



Development Consent Order

Application Reference Number: WW010001

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

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Thames Water Utilities Limited



Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

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

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Environmental Statement

List of contents

Environmental Statement glossary and abbreviations	
Volume 1	Introduction to the Environmental Statement
Volume 2	Environmental assessment methodology
Volume 3	Project-wide effects assessment
Volume 4	Acton Storm Tanks site assessment
Volume 5	Hammersmith Pumping Station site assessment
Volume 6	Barn Elms site assessment
Volume 7	Putney Embankment Foreshore site assessment
Volume 8	Dormay Street site assessment
Volume 9	King George's Park site assessment
Volume 10	Carnwath Road Riverside site assessment
Volume 11	Falconbrook Pumping Station site assessment
Volume 12	Cremorne Wharf Depot site assessment
Volume 13	Chelsea Embankment Foreshore site assessment
Volume 14	Kirtling Street site assessment
Volume 15	Heathwall Pumping Station site assessment
Volume 16	Albert Embankment Foreshore site assessment
Volume 17	Victoria Embankment Foreshore site assessment
Volume 18	Blackfriars Bridge Foreshore site assessment
Volume 19	Shad Thames Pumping Station site assessment
Volume 20	Chambers Wharf site assessment
Volume 21	King Edward Memorial Park Foreshore site assessment
Volume 22	Earl Pumping Station site assessment
Volume 23	Deptford Church Street site assessment
Volume 24	Greenwich Pumping Station site assessment
Volume 25	Abbey Mills Pumping Station site assessment
Volume 26	Beckton Sewage Treatment Works site assessment
Volume 27	Minor works sites assessment

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Environmental Statement

Volume 23 Deptford Church Street site assessment

List of contents

Section 1	Introduction
Section 2	Site context
Section 3	Proposed development
Section 4	Air quality and odour
Section 5	Ecology – aquatic
Section 6	Ecology – terrestrial
Section 7	Historic environment
Section 8	Land quality
Section 9	Noise and vibration
Section 10	Socio-economics
Section 11	Townscape and visual
Section 12	Transport
Section 13	Water resources – groundwater
Section 14	Water resources – surface water
Section 15	Water resources – flood risk

Volume 23 Deptford Church Street figures

Section 1	Plans from the <i>Book of Plans</i>
Section 2	Environmental impact assessment figures

Volume 23 Deptford Church Street appendices

Appendix A	Introduction
Appendix B	Air quality and odour
Appendix C	Ecology – aquatic
Appendix D	Ecology – terrestrial
Appendix E	Historic environment
Appendix F	Land quality
Appendix G	Noise and vibration
Appendix H	Socio-economics
Appendix I	Townscape and visual

Appendix J	Transport
Appendix K	Water resources – groundwater
Appendix L	Water resources – surface water
Appendix M	Water resources – flood risk
Appendix N	Development schedule

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Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix A: Introduction

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Thames Tideway Tunnel
Environmental Statement
Volume 23 Deptford Church Street appendices
Appendix A: Introduction

List of contents

	Page number
Appendix A : Introduction.....	1
A.1 Summary.....	1

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Appendix A: Introduction

A.1 Summary

- A.1.1 This document presents the appendices that accompany the *Environmental Statement* Volume 23 Deptford Church Street 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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Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix B: Air quality and odour

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Thames Tideway Tunnel

Environmental Statement

Volume 23 Appendices: Deptford Church Street site assessment

Appendix B: Air quality and odour

List of contents

	Page number
Appendix B : Air quality and odour	1
B.1 Model verification.....	1
B.2 Traffic data.....	4
B.3 Construction plant emission factors.....	7
References	10

List of plates

	Page number
Vol 23 Plate B.1 Air quality - monitored road NO _x vs. modelled road NO _x	2
Vol 23 Plate B.2 Air quality – monitored road NO _x vs. adjusted modelled road NO _x ..	2
Vol 23 Plate B.3 Air quality – total monitored NO ₂ vs. total adjusted modelled NO ₂ ...	3

List of tables

	Page number
Vol 23 Table B.1 Air quality - traffic data model inputs	4
Vol 23 Table B.2 Air quality - construction plant assessment model inputs.....	7

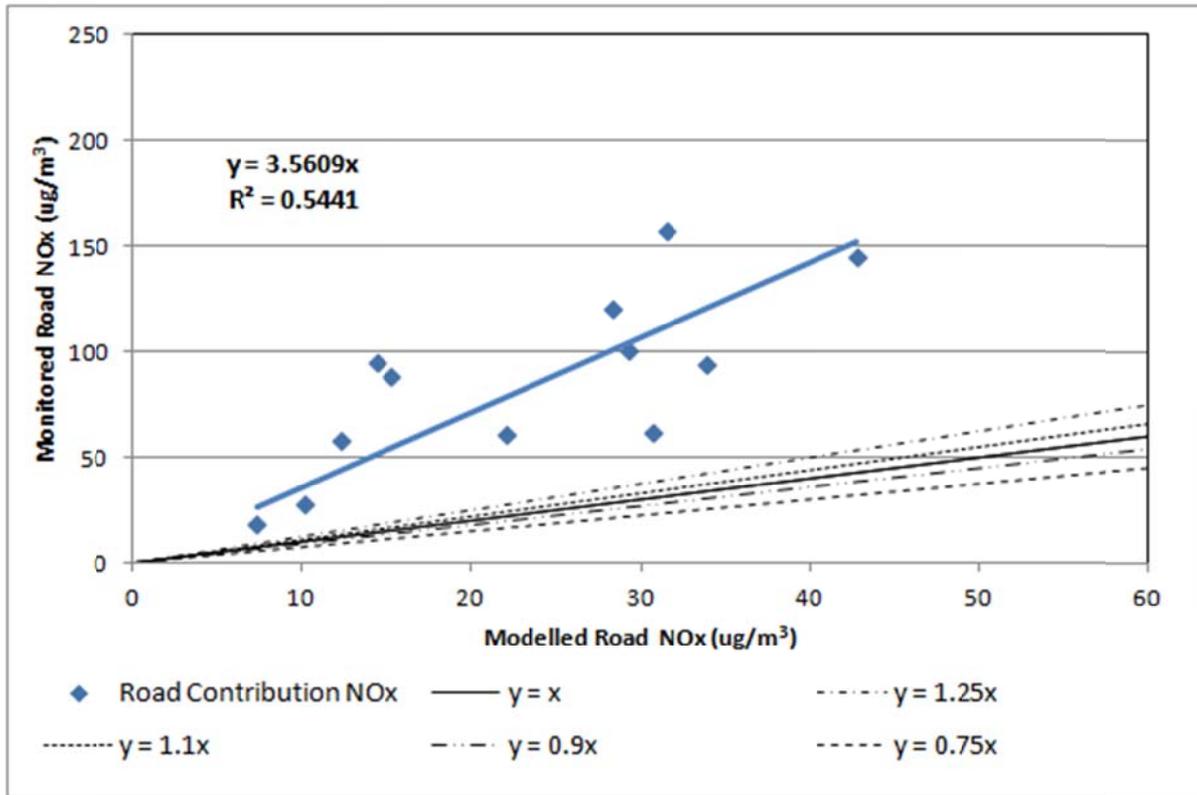
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Appendix B: Air quality and odour

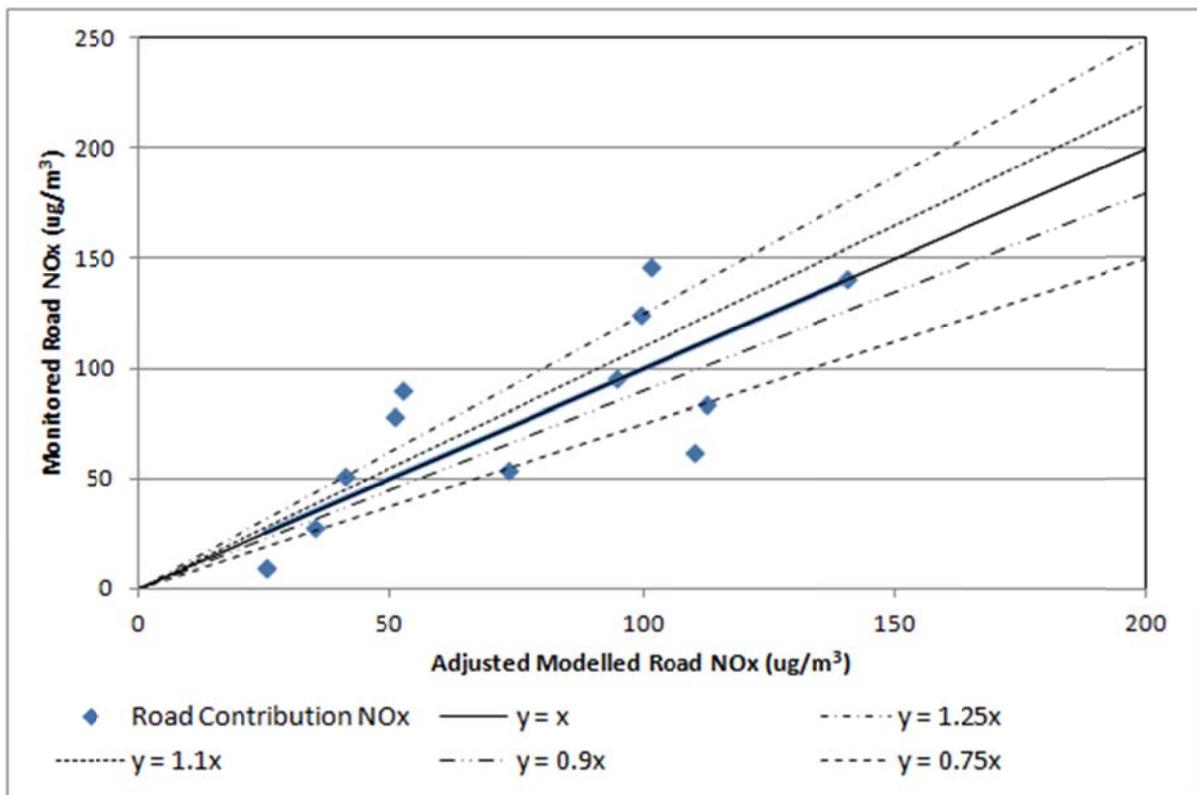
B.1 Model verification

- B.1.1 Modelled NO₂ concentrations have been plotted against monitored concentrations at the twelve diffusion tube sites (DCSM1, DCSM5-DCSM9, GPSM1-GPSM4 and GWS43, GWS48) shown in Vol 23 Figure 4.4.1 (see separate volume of figures).
- B.1.2 This showed that the modelled results underestimated NO₂ concentrations by between 10% and 42%. 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 23 Plate B.1 below. An adjustment factor of 3.56 was calculated to adjust modelled roadside NO_x concentrations, in accordance with LAQM.TG(09)¹ and was subsequently applied – see Vol 23 Plate B.1. This factor was also applied to the PM₁₀ results as the PM₁₀ 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 NO₂ concentrations, as shown in Vol 23 Plate B.2, provides better overall agreement between actual and predicted data. The subsequent linear regression calculation for monitored versus modelled total NO₂, as shown in Vol 23 Plate B.3, indicated that eight of the twelve modelled concentrations were within 10% of the measured value and the remaining four were within 25% of the modelled value.

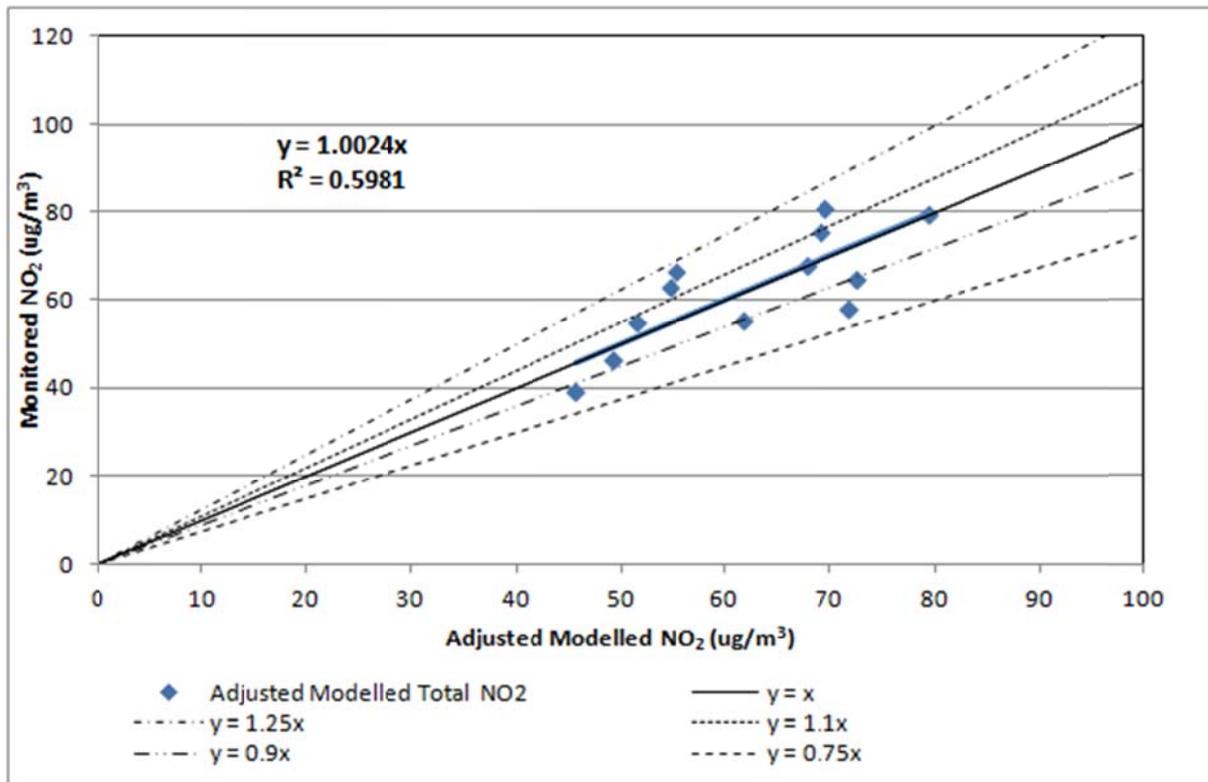
Vol 23 Plate B.1 Air quality - monitored road NO_x vs. modelled road NO_x



Vol 23 Plate B.2 Air quality – monitored road NO_x vs. adjusted modelled road NO_x



Vol 23 Plate B.3 Air quality – total monitored NO₂ vs. total adjusted modelled NO₂



B.2 Traffic data

B.2.1 The traffic data used in the air quality modelling for the Deptford Church Street site are shown in Vol 23 Table B.1.

