.18 The RFRA indicates that SuDS should be included within developments to reduce surface water discharge.

References

[1] Department of Environment, Food and Rural Affairs (Defra), *National Planning Policy for Waste Water.* (February 2012).

[2] Scott Wilson Ltd . *London Boroughs of Wandsworth, Merton, Sutton and Croydon Level 1 Final Report. Scott Wilson Ltd (Dec 2008). London Boroughs of Wandsworth, Merton, Sutton and Croydon Level 2 Final Report.* (April 2009).

[3] Greater London Authority. *London Borough of Wandsworth Surface Water Management Plan.* (September 2011).

[4] Environment Agency. *Thames Estuary 2100 Plan*. (November 2012).

[5] Greater London Authority. *London Regional Flood Risk Appraisal*. (Oct 2009).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.11**

Volume 11: Falconbrook Pumping Station appendices

Appendix N: Development schedule

APFP Regulations 2009: Regulation **5(2)(a)**

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Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 11 Falconbrook Pumping Station appendices

Appendix N: Development schedule

List of contents

Page number

List of tables

Page number

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Appendix N: Development schedule

N.1 Summary

N.1.1 The assessments undertaken for this site take account of other relevant development projects within the vicinity of the site which are under construction, permitted but not yet implemented or submitted but not yet determined. In order to identify the relevant developments for consideration, the Planning Inspectorate, local planning authorities and the Greater London Authority have been consulted on the methodology (see Volume 2) and asked to assist in identifying and verifying the development projects included in the assessment. A schedule is provided in Vol 11 Table N.1 of the resulting development projects, a description of what is proposed and assumptions on phasing. Longer term development projects may be included under both base case, with construction preceding that of the Thames Tideway Tunnel site, and cumulative with construction or operation occurring at the same time as a given Thames Tideway Tunnel site.

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Vol 11 Table N.1 Development schedule for Falconbrook Pumping Station

Category types:

a. Under construction

b. Permitted but not yet implemented

c. Submitted but not yet determined

Development within 1km (IPC or Mayoral referral unless otherwise noted)	Dist from site (closest point)	Development description			Category type (based on 'current' status)	Year specific assumptions			Source of assumption information / Notes	Base case or cumulative dev?
		Appl. No.	Developer	Description		2018 (Site Year 1 of construction)	2019 (peak construction traffic year)	2023 (Year 1 of operation)		
Battersea Reach	Approx 600m southwest	2011/0324	St. George South London Limited	Erection of five buildings ranging in height between 6 and 15-storeys (Blocks M, N, P, Q & T) to south-west part of site, to include 374 flats and 2,636sq.m. of commercial floorspace comprising retail, restaurants/cafes/bars (Class A1, A2, A3 and B1 Use), with associated car parking, access and landscaping. (Revision to Outline planning permission dated 02.01.2008 ref: 2006/4533)	B	100% complete and operational	100% complete and operational	100% complete and operational	No information in planning application documentation on construction phasing. As the development is permitted it is expected that construction will begin by 2013 and take several years. Given the scale of the development it is therefore assumed that the development will be complete and operational by Site Year 1 of construction.	Base case (all years)
Townmead Road	Approx 650m west	2010/01792/FUL	Cemex UK Operations,	Redevelopment of site involving the demolition of existing concrete plant, conveyors, aggregate building, workshop and related structures and the erection of a replacement concrete plant, aggregate storage facility, transfer building and conveyors and siting of batch cabin and office portacabin with associated cycle storage area.	B	100% complete and operational	100% complete and operational	100% complete and operational	LBHF online planning applications database. The information submitted does not indicate that the development is proposed to be built out in phases and therefore assumption made that the development would be built out in full by Site Year 1 of construction.	Base case (all years)
Imperial Wharf	Approx 700m northwest	2009/00974/FUL	St George (West London) Ltd.	Erection of a 10 storey building, to provide a mixed use development comprising 165 residential units at level 1 to level 9; 1190 sq.m of Class A1, A2, A3, A4, A5 floorspace at ground and first floor; 492 sq.m office floorspace (Class B1) at level 2; associated car parking and landscaping.	B	100% complete & operational	100% complete & operational	100% complete & operational	No information in planning application documentation on construction phasing. On the basis that the application has been permitted and needs to commence within three years, it has been assumed that it will be built by Site Year 1 of construction.	Base case (all years)
Chelsea Creek (land bounded by Imperial Road and Fulham Gasworks and Railway Line and Imperial Wharf J2)	Approx 900m northwest	2011/01472/COMB	St George West London Ltd	Hybrid Planning Application (part outline/part detailed) for the mixed use development of the site following demolition of existing office building, comprising 489 residential units (including 147 affordable residential units), 1,190 sq. m of commercial floorspace (Use Class A1-A5), 8,896 sq. m of office floorspace (Use Class B1), within seven buildings ranging from six to eight storeys in height, and a 25 storey building; formation of water basin,	B	Blocks C, D & E complete & operational Blocks A, B, F & G under construction	Blocks C, D & E complete & operational Blocks A, B, F & G under construction	100% complete & operational	Environmental Statement. NTS and section 6 on construction programme. The construction programme will span approximately nine years (from 2012 to 2021) for the construction of Blocks A-G. Construction will be broken into phases and it is currently envisaged that the development will be commenced from the	**2018 and 2019**: Base case = Blocks C, D & E Cumulative = Blocks A, B, F & G **2023**: Base case (all blocks)

Development within 1km (IPC or Mayoral referral unless otherwise noted)	Dist from site (closest point)	Development description			Category type (based on 'current' status)	Year specific assumptions			Source of assumption information / Notes	Base case or cumulative dev?
		Appl. No.	Developer	Description		2018 (Site Year 1 of construction)	2019 (peak construction traffic year)	2023 (Year 1 of operation)		
				two canals and navigable lock to replace existing Chelsea Creek barrier gates; provision of public and private open space; cycle and 402 car parking spaces at basement level. Approval sought for Access, Layout and Scale, with matters of Landscaping and Appearance reserved for later determination.					Imperial Road side with Blocks C, D and E being built out first. On this basis it is assumed that this will be built out by 2018 with remaining blocks still under construction. The whole development will be built out by 2021.	

Note: phasing and site layout information has been sourced from local authority planning portals unless otherwise indicated.

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