Vol 23 Table B.1 Air quality - traffic data model inputs

Source	Road link	2010 baseline AADT*	Baseline % HGV >3.5t	Speed limit (mph)	Model input speed (mph)	Growth factor % (2009 - 2018)	Peak construction year AADT	Peak construction year scheme construction HGV (HGV >3.5t)	Peak construction year development case (total AADT)	Peak construction year development case AADT % HGV (>3.5t)
ATC** 'Indirect'	Brookmill Road A2210	20076	5.1%	30	19.3	5.0%	21089	0	21143	5.1%
ATC 'Indirect'	Deptford Bridge A2	46512	9.3%	30	19.3	5.0%	48859	59	48949	9.4%
ATC 'Indirect'	Deptford Broadway A2	35462	10.2%	30	19.3	5.0%	37252	23	37311	10.2%
ATC 'Indirect'	Deptford Church Street A2209	27572	6.7%	30	19.3	5.0%	28963	45	29057	6.9%
ATC 'direct'	Deptford Church Street A2209	20604	11.3%	30	26.4	5.0%	21644	45	21702	11.4%
Speed Limit	Bronze Street	170	0.0%	20	20.0	5.0%	179	0	179	0.0%
Speed	Coffey Street	972	3.1%	20	20.0	5.0%	1021	32	1053	6.0%

Source	Road link	2010 baseline AADT*	Baseline % HGV >3.5t	Speed limit (mph)	Model input speed (mph)	Growth factor % (2009 - 2018)	Peak construction year AADT	Peak construction year scheme construction HGV (HGV >3.5t)	Peak construction year development case (total AADT)	Peak construction year development case AADT % HGV (>3.5t)
Limit										
ATC 'Indirect'	Deptford Church Street A2209	22002	7.3%	30	26.4	5.0%	23112	45	23171	7.4%
ATC 'Indirect'	Creek Road A200	35340	6.6%	30	25.3	5.0%	37124	48	37186	6.7%
ATC 'Indirect'	Creek Road A200	22161	5.8%	30	25.3	5.0%	23280	49	23330	6.0%
ATC 'direct'	New Cross Road A2	29755	9.0%	30	19.3	5.0%	31257	23	31295	9.0%
TfL Model	Greenwich High Street A206	8884	6.2%	30	13.4	5.0%	9332	37	9387	6.6%
TfL Model	Norman Road (A208)	5060	7.0%	30	14.9	5.0%	5315	21	5337	7.4%
TfL Model	Greenwich High Street A206	11284	5.1%	30	12.4	5.0%	11854	0	11854	5.1%
TfL Model	Norman Road (A208)	5348	7.5%	30	14.9	5.0%	5618	49	5667	8.3%
ATC 'direct'	Creek Road A199	20307	10.6%	30	25.3	5.0%	21332	0	21334	10.6%

Source	Road link	2010 baseline AADT*	Baseline % HGV >3.5t	Speed limit (mph)	Model input speed (mph)	Growth factor % (2009 - 2018)	Peak construction year AADT	Peak construction year AADT >3.5t	Peak construction year development case (total AADT)	Peak construction year development case AADT % HGV (>3.5t)
ATC 'Indirect'	Creek Road A200	26470	5.1%	30	25.3	5.0%	27806	49	27857	5.3%
TfL Model	Church Street A206	10397	8.9%	30	16.8	5.0%	10922	0	11027	8.8%
TfL Model	Greenwich High Street A206	5952	11.3%	30	19.2	5.0%	6253	0	6253	11.3%

* AADT – annual average daily traffic. ** 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 23 Table B.2 has been modelled for the peak construction year at the Deptford Church Street site.

Vol 23 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	5.8E-07	3.6E-08	
	Ground level behind hoarding	Generator - 200kVA	1	100	160	1.8E-06	1.1E-07	
	Ground level behind hoarding	JCB with hydraulic breaker	1	50	67	3.7E-07	2.3E-08	
	Ground level behind hoarding	Cutting equipment (diamond saw)	2	10	2.3	1.3E-08	2.8E-08	
	Ground level behind hoarding	Telescopic handler / FLT**	1	30	60	2.0E-07	1.2E-08	
	Ground level behind hoarding	Hiab*** lorry/crane	1	5	56	3.1E-08	1.9E-09	
	Ground level behind hoarding	Well drilling rig	1	50	403	2.2E-6	1.4E-7	
	Demolition	Ground level behind hoarding	Service crane 25t mobile crane	1	30	275	9.2E-07	5.7E-08
		Ground level behind hoarding	22t excavator with hydraulic hammer	1	30	122	4.1E-07	2.5E-08

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	Site dumper	1	30	81	2.7E-07	1.7E-08
	Ground level behind hoarding	Vibrating rollers	2	50	145	1.6E-06	1.0E-07
Diaphragm wall	Ground level behind hoarding	Diaphragm wall rig (grab)	1	20	250	5.6E-07	3.5E-08
	Ground level behind hoarding	Diaphragm wall rig (hydrofraise)	1	80	250	2.2E-06	1.4E-07
	Ground level behind hoarding	Concrete deliveries (discharging)	1	20	223	5.0E-07	3.1E-08
	Ground level behind hoarding	Concrete pump	1	20	223	5.0E-07	3.1E-08
	Ground level behind hoarding	Compressor 400cfm*	1	50	104	5.8E-07	3.6E-08
Shaft excavation	Ground level behind hoarding	Dumper	1	50	81	4.5E-07	2.8E-08
	Ground level behind hoarding	150t crawler crane	2	50	240	2.7E-06	1.7E-07
	Ground level behind hoarding	Long reach excavator	1	80	178	1.6E-06	9.9E-08
	Within shaft	20t excavator with breaker	1	50	73	4.1E-07	2.5E-08
	Ground level behind hoarding	25t excavator	1	80	125	1.1E-06	6.9E-08

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	Dumper	1	50	81	4.5E-07	2.8E-08
	Ground level behind hoarding	80t crawler crane	1	50	240	1.3E-06	8.3E-08
	Ground level behind hoarding	100t crawler crane	1	50	240	1.3E-06	8.3E-08
	Ground level behind hoarding	100t crawler crane	1	50	240	1.3E-06	8.3E-08
Shaft secondary lining	Ground level behind hoarding	Service crane 40t mobile crane	1	25	275	7.6E-07	4.8E-08
	Ground level behind hoarding	Concrete deliveries (discharging)	1	20	223	5.0E-07	3.1E-08
	Ground level behind hoarding	Concrete pump	2	20	223	9.9E-07	6.2E-08

*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. * cfm – cubic feet per minute. ** FLT – fork lift truck. ***Hab – loader crane.*

References

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

Thames Tideway Tunnel
Thames Water Utilities Limited



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Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix C: Ecology - aquatic

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

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Thames Tideway Tunnel
Environmental Statement
Volume 23 Deptford Church Street
Appendix C: Ecology - aquatic

List of contents

	Page number
Appendix C : Ecology - aquatic	1
C.1 Introduction	1

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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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Application for Development Consent

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Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix D: Ecology - terrestrial

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Tideway Tunnel**



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Thames Tideway Tunnel

Environmental Statement

Volume 23 Deptford Church Street appendices

Appendix D: Ecology – terrestrial

List of contents

	Page number
Appendix D : Ecology – terrestrial	1
D.1 Notable species survey report	1

List of plates

	Page number
Vol 23 Plate D.1 Terrestrial ecology – bat passes recorded during remote recording surveys at one location at Deptford Church Street.....	3

List of tables

	Page number
Vol 23 Table D.1 Terrestrial ecology - species recorded within 500m of the site between 2001 - 2011	2
Vol 23 Table D.2 Terrestrial ecology – bat survey weather conditions	3
Vol 23 Table D.3 Terrestrial ecology - plant species recorded during the botanical survey including ground cover.....	4

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Appendix D: Ecology – terrestrial

D.1 Notable species survey report

Introduction

- D.1.1 Surveys for the following species were undertaken at Deptford Church Street, as suitable habitat for these species was recorded on site during the Phase 1 Habitat Survey conducted on 18 February 2011, as shown in (Vol 23 Figure 6.4.2, see separate volume of figures):
- a. bats
 - b. botanical.
- D.1.2 This report presents the survey findings. The survey area is described with reference to the habitat types identified during the Phase 1 Habitat Survey as having potential for notable species (paras. D.1.4 to D.1.9). The results from the surveys are then presented (paras. D.1.10 to D.1.16). The final section provides an interpretation of the results (paras. D.1.17 to D.1.19). Figures referred to in this report are contained within Vol 23 Deptford Church Street Figures.
- D.1.3 Information on legislation, policy and methodology can be found in Vol 2 of the *Environmental Statement*. Information on site context can be found in Section 3 of this volume.

Survey area

Bats

- D.1.4 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.1.5 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, commuting or roosting bats, one location was chosen for the installation of the remote recording device and is shown on Vol 23 Figure 6.4.3 (see separate volume of figures).
- D.1.6 Location one is towards the centre of the northern boundary of the site. This location was selected in order to record potential foraging and commuting activity over the site and any roosting activity associated with the adjacent church and church grounds.
- D.1.7 The bat activity recorded during the remote recording surveys did not trigger the need for an additional dawn survey (see Vol 2 Methodology for bat triggering criteria).

Botanical

- D.1.8 Following consultation with the London Borough of Lewisham, a botanical survey of the grassland habitat within Crossfield's Open Space on the Deptford Church Street site was undertaken. Where grasslands have a high species diversity, they can be of value as foraging and shelter for invertebrates, and for birds and bats that feed on those invertebrates.
- D.1.9 The survey area incorporated the grassland habitat on the Crossfield's Open Space area of the St Paul's Churchyard and Crossfield Street Open Space SINC (Grade Lⁱ) as shown on Vol 23 Figure 6.4.4 (see separate volume of figures).

Results

- D.1.10 In this section, the results of the desk study and the bat survey are presented. The results are then interpreted in paras. D.1.11 to D.1.13

Desk Study

- D.1.11 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 23 Table D.1.

Vol 23 Table D.1 Terrestrial ecology - species recorded within 500m of the site between 2001 - 2011

Common name	Latin name	Record count
Birds		
Black Redstart	<i>Phoenicurus ochruros</i>	8
Common Kingfisher	<i>Alcedo atthis</i>	3
Common Linnet	<i>Carduelis cannabina</i>	2
Common Starling	<i>Sturnus vulgaris</i>	1
Cornflower	<i>Centaurea cyanus</i>	1
Eurasian Hobby	<i>Falco subbuteo</i>	1
Hedge Accentor	<i>Prunella modularis</i>	1
Herring Gull	<i>Larus argentatus</i>	3
House Sparrow	<i>Passer domesticus</i>	8
Peregrine Falcon	<i>Falco peregrinus</i>	1
Red Kite	<i>Milvus milvus</i>	1
Sand Martin	<i>Riparia riparia</i>	1
Invertebrates		
Stag Beetle	<i>Lucanus cervus</i>	2

ⁱ SINC (Grade L) = Site of Importance for Nature Conservation (Grade I of local Importance)

Bat surveys

Bat triggering (remote recording) surveys

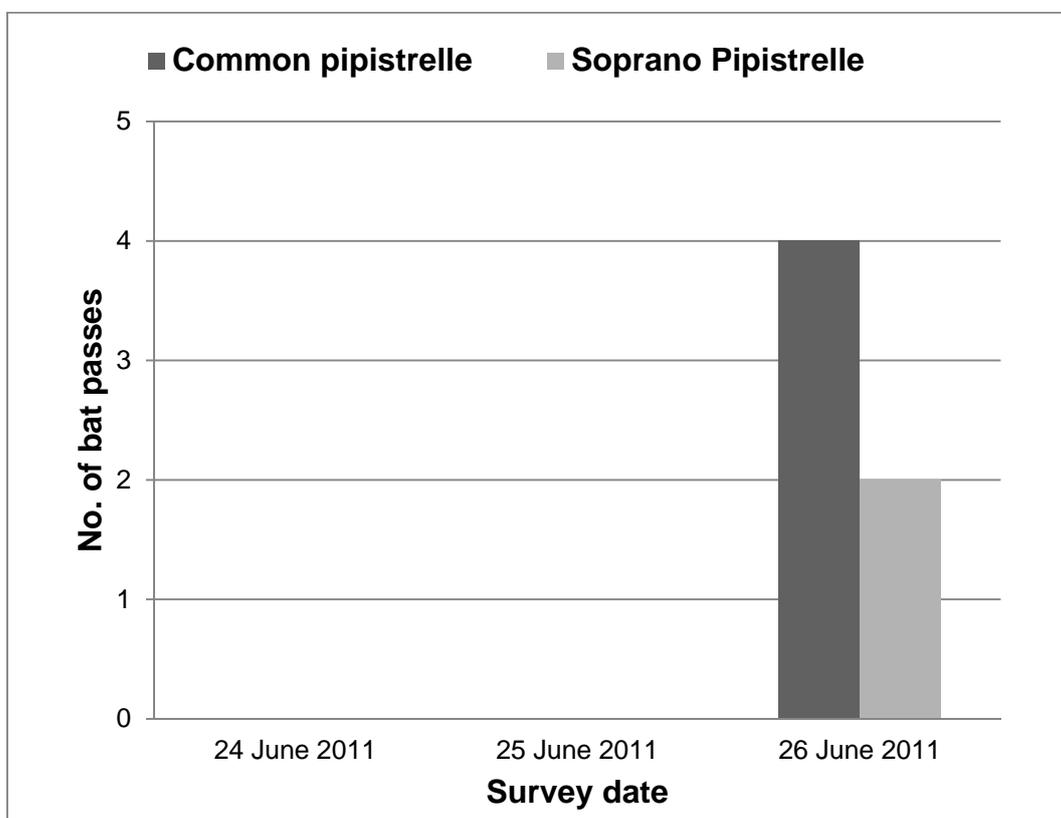
D.1.12 The bat triggering (remote recording) surveys were undertaken between 24 and 26 June 2011. All surveys were undertaken in suitable weather conditions (see Vol 23 Table D.2 below)

Vol 23 Table D.2 Terrestrial ecology – bat survey weather conditions

Survey visit	Weather conditions
24 June 2011	12°C, gentle westerly wind, 25% cloud cover, dry.
25 June 2011	11°C, gentle southerly wind, 25% cloud cover, dry.
26 June 2011	17°C, gentle westerly wind, 100% cloud cover, dry.

D.1.13 The remote recording surveys recorded two species of bats using the site, common pipistrelle (*Pipistrellus pipistrellus*) and soprano pipistrelle (*Pipistrellus pygmaeus*), which were both recorded on one night out of the three and in low numbers (Vol 23 Plate D.1). A maximum of six bat passes were recorded, with none recorded close to sunset or sunrise, indicating that bats are not roosting within close proximity to the site.

Vol 23 Plate D.1 Terrestrial ecology – bat passes recorded during remote recording surveys at one location at Deptford Church Street.



Botanical

- D.1.14 The botanical survey was undertaken on the 12 December 2012 by an experience botanist. The grasses, forbs (herbaceous flowering plants that are not grasses, sedges or rushes), and mosses. The survey results are shown in Vol 23 Table D.3.
- D.1.15 The management of the grassland varies with a tall sward due to infrequently mowing. The remainder of the site a short mown sward. The composition of the sward was similar between both areas of management, although moss species were slightly more abundant in the short mown sward.
- D.1.16 The botanical survey was undertaken during winter when some plants are dormant. This can limit the survey results where annual plants that grow from seed can be missed. However, an experienced botanist identified all other plants by the above and below ground growth of plants present. The general composition and species-richness of the grassland sward can be inferred from the species present. The experience botanist used professional judgement to determine whether any unrecorded protected and otherwise notable plant species are likely to naturally occur at the site. Therefore, this survey is considered to be sufficient to determine the value of the habitat for the purposes of this assessment.

Vol 23 Table D.3 Terrestrial ecology - plant species recorded during the botanical survey including ground cover

Common Name	Scientific Name
Dominant – 75%-100% ground cover	
Common Bent	<i>Agrostis capillaris</i>
Perennial Rye-grass	<i>Lolium perenne</i>
Abundant – 25%-74% ground cover	
Yarrow	<i>Achillea millefolium</i>
Ribwort Plantain	<i>Plantago lanceolata</i>
Rough-stalked Feather-moss	<i>Brachythecium rutabulum</i>
Springy Turf-moss	<i>Rhytidiadelphus squarrosus</i>
Frequent – 10%-24% ground cover	
Red Fescue	<i>Festuca rubra</i>
Smooth Meadow-grass	<i>Poa pratensis</i>
Occasional – 5%-9% ground cover	
False Oat-grass	<i>Arrhenatherum elatius</i>
Cock's-foot	<i>Dactylis glomerata</i>
Timothy	<i>Phleum pratense</i>
Black Horeground	<i>Ballota nigra</i>
Daisy	<i>Bellis perennis</i>

Common Name	Scientific Name
Canadian Fleabane	<i>Conyza canadensis</i>
Common Mallow	<i>Malva sylvestris</i>
Creeping Cinquefoil	<i>Potentilla reptans</i>
Creeping Buttercup	<i>Ranunculus repens</i>
Hedge Mustard	<i>Sisymbrium officinalis</i>
Dandelion	<i>Taraxacum officinale</i> agg.
Rare - <5% or 5 clumps or individual plants	
Wall Barley	<i>Hordeum murinum</i>
Common Mouse-ear	<i>Cerastium fontanum</i>
Buck's-horn Plantain	<i>Plantago coronopus</i>
Broad-leaved Dock	<i>Rumex obtusifolius</i>
Common Ragwort	<i>Senecio jacobaea</i>
White Clover	<i>Trifolium repens</i>

Interpretation

Bats

- D.1.17 The remote recording survey identified a low number of bat passes on one night.
- D.1.18 Two soprano pipistrelle and four common pipistrelle bat passes were recorded on 26 June 2011. All of these passes were recorded later into the evening close to midnight and before dawn. The small number of bat passes is indicative of small numbers of individual bats foraging and/or commuting through the survey area. The number of bat passes and recordings only occurring on a single survey night suggest that these species are occasional visitors to the site.
- D.1.19 As there were no records close to dusk or dawn when bats generally leave and return to their roosts, it is considered unlikely that common pipistrelle or soprano pipistrelle are roosting within the survey area, or in close proximity to it.

Botanical

- D.1.20 No notable botanical species were recorded on site. Those present species are common and widespread in the UK and indicative of semi-improved neutral grassland. This habitat type is common in the squares and parks in London and throughout the UK, and complements the similar habitat present in the Sue Godfrey LNR to the east of the site.

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Thames Tideway Tunnel
Thames Water Utilities Limited



Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix E: Historic environment

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

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Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 23 Deptford Church Street appendices

Appendix E: Historic environment

List of contents

	Page number
Appendix E : Historic environment	1
E.1 Gazetteer of known heritage assets	1
E.2 Site location, topography and geology.....	12
E.3 Past archaeological investigations within the assessment area	14
E.4 Archaeological and historical background of the site.....	14
E.5 Plates	23
References	29

List of plates

	Page number
Vol 23 Plate E.2 Historic environment – Rocque’s map of 1746.....	23
Vol 23 Plate E.3 Historic environment – Stanford’s map of 1862	23
Vol 23 Plate E.4 Historic environment – Ordnance Survey 1st edition 25” scale map of 1862 (not to scale)	24
Vol 23 Plate E.5 Historic environment – Ordnance Survey 2nd edition 25” scale map of 1896 (not to scale)	24
Vol 23 Plate E.6 Historic environment – Ordnance Survey 25” scale map of 1947 (not to scale)	25
Vol 23 Plate E.7 Historic environment – Ordnance Survey 1:10,000 scale map of 1976 (not to scale)	25
Vol 23 Plate E.8 Historic environment – Brick wall running through the site (HEA 1b); standard lens; looking southeast.....	26
Vol 23 Plate E.9 Historic environment – Original 19th century cobbled surface (HEA 1c) of the southern entrance to a lane behind the rectory buildings; standard lens; looking north	26
Vol 23 Plate E.10 Historic environment – mid 19th-century viaduct for the London and Greenwich Railway (HEA 1d); view to the northwest showing the modern	

concrete deck replacement over Deptford Church Street (within the site).
Standard lens. 27

Vol 23 Plate E.11 Historic environment – Church of St Paul, Deptford Church Street;
standard lens; looking northwest..... 28

List of tables

Page number

Vol 23 Table E.1 Historic environment – gazetteer of known heritage assets within
the site and assessment area 1

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 23 Table E.1 below, with their location shown on the historic environment features map (Vol 23 Figure 7.4.1, see separate volume of figures). Locally listed buildings, conservation areas and archaeological priority zones are not shown.
- 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 23 Table E.2 Historic environment – gazetteer of known heritage assets within the site and assessment area

HEA Ref no.	Description	Site code/ HER ref/ List entry number
1A	Crossfield Street, southwestern boundary of the site Find spot of unspecified post-medieval remains dating to the 18th and beginning of the 19th centuries. Perhaps building material and/or evidence of the demolition of earlier buildings and the construction of houses and a garden which were known to exist on the site by the mid-19th century.	071323 071324
1B	Adjacent to Deptford Church Street, in the centre of the site The remains of a brick wall noted on the Museum of London Archaeology (MOLA) Thames Tideway Tunnel project site visit. The wall follows the line of the back wall of since demolished 19th-century residential properties fronting on to Deptford Church Street. The wall is dated to the late 19th/early 20th centuries. The late 19th century/early 20th century date is confirmed by its two-layer slate Damp Proof Course.	---
1C	Surviving traces of Coffey Street and the 19th-century cobbled rear alley to the Rectory Buildings in the western-central part of the site.	---
1D	Railway viaduct for the London and Greenwich Railway A Grade II listed railway viaduct for the London and Greenwich Railway. Construction was authorised by Act of Parliament in 1833; the section from North Kent Junction to Deptford was opened in February 1836, that east to	1253151

HEA Ref no.	Description	Site code/ HER ref/ List entry number
	<p>Deptford Creek in December 1836. The total length of the viaduct is 5,150 metres. The viaduct is constructed of grey brick; each arch is 20 feet from centre to centre and 22 feet high. The viaduct comprises the following: 32 arches from Deptford Creek to Deptford Church Street - most of the arches remain open; 30 arches from Deptford Church Street to Deptford High Street – the southern parapet has been rebuilt with modern construction within its arches; 52 arches from Deptford High Street to Edward Street - the platform buildings of Deptford Station, which surmount the viaduct, have been rebuilt and are not of special interest; 36 arches from Edward Street to Abinger Grove - the south face is obscured by other buildings up against it, but the north face is a strong composition; 33 arches from Abinger Grove to Rolt Street - the arches have been infilled with workshops of no special interest; 13 arches from Rolt Street to North Kent Junction. This viaduct carried the first passenger railway in London, and is one of the first major achievements of railway engineering in Britain.</p>	
1E	<p>Deptford Church Street The site of the former Old Roman Eagle, a public house which was built in c.1841.</p>	070123
1F	<p>The Rectory, Church of St. Paul The former location of a triangular rectory building with octagonal rooms. It was designed by Thomas Archer, and construction began at the same time as the Church of St. Paul in c. 1717–1719. It was completed in 1729 and demolished in 1885.</p>	---
2	<p>St Paul's Churchyard, Deptford Church Street A watching brief was carried out here by Museum of London Archaeology Service (MoLAS; now called MOLA) in 2000. An area on the north side of the church, in front of the stairways and on either side of the entrance to the crypt, exposed a brick barrel-vaulted tomb on the east side of the steps, close to the present path. On the south side of the church two probable brick-lined graves were found, positioned either side of the southern entrance into the crypt, and a shaft excavated to the south of the roadway revealed a total of 20 burials in wooden coffins which had handles of 19th century type.</p>	DHG00
3	<p>St Joseph's Roman Catholic School, Crossfield Street An archaeological investigation was carried out here by AOC Archaeology in 2010. No further information listed in</p>	JOD10

HEA Ref no.	Description	Site code/ HER ref/ List entry number
	London Archaeological Archive and Research Centre (LAARC).	
4	<p>St Paul's Parsonage, Mary Ann Gardens, Deptford High Street</p> <p>An archaeological evaluation was carried out here by Sutton Archaeological Service (SAS) in 1999. In the eastern half of the site, beneath the demolished 1960s parsonage, a deep cellar was revealed; modern levelling covered the western part of the site.</p>	MYG99
5	<p>176 Deptford High Street</p> <p>A watching brief was carried out here by Archaeology South East in 2003. Observation of ground works in the eastern part of the site revealed deposits indicating that the area had been relatively undisturbed until the 20th century, when the ground level had been substantially raised. In the western part of the site, closer to the street frontage, the ground had also been considerably raised but to have been truncated prior to modern landscaping.</p>	DFH03
6	<p>Deptford Station, Deptford High Street</p> <p>An archaeological watching brief was carried out here by Pre-Construct Archaeology (PCA) in 2005. Two cut features pre-dating the construction of Deptford Station in 1834 and evidence of the station's foundation walls were recorded cutting the natural sand. Concrete slabs and basements associated with the development of the site in the late 19th-20th century were also revealed. Modern made ground sealed the site.</p>	DHD05
7	<p>Berthon Street</p> <p>An archaeological evaluation was carried out here by MOLAS in 1993. Natural gravels and alluvium, on the Deptford Church Street side of the site, were cut by several robbed-out wall trenches from the 17th century Trinity Almshouses and by brick foundations of 19th century domestic buildings. On the Berthon Street side of the site they were directly overlain by a series of ground consolidation deposits, apparently associated with industrial activity of the immediate post-WWII period.</p>	BTN93 071924 071925
8	<p>221-225 Deptford High Street, 2-4 Edward Street</p> <p>An archaeological watching brief was carried out here by MOLAS in 1993. Natural gravels were truncated by the brick foundations of a post-medieval building, with modern levelling above or modern basements.</p>	DEF93 071320

HEA Ref no.	Description	Site code/ HER ref/ List entry number
9	<p>McMillan Herb Garden Project, 76-78 McMillan Street</p> <p>An archaeological watching brief was carried out here by PCA in 1998. Natural strata were not observed. The remains of a building dating to the second half of the 19th century were recorded; after demolition it had been backfilled with modern debris.</p>	MCM98
10	<p>St Nicholas' Church, Deptford Green</p> <p>An archaeological watching brief was carried out here by PCA in 1998. Natural deposits were not located. A slab pathway between the north church door and a blocked gateway in the northern perimeter wall of the church grounds were examined: they are probably of pre-20th century date. Wall footings of the eastern boundary wall were revealed and are considered to possibly date to the 18th century. Rebuilds occurred on the same alignment.</p>	NCH98
11	<p>St Nicholas' Church, Deptford Green (Greenwich)</p> <p>NHC03 (church tower): Standing building recording was carried out by PCA in 2003. Elevations of the tower were recorded before and after stone cleaning and profiles were drawn of capitals, corbels, mullions and hood mouldings.</p> <p>MMN02: A watching brief was carried out by PCA in 2002. The top corner of a red brick burial vault was revealed beneath the nave near the southeastern corner of the church; it seems to be contemporary with the rebuilding of the church and better provision for the dead, around the turn of the 18th century. A large square fragment of worked stone was recovered, possibly part of a tombstone or tomb lid. A burial was also recorded. Disturbed human bones were found in all of the deposits, indicating that the burial ground had been in use over a long period of time.</p> <p>SND88: No information available.</p> <p>NCD76: An excavation was carried out in 1976 (organisation unknown). The north chamber had a surface of sand and pebbles covered with mortar and rubble, fragments of coffins, pottery and glass. Medieval burials were disturbed by the cutting of the floor during the late 17th century. Most of the bones of one burial, lower than others, were preserved except the head. At the western end medieval foundations had been cut back to and the chamber built against the east face of the tower. A flight of steps had been constructed to allow access to the chamber; only their northern edge was seen during the excavation. In the later 18th century a possible collapse of</p>	<p>NHC03 MMN02 SND88 NCD76</p>

HEA Ref no.	Description	Site code/ HER ref/ List entry number
	two rotting coffins resulted in a pile of wood and bones (from two individuals) becoming located in a shallow hole scraped in the floor. Each chamber had a circular opening just below the crown of vault which communicated with roughly built brick channels (these were truncated by the 1957 restoration work). The west wall had been bricked up some time after 1830 using original and later bricks.	
12	Rachel McMillan College, Creek Road, Stowage An archaeological evaluation was carried out by MOLAS in 2002. Natural gravels were overlaid by made ground dating from the mid-late 18th century. This represented land clearance and demolition of earlier buildings in order to develop the site with early 19th century and Victorian houses. The presence of buildings along the western, northern and eastern boundaries of the site was confirmed by 19th-century brick walls. Modern rubble and make-up sealed the walls, their demolition probably connected in most cases with WWII bombing in the area and subsequent land clearance for rebuilding. Brick foundations survived beneath the modern ground surface, which probably date from the mid-18th century to the Victorian period.	CKI02
13	Laban Dance Centre, Creekside An archaeological evaluation was carried out by MOLAS in 2000. Above fluvial clays there was evidence of land reclamation, consisting of two unlined 18th century drainage channels (MLO 74889). The earliest structural features on site were the foundations of an early 19th-century brick boiler house (MLO 74890), interpreted as part of the soap works that used to occupy the site. Part of the north wall of an in-filled 20th century barge dock was also located.	LGR00 MLO74888 MLO 74889 MLO 74890
14	River Wall, Creekside A topographic survey of the revetment on the west side of Deptford Creek was undertaken by MOLAS in 2001, as well as a plan of a crane base rail.	CEK01
15	Deptford Creek, Creekside Road A foreshore survey of the drift geology and archaeology, a photographic record of the principal riverine structures of late 19th century or earlier date, and a record of the physical attributes of the creek bed and associated structures was undertaken by MOLAS in 2002. Amongst the latter were: stretches of timber river walls, constructed in the mid-19th century, timber revetments, a masonry	FLS02 070263 MLO 2120

HEA Ref no.	Description	Site code/ HER ref/ List entry number
	riverbed lining of c.1838, a dock or inlet of 1876-94, barge-bed revetments, masonry and timber splash aprons for a sewage pumping station outfall pipe of 1868, a masonry and timber drain of c.1868, Halfpenny Hatch rail bridge of 1870 (MLO 2120), and a line of timber uprights which may be remnants of the river wall line predating the 18th century.	
16	Harold Wharf, 6 Creekside An archaeological watching brief was carried out by Compass Archaeology in 2001. Above the natural gravels 19th-20th century dumps and the boundary walls and outbuildings of a 19th century chemical works were recorded.	CEP01
17	Deptford to St John's North (Thames Water Pipe Replacement Project) An archaeological watching brief was carried out by Compass Archaeology (CA) in 2006. Water mains replacement works running from Brookmill Road to Creek Road exposed mainly 19th century and later made ground or fill deposits, in some cases overlying truncated natural alluvium. Occasional brick remains and foundations of this date were also exposed.	DSJ06
18	Giffin Street An archaeological evaluation and a watching brief were carried out by Wessex Archaeology and PCA in 2009. No further information listed in LAARC.	GIF09 GFN09
19	Princess Louise Institute, Hale Street Ground works were monitored as part of a watching brief carried out by MOLAS in 2007 and revealed natural gravel and brickearth overlaid by 18th century and later dumping. Road and yard surfaces of 18th-19th century date were also observed. Modern material, concrete and services completed the sequence.	PLI07
20	Hales Street An archaeological watching brief was carried out by MOLAS in 2003. Alluvial clay capped with gravel had been truncated by the construction of terraced houses in the 19th century. These had been destroyed as a result of WWII bomb damage, after which the site became a car park.	HAE03
21	15 Deptford High Street An archaeological watching brief was carried out by MOLAS in 1993. Natural gravels had been truncated by the	DEP93

HEA Ref no.	Description	Site code/ HER ref/ List entry number
	present basement WC.	
22	45 Deptford High Street, Site information not yet available.	DHS11
23	34 Deptford High Street (land, rear of) An archaeological investigation was carried out by Archaeological Solutions (AS) in 2010. Site information not yet available on LAARC.	DPT10
24	36 Reginald Square An archaeological investigation was carried out by Archaeological Solutions (AS) in 2010. Site information not yet available on LAARC.	RGI10
25	18-20 Reginald Square An evaluation was carried out by Oxford Archaeology (OA) in 2006. Victorian brick drains and soakaways to the west of the site were located, as well as considerable depths of made ground overlying a Victorian soil horizon to the east.	RIQ06
26	Bazalgette Southern Branch Sewer. Mid-late 19th century.	---
27	Deptford Church Street The site of the Baptist Old Meeting House dating to the latter half of the 17th century.	211563
28	Crossfield Street Site of the former Rectory of St Paul's; dating to the 18th century.	071580 071495
29	Berthon Street The site of the 17th century Trinity Almshouses.	071249
30	Bronze Street Find spot of unspecified 17–19th century remains.	07002301 07002303
31	Bronze Street The location of late 19th century cottages, late 19th and early 20th century pottery, flowerpots, drainpipes and tiles (MLO 24486). A fragment of an earthenware pot was also recovered from a wall composed of concrete and pottery fragments (MLO 11370).	MLO 11370 070061 MLO 24486 070274
32	Albury Street or River Thames The find spot of unspecified 1st century Roman remains (exact location uncertain).	070024

HEA Ref no.	Description	Site code/ HER ref/ List entry number
33	Junction of Deptford Creek Road and Deptford Church Street The site of a former medieval road, believed to have been known as Addey Street, dated to the 15th century.	070059
34	Junction with Watergate Street The site of the 19th century 'Harp of Erin' – a public house.	070130
35	Junction of King Street with Evelyn Street The site of the former Globe Inn, dating to the 17th century.	070116
36	Charlotte Turner Gardens, McMillan Street The site of the former 18th century Armada Street.	070307
37	Deptford Green The approximate centre point of medieval Deptford Green.	071584
38	West bank of Deptford Creek The line of Roman Watling Street where it is believed to have crossed Deptford Creek.	MLO 11490 070557
39	Deptford Creek Viaduct Pier bases The find spot of an undated revetment and a peat deposit.	MLO 77153 MLO77152
40	Creekside, Deptford Church Street The site of a post-medieval gravel pit.	MLO 72934 071818
41	Deptford Creek, to the south of the site The location of a former tide mill, used for grinding corn into flour, dating to the 14th century.	MLO 1910 070074
42	Library, Giffin Street The find spot of unspecified 18th century remains.	071049
43	Mary Ann Buildings The location (uncertain, as the find spot was wrongly positioned) of a post-medieval quarry (MLO 64269) and presumably a later cellar (MLO 64270). It is also noted as the location of a burial vault (MLO 64271) and burial (MLO 64272), although the exact relationship, if the features are related, between the burial, quarry and cellar are not known.	MLO64269 071323 MLO64270 071324 MLO64271 071325 MLO64272 071326
44	St Paul's Churchyard, Deptford Church Street The churchyard of the Church of St Paul (now disused). It	Basil Holmes

HEA Ref no.	Description	Site code/ HER ref/ List entry number
	received a considerable number of interments until its closure in the mid-1850s. Over 13,000 were buried here in its first fifty years of existence; in all tens of thousands of people were buried in the churchyard. It was recorded by Mrs. Basil Holmes in 1897 as part of a survey of known and existing London burial grounds and was described as containing 'many quaint specimens'. In 1912–1913 the churchyard was cleared of hundreds of tombstones (mainly dating to the 19th century) and was turned into a garden and recreational space, as it has remained.	Map Sheet 57
45	Old Baptist (Unitarian) Chapel burial ground, Deptford Church Street Belonging to the Baptist Chapel immediately to the east of the Church of St Paul and now disused. It was described by Basil Holmes in 1897 as 'closed, the railings and gravestones are broken, and there is a quantity of rubbish lying about'.	Basil Holmes Map Sheet 57
46	Friend's burial ground, Deptford High Street A former Quaker burial ground, now built over and occupied by shops. It was still in existence (although disused) when Mrs. Basil Holmes carried out her survey in 1897, and was described as neatly kept with one gravestone.	Basil Holmes Map Sheet 57
47	Congregational Chapel burial ground, Deptford High Street A former burial ground, now built over and occupied by a Job Centre. It was disused by the mid-19th century and was described by Basil Holmes as neatly laid out, with gravestones against its walls.	Basil Holmes Map Sheet 68
48	St Nicholas' Churchyard, Deptford Green (Greenwich) A now disused but preserved churchyard belonging to the Church of St Nicholas. It was described in the Basil Homes survey of 1897 as 'closed and full of tombstones'.	Basil Holmes Map Sheet 57
49	Additional burial ground of the Church of St Nicholas, McMillan Street (Greenwich) An additional burial ground belonging to the Church of St Nicholas which was laid out in 1884. It is now occupied by blocks of flats.	Basil Holmes Map Sheet 57
50	Church of St Paul, Deptford Church Street A Grade I listed white ashlar church built in the Classical style and completed in 1730 by Thomas Archer as part of a scheme of church building to alleviate a lack of places of worship following the Great Fire of 1666. It is rectangular with an eastern apse, short, transept-like side projections,	1080003

HEA Ref no.	Description	Site code/ HER ref/ List entry number
	and a western apse surround by a giant semicircular Doric portico. Very strongly modelled. It has rusticated pilasters and recessed round arched windows with triple keystones. A round vestibule leads to a dignified Baroque interior. Giant Corinthian columns support rich entablature. The church contains several large 18th century monuments.	
51	Walls of the former graveyard to the Old Baptist Chapel (now demolished) and the southeast angle of St Paul's Churchyard. Grade II listed. 18th century walls to the west of former chapel. Red brick mixed with stock brick, stone-coped. Square buttress piers, of greater height and with stone cornice at intervals. Wall continues without coping, and with 19th century rebuilding in places, around southeast corner of St Paul's Churchyard. Old gravestones against east face of eastern wall and north face of southern wall.	1080002
52	Walls and railings to north and east of St Paul's churchyard. Early 18th century walls of dark red brick having stone-coped square piers at close intervals. At western end north wall is low with steeply-sloping brick coping. Further east it is high without coping. Along east end of churchyard low modern brick wall with 19th century wrought iron railings and gate with overthrow. Returning to westward a farther section of brick wall with taller piers at intervals which have stone cornice and blocking course.	1080004
53	34–40 Albury Street. Grade II* listed.	1080023
54	39 and 41 Albury Street. Grade II listed. 45 Albury Street. Grade II listed. (This is part of a group consisting of nos. 13–45 Albury Street)	1358922 1217928
55	13 and 15 Albury Street. Grade II* listed. 17 Albury Street. Grade II* listed. 19 and 21 Albury Street. Grade II* listed. 23–27 Albury Street. Grade II* listed. 29 and 31 Albury Street. Grade II* listed. 33 Albury Street. Grade II* listed. 35 Albury Street. Grade II* listed. 37 Albury Street. Grade II* listed. 43 Albury Street. Grade II* listed. (Part of group including nos. 13– 45 Albury Street)	1358938 1079072 1079073 1358939 1079074 1358940 1079075 1079076 1079077

HEA Ref no.	Description	Site code/ HER ref/ List entry number
56	227 Deptford High Street. Grade II listed.	1387525
57	Church of St Nicholas, Deptford Green (Greenwich). Grade II* listed.	1358943
58	Charnel house to the Church of St Nicholas, Deptford Green (Greenwich). Grade II* listed.	1289734
59	North and east walls to churchyard of St Nicholas and gate piers on west wall. Grade II* listed.	1219793
60	Deptford Creek, to the southwest of the site. The location of the Halfpenny Hatch Rail Bridge, which replaced an earlier 19th century lifting bridge.	TDP Zone FGW29; A102
61	Deptford Creek, to the southwest of the site. The location of masonry river bed lining, probably related to the construction of the Halfpenny Hatch Rail Bridge (HEA 60) above.	TDP Zone FGW29; A103
62	Deptford Creek, to the southwest of the site. A barge bed revetment is located here, consisting of a series of stout timber posts, retaining a wall of planks laid horizontally, forming a platform extending alongside the cast iron river wall of a former pumping station.	TDP Zone FGW29; A104
63	Deptford Creek, to the southwest of the site. The location of a masonry and timber splash apron for the sewage pumping station.	TDP Zone FGW29; A105
64	Deptford Creek, to the southwest of the site. The location of a masonry and timber drain.	TDP Zone FGW29; A106
65	Deptford Creek, to the southwest of the site. The remains of a timber barge bed revetment.	TDP Zone FGW29; A107
66	Deptford Creek, to the southwest of the site. The location of a masonry and timber splash apron for the sewage pumping station.	TDP Zone FGW29; A108
67	Deptford Creek, to the southwest of the site. The remains of a flood defence, consisting of upright timbers in the centre of the present channel which may once have formed a revetment or timber wall.	TDP Zone FGW29; A109
68	Deptford Creek, to the southwest of the site. The remains of a timber river wall.	TDP Zone FLS02;

HEA Ref no.	Description	Site code/ HER ref/ List entry number
		A102
69	Deptford Creek, to the southwest of the site. The location of a dock or inlet formed by brick walls with upright timbers.	TDP Zone FLS02; A104
70	Deptford Creek, to the southwest of the site. The location of a timber revetment formed of at least 26 upright round timbers which extend for c.7m at a maximum surviving height of c.0.2m.	TDP Zone FLS02; A105
71	Bazalgette Southern Lower Level Sewer. Mid-late 19th century.	---
72	St Joseph's Roman Catholic School, Crossfield Street. Three storey school of the late 19th century with a modern extension. Not statutorily or locally listed.	---
73	167 Deptford High Street Locally listed building Eighteenth century two storey house, with pitched roof and modern shop front to the ground floor. Originally 167 and 169 were one dwelling.	
74	169 Deptford High Street Locally listed building Eighteenth century two storey house, with pitched roof and modern shop front to the ground floor. Originally 167 and 169 were one dwelling.	

E.2 Site location, topography and geology

Site location

- E.2.1 The majority of the site consists of a triangular-shaped plot of open space containing a north-south aligned brick wall parallel to Deptford Church Street (**HEA 1B**). The wall is believed to date to the late 19th/early 20th-century and is probably a boundary wall associated with buildings within the centre of the site shown on the Ordnance Survey map of 1896. The north-western part of the site contains a roundabout situated at the junction of Coffey Street and Crossfield Street. The eastern part of the site consists of sections of Deptford Church Street, to the east, north and south of the open plot of land. To the north of Coffey Street is the Church of St Paul and the terraced houses of Albury Street. To the west lies Deptford High Street, lined with shops and public amenities. Resolution

Way, over which the South Eastern Greenwich railway line runs, and a car park, swimming pool and library are located to the south of the site beyond Crossfield Street.

Topography

- E.2.2 The site lies at c. 105.5m Above Tunnel Datum (ATD; the equivalent of 5.5m Ordnance Datum). There is a gradual slope downwards from north to south along Deptford Church Street, from c. 106.2m ATD c. 60m northeast of the site, to c. 104.9m ATD c. 35m to the southeast. The ground also slopes down very slightly in the vicinity of the site from west to east, towards Deptford Creek, from c. 105.2m ATD c. 110m southwest of the site, to c. 104.9m ATD c. 35m to the southeast.

Geology

- E.2.3 The site is located entirely upon the Kempton Park river terrace gravels (British Geological Survey digital data)¹. In several places within the assessment area, but outside the site, the terrace is overlain by brickearth (Langley Silt Complex) which is a fine grained silt believed to have accumulated by a mixture of processes such as wind, slope and freeze-thaw, mostly since the Last Glacial Maximum around 17,000BP.
- E.2.4 Three boreholes (SR4031, SR4117 and SR6902D) drilled within the southern part of the site as part of ground investigations for the Thames Tideway Tunnel project were archaeologically monitored and recorded c. 1.0m of modern brick rubble below c. 0.3m of topsoil, overlying c. 1.0m of dark brown sandy clay with occasional gravel that becomes sandier with depth. This deposit is likely to be the former soil/subsoil formed in the underlying sand and gravel of the river terrace, the surface of which was recorded at c. 1.2m below ground level (c. 104.5m ATD). Truncation of the soil appears to have been minimal and it could therefore include finds and features dating from the prehistoric period onwards.
- E.2.5 Previous archaeological investigations within the assessment area have recorded the nature and levels of the sediments and underlying geology as follows:
- An evaluation (**HEA 12**) 110m northeast of the site noted gravels at 103.5m ATD overlain by 1.0m of truncated brickearth deposits, beneath made ground to 105.5m ATD.
 - A watching brief (**HEA 19**) 195m southwest of the site recorded gravels at similar levels of 103.5m ATD, overlain by 0.1m of truncated brickearth beneath made ground to 105.3m ATD.
 - An evaluation (**HEA 7**) 65m east of the site recorded terrace gravels at 104.5m ATD, overlain by 0.2m of truncated brickearth beneath made ground to 106.0m ATD.
- E.2.6 The top of the underlying subsurface gravels are likely to be fairly level at between 103.0m and 105.0m ATD, sloping gently down to the north towards the Thames. The river terrace would have remained high and dry in relation to the river systems, although soils would have developed across the gravels from the Mesolithic period onwards.

E.3 Past archaeological investigations within the assessment area

- E.3.1 Other than the archaeological monitoring of geotechnical boreholes on the site described above (see para. E.2.4), no archaeological investigations have been carried out on the site in the past. However, a considerable number have been carried out within the surrounding assessment area (numbering 25 investigations in total), mainly to the north and southeast of the site. Despite the number of investigations, understanding of the area prior to the later medieval period is limited. This is due to the localised nature of most of the investigations. Evidence for the post-medieval period is more abundant, particularly from the 18th century onwards, as many building, surface and road remains dating to this period have been uncovered.
- E.3.2 The closest archaeological investigation to the site was carried out at St Paul's Churchyard (**HEA 2**), adjacent to the northern boundary of the site, where a number of 18th-19th century burials were discovered on the north side of the church. An evaluation in Mary Ann Gardens (**HEA 4**), c. 60m to the northwest of the site, revealed a deep, 18th-19th century cellar beneath the demolished 1960s parsonage. At 176 Deptford High Street (**HEA 5**), c. 85m to the northwest of the site, evidence of natural ground overlain by 20th-century dumping was uncovered. An investigation at Deptford Station (**HEA 6**), c. 95m to the west of the site, uncovered cut features pre-dating the construction of the station in 1834.
- E.3.3 Results from investigations carried out further from the site include the remains of 18th-19th century dumping and buildings, reflecting the urbanisation of the area and the demolition of earlier houses and factories to make way for 19th and 20th century buildings. Such evidence has been recovered at Berthon Street (**HEA 7**), 65m to the east, McMillan Street (**HEA 9**), 140m to the north, Creek Road (**HEA 12**), 110m to the north east, the Laban Dance Centre (**HEA 13**), 235m to the east, Hale Street (**HEA 19**) 195m to the southwest, and at 18–20 Reginald Square (**HEA 25**), 300m to the southwest.
- E.3.4 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, and the individual site-specific assessments, within a broader historic environment context (ie, 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 There are no known archaeological remains dated to this period within the site or assessment area. The site lay on dry ground in this period, c. 500m to the southwest of the confluence of the Thames and the River Ravensbourne, known locally as Deptford Creek. The free draining nature of the gravels underlying the site, and its close proximity to the Thames and Ravensbourne rivers would have made it area ideal for farming and settlement. As a consequence, features or artefacts relating to prehistoric activity may survive at the top of the terrace gravel, if not truncated by later medieval or post-medieval activity.
- E.4.3 Outside the assessment area, a Palaeolithic tranchet axe was recovered from the Ravensbourne River at the Century Works, Conington Road c. 1.4km to the south of the site. Bronze Age artefacts have also been recovered from the Ravensbourne and its floodplain in Lewisham, c. 1.5km to the south of the site, suggesting that its natural resources were exploited throughout the prehistoric period.

Roman period (AD 43–410)

- E.4.4 There are no known archaeological remains dated to this period within the site and no definite remains within the assessment area. Watling Street, (**HEA 38**), a Roman road which was a major route between Canterbury (*Durovernum*) and St Albans (*Verulamium*) is believed to have crossed Deptford Creek c. 250m to the east of the site. It then continued further to the southeast. The site was probably located in open fields, some distance from nearby roads or known settlement centres, in a rural landscape of scattered farmsteads.
- E.4.5 An uncertain location has been given by the Greater London Historic environment Record (GLHER) for a bronze lamp believed to date to the 1st century, (**HEA 32**), discovered in the 19th century c. 100m to the north-west of the site in Albury Street. Alternatively, the GLHER suggests that the lamp may have come from the Thames at Greenwich. Outside the assessment area, excavations carried out at the junction of Deptford Church Street and The Broadway, c. 450m to the south of the site, revealed ditches and two burials which may be of Roman date (Philip and Chenery, 1993)². These burials are likely to have been located to the south of Watling Street and perhaps represent a roadside burial ground. Roman law required burial grounds to be situated outside the cities or settlements and they were typically placed along the main approach roads.

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

- E.4.6 There are no known archaeological remains dated to this period within the site or assessment area. It is likely that the site lay in open fields outside of, and between, Saxon settlements at Deptford Green (**HEA 57**) c. 200m to the north of the site; and Deptford Bridge, c. 410m to the southwest.
- E.4.7 The name Deptford is thought to be Anglo-Saxon in origin, a reference to a deep ford crossing the River Ravensbourne (Gaimster, 2005)³. Watling Street is likely to have continued in use as a route to Canterbury. A ford,

and later a bridge, provided access across the Ravensbourne River at the point just before it becomes tidal and widens into Deptford Creek, at the site of modern Deptford Bridge, c. 485m to the south of the site.

- E.4.8 The Saxon settlement centres were at Deptford Strand, in the area of St Nicholas' Church at Deptford Green (**HEA 57**) c. 190m to the northeast of the site. The church may be a Saxon foundation. Early to Middle Saxon pottery was found nearby on the site of the former Deptford Power Station, c. 300m to the northeast (outside of) the site. The other settlement lay to the south, in the vicinity of Deptford Bridge and Deptford Broadway, c. 410m to the southwest of the site. Here, two 7th century burials with grave goods of jewellery and other personal items were found during excavations (Gaimster, 2005)⁴.
- E.4.9 At the end of the early medieval period, Domesday Book (1086), records that Grenviz (West Greenwich, or Deptford) comprised two manors (estates held by Earl Harold and Beorhtsige) (Williams and Martin, 2005)⁵.

Later medieval period (AD 1066–1485)

- E.4.10 Domesday Book records that after the Norman Conquest (1066), the manor (estate) of West Greenwich (Deptford), within which the site lies, was owned by Odo, Bishop of Bayeux and the brother of King William I, and held by Gilbert de Magminot, the Bishop of Lisieux. Deptford included arable land, meadow, pasture, woodland and four mills (Williams and Martin, 2005)⁶. The manor continued to be held by the de Magminot family until 1191, when it passed to the de Say family and was given to the Knights Templar. It was later recovered by an exchange of land. Seized by King John in the early 13th century, but restored by King Henry III in 1223, the manor was held by descendants of the de Say family until it was again forfeited to the crown in 1487 (Lysons, 1796)⁷.
- E.4.11 The main settlement at Deptford Strand was focused on the church of St Nicholas (**HEA 57**), c. 190m to the northeast of the site. The church is first mentioned in documentary references in the 12th century, but an earlier church may have been present. Its extant tower dates from c. 1500 (Cherry and Pevsner, 2002)⁸. The manor house of Sayes Court lay to the northwest of the church, c. 670m to the northwest of the site.
- E.4.12 The settlement of Deptford continued to develop c. 800m to the south of the church, around the river crossing, which was a wooden bridge by 1359. It lay on the route to Canterbury, and in the late 14th century was mentioned in Chaucer's Canterbury Tales. Near the junction of Deptford Broadway and Deptford High Street, c. 425m to the southwest of the site, excavations produced a sequence of pottery from the 11th to 15th centuries (Gaimster, 2005)⁹.
- E.4.13 There are no known archaeological remains dated to this period within the site. A medieval tide (flour) mill, known as the Tide Mill (**HEA 41**), and dating to the 14th century (Steele, 1993)¹⁰ was located c. 215m to the south of the site on the west bank of the Ravensbourne. A former medieval road (**HEA 33**) dated to the 15th century and named 'Addey Road' was located c. 30m to the northeast of the site.

- E.4.14 The site probably remained open land lying between the main medieval settlement areas of Deptford Strand and Deptford Bridge, and was perhaps used for growing crops, or to graze sheep and cattle.

Post-medieval period (AD 1485–present)

- E.4.15 The GLHER records that early 19th century remains (**HEA 1A**), likely to relate to earlier buildings and gardens, were found within the southwestern part of the site. There is no further information. Within the assessment area, the majority of known archaeological remains date from the 17th–19th centuries, reflecting the rapid growth of Deptford as a centre of manufacturing and industry centred on the King's Yard royal dockyard, the commercial docks and wharves on Deptford Strand and along the Ravensbourne river.
- E.4.16 In 1513, King Henry VIII established the King's Yard, a royal dockyard which became a major centre of ship-building, c. 830m to the northwest. The establishment of this, and commercial docks and wharves in the 15th–17th centuries, attracted large numbers of sailors, shipbuilders, storekeepers and merchants to Deptford Strand.
- E.4.17 The site remained a primarily agricultural area and on the periphery of the main settlement. Those living close to the site were engaged in fishing, boat-building and farming, including the rearing of cattle, sheep and pigs and the growing of crops (Steele, 1993)¹¹. Several corn mills, including a former tide mill, (**HEA 41**), c. 215m to the southeast of the site, had been established by the 14th century. Located along the Ravensbourne, the tide mills remained in use for producing flour until the 18th–19th centuries.
- E.4.18 The low-lying area along the Thames some distance to the northeast would have been similar in character to the marshes of Southwark and Rotherhithe. Early records are scarce, but Lysons recorded in 1796 that 'In the Year 1671, a great inundation happened at and near Deptford. About 700 sheep, with a great number of oxen, cows, &c. were destroyed in the marshes; the cables of ships at anchor were broken, and the water rose to the height of ten feet in the streets near the river. An account of it is extant, in a small pamphlet published at the time' (Lysons, 1796)¹². Local landowners were also frequently taxed to pay for repairs to the marsh walls between the town and the Ravensbourne (Steele, 1993)¹³. Land reclamation and further drainage probably took place after this natural disaster. An evaluation carried out at the Laban Dance Centre (**HEA 13**), c. 235m to the east of the site on the west bank of Deptford Creek, identified evidence of land reclamation, including two unlined 18th century drainage channels.
- E.4.19 The area was extensively urbanised during the 18th and 19th centuries. Evidence of truncation of natural gravels and the demolition of earlier buildings in order to develop the area with Victorian houses has been uncovered in a number of past investigations. At Berthon Street, (**HEA 7**), c. 60m to the east of the site, wall trenches associated with the 17th century Trinity Almshouses (**HEA 29**), adjacent to the eastern boundary of the site, were uncovered alongside the brick foundations of 19th century houses. The remains of a 19th century building were recorded at

McMillan Street (**HEA 9**), c. 145m to the north of the site. At Rachel McMillan College on Creek Road (**HEA 12**), c. 110m to the northeast of the site, made ground dating from the mid-18th century represented land clearance and demolition of earlier buildings. Brick walls and foundations of 19th century date were found sealed by modern rubble. Road and yard surfaces dating to the 18th and 19th century were also observed at the Princess Louise Institute on Hale Street (**HEA 19**), c. 190m to the southwest of the site. On Creekside Road, beside Deptford Creek, (**HEA 15**), c. 285m to the east of the site, a number of 19th century riverside structures were recorded, including stretches of timber river walls, revetments and a masonry riverbed lining dating to the mid 19th century, and a late 19th-century dock. A line of upright timbers were recorded as possible remnants of the pre-18th century river wall.

- E.4.20 The 'Alpha' surveys carried out by the Thames Archaeological Survey (TAS) in the 1990s along Deptford Creek, to the southeast of the site, uncovered the remains of riverside structures which probably date to the 18th and 19th centuries, including barge bed revetments (**HEA 62** and **HEA 65**), c. 240m and 265m to the southeast of the site, flood defences and river walls (**HEA 67, 68** and **70**), c. 250m, 235m and 225m to the southeast, and the remains of a former dock or inlet (**HEA 69**), c. 200m to the southeast, constructed of brick and timber.
- E.4.21 Throughout the 17th century, the site was located in an extensive area of fields and market gardens, with 'small farming' remaining a common occupation (Lysons, 1796)¹⁴. Nearby industries located close to the Ravensbourne by c. 1700 included brick-making, leather and metal-working and brewing (Lysons, 1796)¹⁵. Writing in 1703, Evelyn describes the great increase in the population of Deptford since the beginning of the 17th century, commenting that "...the Town is in 80 years become neere as big as Bristoll". At this time the largest cities in the country were London, Norwich and Bristol, and it is clear that the town grew rapidly, with a number of public and private buildings constructed within the assessment area.
- E.4.22 The site is shown first in on schematic map drawn by J Evelyn in c. 1700 (not reproduced). The site occupies a triangular open field that is clearly separate from the rectangular plot of land to the north that would subsequently be occupied by the church of St Paul, its burial ground and rectory. St Paul (**HEA 50**) is one of London's finest Baroque parish churches (Weinreb and Hibbert, 1995)¹⁶. It is a Grade I listed building designed by architect Thomas Archer and built between 1712 and 1730. At the same time as the construction of the church, a rectory was erected in the north-western part of the site (**HEA 1F**). The rectory building was triangular in shape, with octagonal rooms, and was considered highly original in design for its day (Steele, 1993)¹⁷. An Act of Parliament passed in 1730, created out of Deptford a new parish of St Paul (the parish in which the site lies). There is no evidence, in terms of historic map evidence or literature, to indicate that the burial ground ever extended to the south of the churchyard wall and into the site (Basil Holmes, 1899)¹⁸.

- E.4.23 Rocque's map of 1741–1745 (Vol 23 Plate E.1) is a small scale map that lacks detail but shows built up areas and land use. The map shows the central part of the site as a triangular plot of mostly undeveloped land consisting of trees and market gardens, clearly separated from St Paul's Churchyard by a wall. The eastern part of the site was occupied by a row of houses and back gardens fronting either side of 'Church Street' (the current Deptford Church Street). The Baptist Old Meeting House (**HEA 27**), adjacent to the north of the site, was constructed in the latter half of the 17th century and is shown as a small square building to the east of the Church of St Paul. The Trinity Almshouses (**HEA 29**), adjacent to the eastern boundary of the site on the other side of Deptford Church Street, were also constructed in the 17th century and its gardens are shown lying partially within the very eastern boundary of the site, prior to the widening of the street..
- E.4.24 To the north and northwest of the site, Deptford Strand was occupied by much denser rows of streets and buildings clustered close to the King's Yard and the wharves and docks along the Thames to the north. At 'Crols Field Lane' (now Albury Street) a row of terrace houses (**HEA 57** and **58**), c. 175m and 155m to the north of the site were built, which largely survive in their early 18th century form and are listed Grade II and II*. To the south, buildings line the two main streets of Butt Lane, (the present High Street), and Deptford Church Street, with the land between and to either side occupied by open fields and gardens. Rocque's map shows the 14th century tide mill (**HEA 41**), c. 235m south of the site, prominently at a bend along Deptford Creek.
- E.4.25 A large gravel pit is also shown c. 260m to the southeast of the site, beside Deptford Creek. It is possible that another undated gravel pit (**HEA 42**), adjacent to the southeast of the site, may also date to this period, although it is not marked on Rocque's map and may have been filled in by this time. A quarry (**HEA 45**), of uncertain location, may have existed during, or prior to, this period, adjacent to the northern boundary of the site.
- E.4.26 Cruchley's map of 1833 (not reproduced) shows little change, with a new row of houses in the south-eastern corner of the site and a boundary wall separating the backyards of the properties fronting onto Deptford Church Street from the open ground in the western part of the site. St Paul's churchyard is clearly still separated from the site by a boundary wall. Shortly after this map, the Old Roman Eagle public house was built in the northeastern part of the site, c.1841 (**HEA 1E**).
- E.4.27 Stanford's map of 1862 (Vol 23 Plate E.2) shows no change in the site. It remained largely open land, walled off from St Paul's Churchyard to the north, with a row of terrace houses and gardens in the eastern part of the site, fronting either side of Deptford Church Street. The existing north-south brick wall in the centre of the site, (**HEA 1B**), is probably a rebuild of the original wall shown separating the back gardens of the houses from the rest of the site in this map. Immediately to the north of the churchyard, a Wesleyan chapel and its grounds had been established (**HEA 27**). A burial and burial vault, is listed by the GLHER as being located at Mary

Ann Buildings (**HEA 43**), c. 70m to the north of the site, and may relate to this chapel.

- E.4.28 Within the assessment area, major expansion of housing and industries had occurred, particularly in areas formerly occupied by open fields to the south and east of the site (towards Greenwich). The greatest change within the vicinity was the construction of the first passenger railway in London by the London and Greenwich Railway Company in 1836, following an Act of Parliament in 1833. The railway included a 5.2km-long viaduct of grey brick with arches 20 feet from centre to centre and 22 feet high. It is considered one of the first major achievements of British railway engineering (English Heritage Listed Building entry no. 436292)¹⁹ and is Grade II listed. A section of the viaduct passes through the southern part of the site, where the site extends along Deptford Church Street (**HEA 1D**), although at this point the original arched brick bridge over the road has been replaced by a modern prefabricated concrete and steel structure. The railway passes Deptford Railway Station, (**HEA 6**) c. 95m to the west of the site, which is the oldest surviving passenger train station in London (Steele, 1993)²⁰.
- E.4.29 Stanford's map shows terrace houses spread outwards from the main town along new roads to the north, west and east of the site. Further to the east, a number of factories, including a gas, paint, chemical, soap and manure works are situated within the assessment area along the length of Deptford Creek. Several industrial tide mills were present in the area of the former 14th century tide mill, (**HEA 41**), c. 235m to the south of the site. Despite an increase in the number of buildings along the main streets, a large part of the outlying land surrounding the site is still shown as market gardens on the map.
- E.4.30 The Ordnance Survey 1st edition 25" map of 1862 (Vol 23 Plate E.3) shows the site in detail. 'Crossfield Lane' (now Crossfield Street) lies within the south-western boundary of the site. The map shows a new row of terrace houses in the southeastern corner of the site, along the north side of a small alley. The rest of the central and western part of the site, separated from the houses by a wall, had been laid out as a pleasure garden with paths and a fountain to the north-west, adjacent to the Rectory (**HEA 1F**), situated in the northwestern corner. A linear building was located in the middle of the site, probably a public building associated with the garden. Along the eastern boundary of the site, terraced housing and the grounds of the Alms Houses (**HEA 29**) continue to lie alongside Deptford Church Street. Within the assessment area, there were virtually no areas of open land, except for strip gardens belonging to terrace houses. Roads, houses and factories beside the Ravensbourne occupied almost all the land between, and to the south, of the Royal Dockyard and Deptford Creek.
- E.4.31 The Ordnance Survey 2nd edition 25" map of 1896 (Vol 23 Plate E.4) shows the former open gardens in the western-central part of the site occupied by large buildings and associated gardens. In the north-western corner of the site, the former Rectory (**HEA 1F**) has been demolished and is now occupied by terrace housing. The 1898 Booth poverty map (not

reproduced) shows Crossfield Street in the lower 'poor' and 'very poor' social categories. These buildings are possibly municipal housing. A new access road runs north-south through the middle of the site and St Joseph's Roman Catholic School has been constructed to the west of the site (**HEA 72**). There have been no major changes to the rest of the site. The Ordnance Survey 25" map of 1914 (not reproduced) shows no major changes within the site other than a widening of Deptford Church Street within its eastern boundary. The street layout and names within the assessment area now largely reflect the modern layout.

- E.4.32 The London County Council (LCC) bomb damage maps of 1939–1945 (London Topographical Society, 2005)²¹ (not reproduced) show minor blast damage to the houses fronting Deptford Church Street (to the east of the boundary wall; **HEA 1B**), and more serious damage ('damaged beyond repair'), including the total destruction of one house, to the houses in the western half of the site, west of the boundary wall.
- E.4.33 The Ordnance Survey revised edition 25" map of 1947 (Vol 23 Plate E.5) shows Deptford Church Street widened to its present extent within the eastern site boundary. The terraced houses in the southeastern corner of the site had been replaced with a large L-shaped building named 'Bates House', fronting onto Deptford Church Street, with a large back garden. The extant wall within the site, (**HEA 1B**), is shown separating the residential buildings from the rest of the site.
- E.4.34 The Ordnance Survey 1:10,000 map of 1976 (Vol 23 Plate E.6) shows the central part of the site cleared of all buildings apart from the existing north-south brick wall (**HEA 1B**). Apart from the wall, this part of the site has remained open space to the present day.

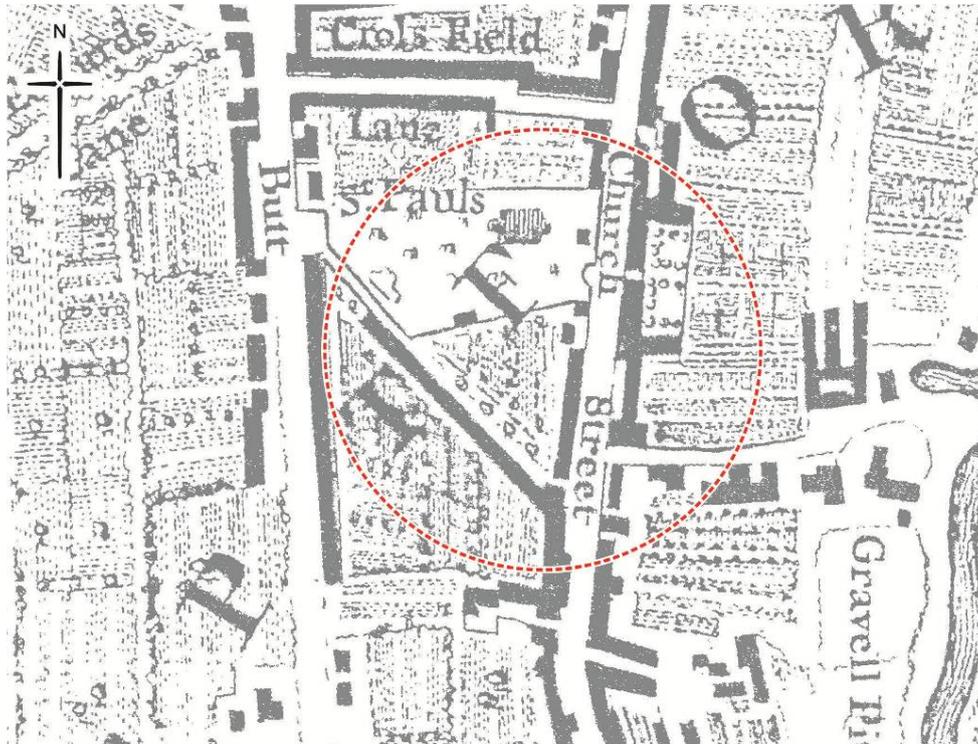
The current site

- E.4.35 The majority of the site consists of a triangular-shaped plot of open grassy ground with a section of Deptford High Street located within the eastern boundary of the site. The north-western part of the site is currently occupied by a roundabout at the junction of Coffey Street and Crossfield Street. The open ground is unoccupied apart from a north-south aligned brick boundary wall (**HEA 1B**) running across the eastern part of the site (Vol 23 Plate E.7). The wall dates to the late 19th/early 20th centuries. Its construction, with pilasters/piers and returns, indicates that it related to the property to the west, rather than the houses to the east. Its brickwork shows that it has never had anything attached to its east side and therefore post-dates the Ordnance Survey 2nd edition map of 1896 which shows two buildings attached to it. The late 19th century/early 20th century date is confirmed by its two-layer slate Damp Proof Course (pers. comm)²². A 19th-century cobbled surface (**HEA 1C**) (Vol 23 Plate E.8) is located within the southern-central part of the site. The mid 19th-century brick-built Deptford and Greenwich Railway viaduct (**HEA 1D**) runs through the southeastern most part of the site and is a Grade II listed structure. The section which lies within the site, where the viaduct crosses over Deptford Church Street, is a modern precast concrete overbridge with steel railings (Vol 23 Plate E.9). This is a replacement of the original brick

structure. To the north of the site is the church of St Paul's, Deptford (Vol 23 Plate E.10).

E.5 Plates

Vol 23 Plate E.1 Historic environment – Rocque’s map of 1746



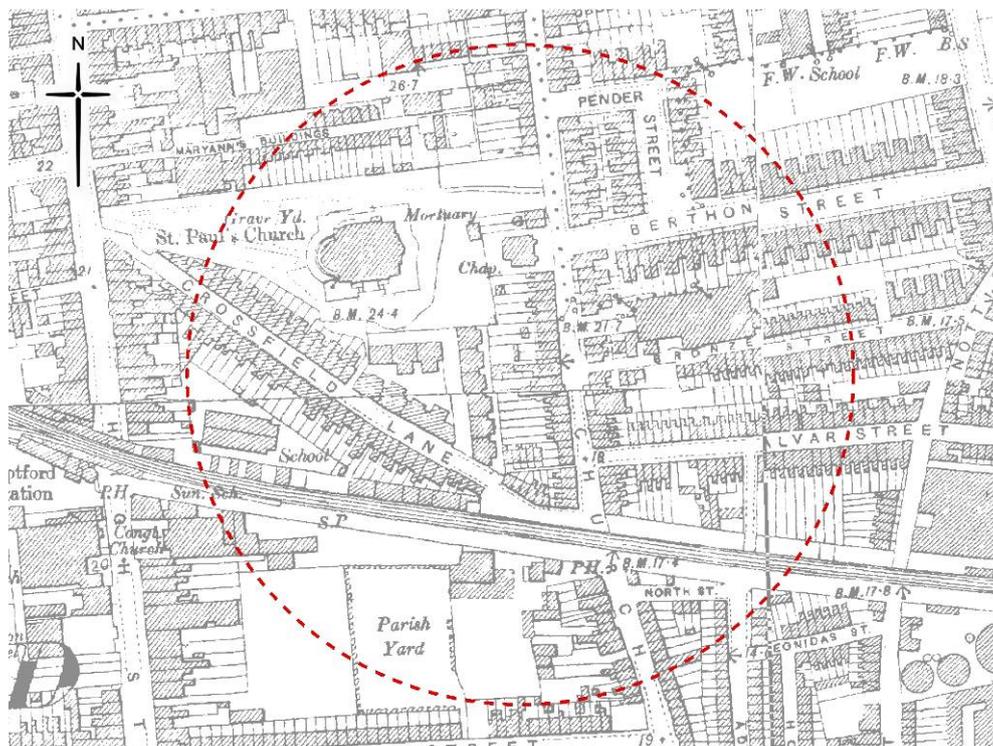
Vol 23 Plate E.2 Historic environment – Stanford's map of 1862



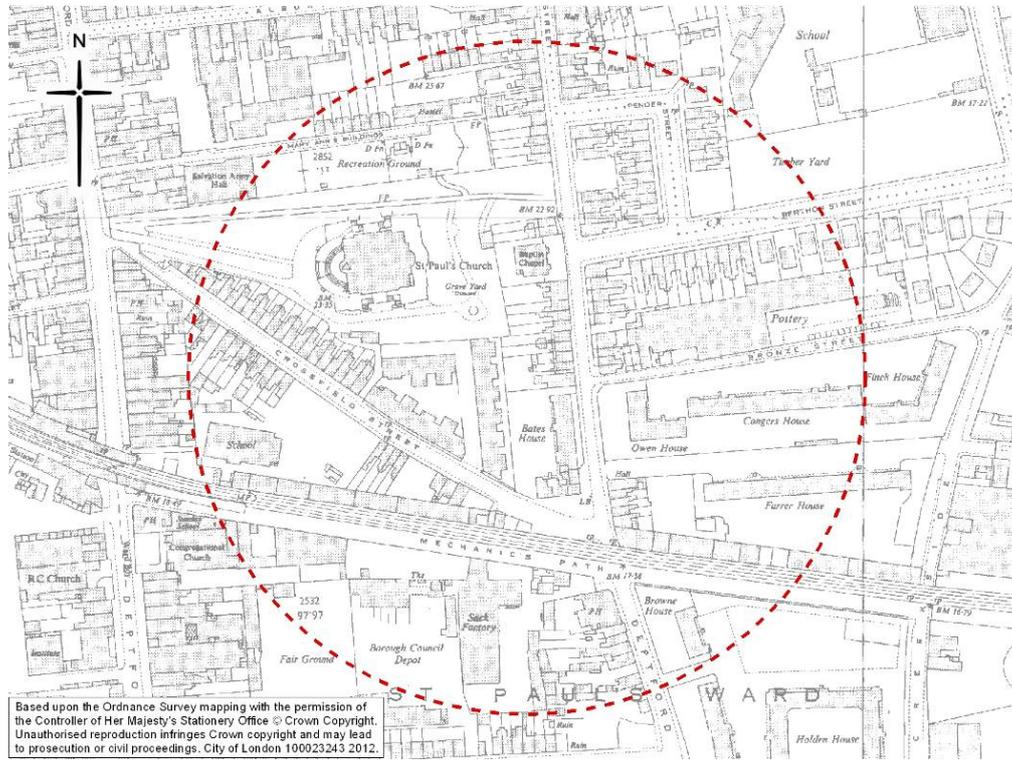
Vol 23 Plate E.3 Historic environment – Ordnance Survey 1st edition 25” scale map of 1862 (not to scale)



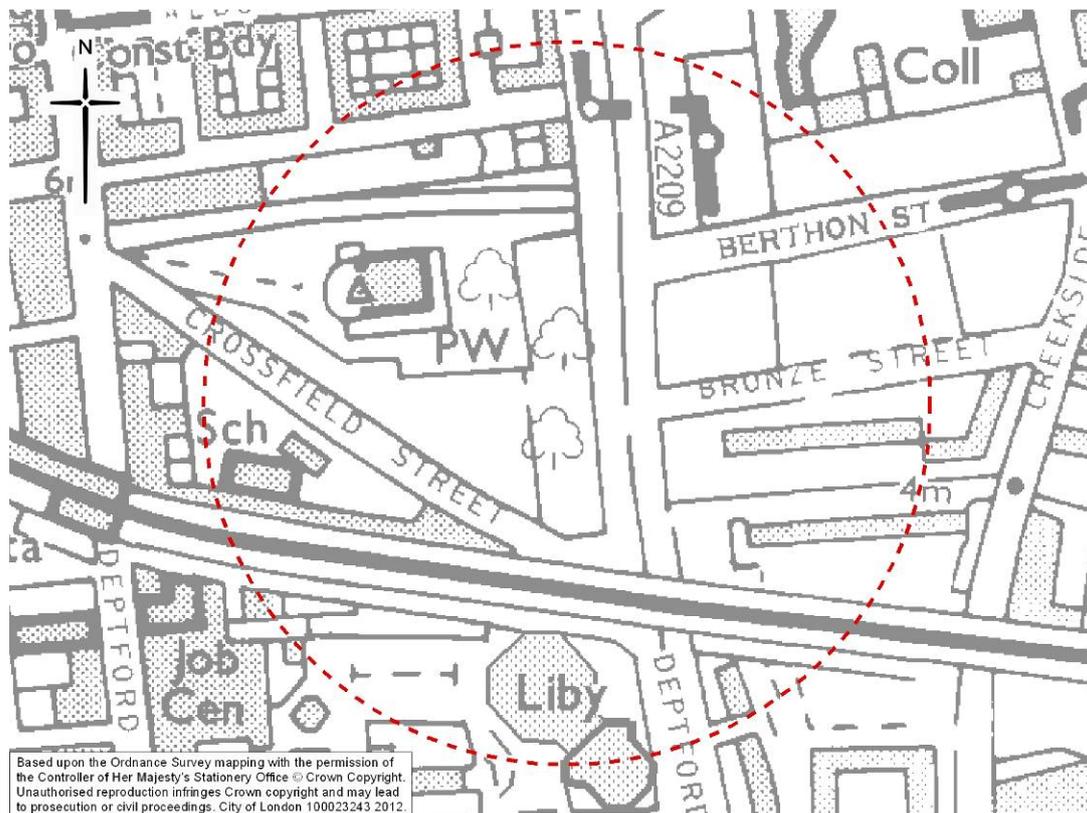
Vol 23 Plate E.4 Historic environment – Ordnance Survey 2nd edition 25” scale map of 1896 (not to scale)



Vol 23 Plate E.5 Historic environment – Ordnance Survey 25” scale map of 1947 (not to scale)



Vol 23 Plate E.6 Historic environment – Ordnance Survey 1:10,000 scale map of 1976 (not to scale)



Vol 23 Plate E.7 Historic environment – Brick wall running through the site (HEA 1b); standard lens; looking southeast



Vol 23 Plate E.8 Historic environment – Original 19th century cobbled surface (HEA 1c) of the southern entrance to a lane behind the rectory buildings; standard lens; looking north



Vol 23 Plate E.9 Historic environment – mid 19th-century viaduct for the London and Greenwich Railway (HEA 1d); view to the northwest showing the modern concrete deck replacement over Deptford Church Street (within the site). Standard lens.



Vol 23 Plate E.10 Historic environment – Church of St Paul, Deptford Church Street; standard lens; looking northwest



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- ¹ British Geological Survey digital data.
- ² Philip, B and Chenery, M. *An Outline Report on Rescue Excavations in 1989 and 1992 at the Broadway, Deptford, Lewisham*. South East London Archaeological Unit. Unpublished report (1993).
- ³ Gaimster, M. *Saxons in Deptford* in *London Archaeologist* 11/2 (2005), 35.
- ⁴ Gaimster. See citation above.
- ⁵ Williams, A and Martin, GH. *Domesday. A complete translation*. Penguin Books (2002); Gaimster M, 'Saxons in Deptford' in *London Archaeologist* 11/2 (2005), 35.
- ⁶ Williams and Martin. See citation above.
- ⁷ Lysons, D. *The Environs of London: volume 4: Counties of Herts, Essex and Kent* (1796), 359–385.
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- ⁹ Gaimster. See citation above.
- ¹⁰ Steele, J. 'Turning the Tide. *The History of Everyday Deptford*. Deptford Forum Publishing Ltd (1993), 3.
- ¹¹ Steele. See citation above, 2–3.
- ¹² Lysons. See citation above, 15.
- ¹³ Steele. See citation above, 15.
- ¹⁴ Lysons. See citation above, 34–35.
- ¹⁵ Lysons. See citation above, 34.
- ¹⁶ Weinreb B and Hibbert C (eds). *The London encyclopaedia*. Macmillan. London (1995), 777.
- ¹⁷ Steele. See citation above, 51.
- ¹⁸ Basil Holmes, *The London Burial Grounds* (1899).
- ¹⁹ English Heritage Listed Building entry no. 436292.
- ²⁰ Steele. See citation above, 66.
- ²¹ London Topographical Society. *The London County Council Bomb Damage Maps 1939–45* (2005), Maps 91 and 104.
- ²² Ken Sabel of Atkins, pers. comm.

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Thames Tideway Tunnel
Thames Water Utilities Limited



Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix F: Land quality

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

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Thames Tideway Tunnel

Environmental Statement

Volume 23 appendices: Deptford Church Street site assessment

Appendix F: Land quality

List of contents

	Page number
Appendix F : Land quality.....	1
F.1 Baseline report.....	1
F.2 Detailed Unexploded Ordnance (UXO) risk assessment.....	14
References.....	15

List of tables

	Page number
Vol 23 Table F.1 Land quality - site walkover report.....	1
Vol 23 Table F.2 Land quality – potentially contaminating land-uses.....	4
Vol 23 Table F.3 Land quality – anticipated site geology.....	9
Vol 23 Table F.4 Land quality – hazard and waste sites.....	12

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Appendix F: Land quality

F.1 Baseline report

F.1.1 Baseline data is sourced from:

- a. walkover survey
- b. the Landmark Information Group database, which includes historic maps and environmental records
- c. stakeholder consultation
- d. results from a preliminary intrusive ground investigation.

F.1.2 The baseline report relates only to the main Deptford Church Street site. The highway is referred to explicitly where relevant.

Site walkover

F.1.3 A site walkover was undertaken on 13th May 2011.

F.1.4 The aim of the walkover survey was 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 is situated within an area of public open space, located on the junction between Coffey Street, Deptford Church Street and Crossfield Street and access was available across the entirety of the site.

F.1.6 There are no buildings on or immediately adjacent to the proposed shaft location.

F.1.7 No potential contamination sources were identified on-site during the survey.

F.1.8 A motor vehicle workshop and plumbers merchants were noted beyond the southern boundary.

F.1.9 Detailed site walkover notes are provided in Vol 23 Table F.1.

Vol 23 Table F.1 Land quality - site walkover report

Item (Site ref: PLM3X, Deptford Church Street)	Details
Date of walkover	13th May 2011
Site location and access	<p>The works at Deptford Church Street comprise the main construction site area and the Deptford Church Street highway works areas.</p> <p>The main site is situated within an area of public open space (St Pauls Churchyard Gardens). This site is located on the junction between Coffey Street, Deptford Church Street and Crossfield Street. The highway works sites are located on Deptford Church Street and were not included in this walkover.</p>

Item (Site ref: PLM3X, Deptford Church Street)		Details
Size and topography of site and surroundings	Record elevation in relation to surroundings, any hummocks, breaks of slope etc.	Site is flat and level with surrounding land.
Neighbouring site use (in particular note any potentially contaminative activities or sensitive receptors)	North	Grade I listed St Paul's Church is located north of the site.
	South	Freight distribution company and motor vehicle repair garage adjacent to the site. Railway line crosses the southern edge of the site boundary.
	East	Closest residential properties are located approximately 50m from the site.
	West	St Josephs Roman Catholic Primary school adjacent to the southwestern corner of the site.
Site buildings	Record extent, size, type and usage. Any boiler rooms, electrical switchgear?	No
Surfacing	Record type and condition	Site is an area of public open space covered with grass and hardsurfacing within the roads.
Vegetation	Any evidence of distress, unusual growth or invasive species such as Japanese Knotweed?	Site is grass with a small number of mature trees located sporadically across the site.
Services	Evidence of buried services?	None observed
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

Item (Site ref: PLM3X, Deptford Church Street)		Details
Vehicle servicing or refuelling onsite	Record locations, tanks and inspection pits etc.	No
Waste generated/stored onsite	Adequate storage and security? Fly tipping?	None observed
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
Summary of potential contamination sources		Motor vehicle repair garage located adjacent. Railway line
Any other comments	Eg access restrictions/limitations	A stone wall runs centrally across the site dividing it into two separate areas.

Review of historical contamination sources

- F.1.10 Historical mapping (dated between 1869 and present day) has been reviewed to identify potentially contaminating land-uses at the site and within the 250m assessment area.
- F.1.11 Vol 23 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.1.12 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.1.13 Items listed in the table are also shown on Vol 23 Figure F.1.1 (see separate volume of figures). In addition, figures illustrating the historical environment of the site and surrounding area are provided in Vol 23 Appendix E.

Vol 23 Table F.2 Land quality – potentially contaminating land-uses

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item ^{1,2}
On-site			
1	Railway line	c1873-present	Hydrocarbons (diesel and lubricating oils), ash and fill with heavy metals, sulphates, polyaromatic hydrocarbons (PAHs), asbestos, herbicides
Off-site*			
2	(a) Colour works (120m east)	c1869-c1882	Solvents, chlorinated hydrocarbons, acetone, heavy metals, paints, dyes
	(b) Depot (120m east)	c1987	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic hydrocarbons, PAHs, petroleum hydrocarbons, solvents
3	Tanks (125m and 155m east)	c1869-c1873	Contents unknown
4	(a) Varnish and naphtha works (180m east)	c1869-c1873	Solvents, chlorinated hydrocarbons, acetone, heavy metals, paints, dyes, tars, PAHs
	(b) Borough Council Depot (180m east)	c1896-c1995	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic hydrocarbons, PAHs, petroleum hydrocarbons, solvents
5	Kent Wharf (170m east)	c1869-c1970	Solvents, hydrocarbons, heavy

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item ^{1,2}
			metals, phenols
6	Chemical works (145m southeast)	c1870	Heavy metals, arsenic, boron, selenium, free cyanide, nitrates, sulphates, sulphides, asbestos, PAHs, phenols, acetones, aromatic hydrocarbons, polychlorinated biphenyls (PCBs), dioxins, furans
7	Surrey Gas Works (110m east)	c1870-c1896	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic hydrocarbons, PAHs, chlorinated aliphatic hydrocarbons, solvents, cyanides, ammoniacal liquors
8	Deptford Rail Station (140m west)	c1873-present	Hydrocarbons (diesel and lubricating oils), ash and fill with heavy metals, sulphates, PAHs, asbestos), herbicides
9	Asphalt and Paving works (175m east)	c1896-c1916	Hydrocarbons, PAHs, tars, metals
10	Borough Council Depot (70m west)	c1896-c1983	Oil/fuel hydrocarbons, aromatic hydrocarbons, PAHs, chlorinated aliphatic hydrocarbons, organolead compounds, heavy metals and asbestos
11	Laundry (105m south)	c1916	Chlorinated aliphatic and aromatic hydrocarbons (eg perchloroethylene)

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item ^{1,2}
12	Dock (190m east)	c1916	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic hydrocarbons, PAHs
13	Gasometer (140m east)	c1916	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic hydrocarbons, PAHs, chlorinated aliphatic hydrocarbons, solvents, cyanides, ammoniacal liquors
14	Hills Wharf (timber) (110m southeast)	c1951	Heavy metals, ash (PAHs), preservatives, hydrocarbons, Volatile Organic Compounds (VOCs), formaldehyde, tars, turpentine, creosote
15	Soap works (140m southwest)	c1951	Hydrocarbons (including tars, paraffin, waxes), fats, salts, acids, mineral oils, metal ions including sodium, ammonium, calcium, glycerol
16	(a) Boiler works (110m west)	c1951	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic hydrocarbons, PAHs, chlorinated aliphatic hydrocarbons, petroleum hydrocarbons, solvents. asbestos
	(b) Engineering works (110m west)	c1970-c1971	
	(c) Works (110m west)	c1983	
17	Timber yard (50m east)	c1951-c1952	Heavy metals, ash (PAHs),

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item ^{1,2}
			preservatives, hydrocarbons, VOCs, formaldehyde, tars, turpentine, creosote
18	Engineering works (190m southwest)	c1951-c1971	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic hydrocarbons, PAHs, chlorinated aliphatic hydrocarbons, petroleum hydrocarbons, solvents
19	Oil Refinery (145m southeast)	c1951-c1971	Hydrocarbons
20	Sack factory (50m west)	c1951-c1971	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic hydrocarbons, PAHs, hydrocarbons, solvents
21	Sun Wharf (asphalt) (140m east)	c1951-c1974	Tars, PAHs, Semi Volatile Organic Compounds (SVOCs)
22	Tank (155m south)	c1970	Content unknown
23	Electrical substation (25m southeast)	c1970	Oils, PCBs
24	Warehouse (120m southeast)	c1970-present	Use unknown
25	Tanks (60m west)	c1970	Content unknown
26	Electrical substation (125m southeast)	c1971-present	Oils, PCBs
27	Electrical substation (95m east)	c1971-present	
28	(a) Deptford Green Dockyard/Stowage Wharf (175m	c1869-c1916	Heavy metals, sulphate, sulphur, asbestos, phenol, aromatic

Ref	Item	Inferred date of operation	Potentially contaminative substances associated with item ^{1,2}
	northeast)		hydrocarbons, PAHs
	(b) Deptford Power Station (175m northeast)	c1951-c1971	Heavy metals, oil/fuel hydrocarbons, ashes, greases, oils, sulphate, sulphur, PAHs, PCBs, dioxins and furans
29	Saw mill (215m south)	c1951-c1971	Heavy metals, ash (PAHs), preservatives, hydrocarbons, (VOCs), formaldehyde, tars, turpentine, creosote
30	(a) Wharf (190m south)	c1896	Heavy metals, arsenic, asbestos, phenols, oil/fuels, hydrocarbons, PAHs, PCBs, sulphide, sulphate, chlorinated aromatic hydrocarbons, chlorinated aliphatic hydrocarbons
	(b) Wharf (Oil Refinery) (190m south)	c1970	
31	Wharf (timber yard) (220m south)	c1896	Heavy metals, ash (PAHs), preservatives, hydrocarbons, volatile organic compounds VOCs, formaldehyde, tars, turpentine, cresols

* refers to the main site.

On-site

F.1.14 The historic mapping has identified no substantial contaminative on-site land-uses. The railway line, which appears to cross the site boundary in the southern extent of land to be used, is situated on an overbridge and thus is not considered to be relevant in terms of representing a contamination source.

- F.1.15 Historic mapping of Deptford Church Street is available for review between 1873 and 1995.
- F.1.16 An assessment of this mapping identifies that between the year c1873 and c1916 the eastern section of site was populated with individual Victorian residential properties.
- F.1.17 Between c1916 and c1949 these individual properties were demolished and replaced with larger housing blocks namely “Bates House” until 1974. Between c1974 and c1981 this building was demolished and site use changed to a public open space.
- F.1.18 The western section of the site remained undeveloped until c1896, when larger properties were developed, attributed to block residential dwellings along the northwestern and southwestern boundary of the site and also located towards the centre of the Deptford Church Street site.
- F.1.19 These blocks were described as Improved Industrial Dwellings Company Limited in 1951 and Rectory Buildings in 1970. These properties were demolished between c1974 and c1981 when the whole site was demolished.
- F.1.20 There are no ongoing sources of contamination on or in the immediate vicinity of the site.

Off-site

- F.1.21 Within the 250m assessment area, the historical mapping shows that the surrounding area was developed for a number of industrial/commercial properties: notably towards the east and south of the site were a number of wharf areas, an oil refinery and gas works (145m southeast and 110m east respectively).

Geology

- F.1.22 Data from the Thames Tunnel project ground investigation indicates the anticipated geological succession, as summarised in Vol 23 Table F.3 below.

Vol 23 Table F.3 Land quality – anticipated site geology

Geological Unit/ Strata	Description	Approximate depth below ground level (m)
Made Ground	Varies but recorded to be clayey gravelly sand with fragments of brick, concrete and flint. No visual or olfactory indicators of contaminants.	0.0-2.9
River Terrace Deposits	Medium dense to dense to dense sand and gravel (predominantly quartz sand and flint gravel).	2.9-8.4

Geological Unit/ Strata	Description	Approximate depth below ground level (m)
Lambeth Group	Generally a dense to very dense, glauconitic fine- to medium-grained sand. Thin clay beds or clay stringers may be present.	8.4-12.9
Thanet Sand Formation	Generally dense glauconitic silty fine sand with coarse gravel and occasional rounded flint gravel.	12.9-28.9
Chalk Group	Weak fine grained limestone with nodular and tabular flints.	28.9 - unproven

Unexploded ordnance

- F.1.23 During World Wars 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.1.24 A desk based assessment for UXO threat was undertaken by 6 Alpha Associates Limited at the Deptford Church Street site (see Vol 23 Appendix F.2). The report reviews information sources such as the Ministry of Defence (MoD), Public Records Office and the Port of London Authority (PLA).
- F.1.25 The report establishes that there were no high explosive strikes within the site area itself (Including the highway works site), however five strikes are recorded within the buffered site boundary and a further twelve are recorded within 100m of the buffered site boundary. One V1 strike was also recorded to the west of the site.
- F.1.26 Taking into account the findings of this study and the known extent of the proposed works, it is considered that there is an overall medium/high threat from UXO at the Deptford Church Street site.

Thames Tunnel ground investigation data

- F.1.27 This section summarises the ground investigation undertaken by the Thames Tunnel project.
- F.1.28 Vol 23 Figure F.1.2 (see separate volume of figures) identifies boreholes excavated in vicinity of the site. These are not considered relevant to the contamination status of the site, either due to their distance from the proposed combined sewer overflow (CSO) drop shaft location or because certain boreholes were excavated purely for geotechnical purposes.

Soil contamination testing

- F.1.29 Three boreholes were drilled as part of the Thames Tideway Tunnel project ground investigation for the Deptford Church Street site. Although the investigation was primarily for geotechnical purposes, samples from borehole SR6092D (located in the southeastern corner of the park) were

tested for the presence of common contaminants to obtain preliminary information on the contamination status of soils in the area.

- F.1.30 Three soil samples comprising two samples of Made Ground and one samples of the underlying River Terrace deposits encountered in the borehole were sent for laboratory analysis.
- F.1.31 No visual or olfactory indicators of contamination were noted on the borehole logs.
- F.1.32 The laboratory analysis comprised a suite of common contaminants that may be associated with older urban environments.
- F.1.33 The testing suite included the following contaminants: heavy metals and metalloids, PAHs, TPH, phenols, cyanide, ammoniacal nitrogen, pH, soil organic matter content.
- F.1.34 The contamination testing recorded one sample of Made Ground (at 1.0m depth) to contain an elevated concentration of lead above withdrawn soil assessment criteria for both industrial sites and residential properties³.
- F.1.35 Concentrations of the PAH compound benzo(a)pyrene were also recorded to be slightly elevated in comparison with widely used assessment criteria for residential land use but not in comparison with criteria for light industrial or commercial land uses⁴. There are no currently no published assessment criteria for parks.

Soil gas testing

- F.1.36 No soil gas testing was available for review.

Groundwater contamination data

- F.1.37 No groundwater testing was available from samples of water taken from boreholes drilled on site.
- F.1.38 Refer to Section 13 Water resources – groundwater of this volume for information on groundwater quality.

Third party ground investigation data

- F.1.39 No third party ground investigation data was available for review at the Deptford Church Street site.

Other environmental records

- F.1.40 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 23 Table F.4. Pertinent records are discussed in further detail below.
- F.1.41 The location of these records is shown on Vol 23 Figure F.1.3 (see separate volume of figures).

Vol 23 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	1
Licensed waste management facility	0	1
Notification of installations handling hazardous substances	0	0
Past potential contaminated industrial uses	0	There are a number of areas classified as past potential contaminated industrial uses within 250m of the site.
Pollution incident to controlled water*	0	0
Registered waste transfer site	0	2
Registered waste treatment or disposal site	0	0

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

- F.1.42 Inspection of the data has identified no on-site hazard and waste sites at Deptford Church Street.
- F.1.43 Within 250m of the Deptford Church Street site, a single local authority pollution prevention and control is located within 250m, which relates to a dry cleaner to the southwest.
- F.1.44 There are a number of areas classified as past potential contaminated industrial uses. It could be inferred that these records relate to the gas works and chemical works located approximately 110m east and 145m southeast, varnish and naphtha works located 175m northeast and the Deptford Green Dockyard/Power Station located approximately 175m northeast, as shown on Vol 23 Figure F.1.1 (see separate volume of figures). Common contaminants associated with such land-uses are identified in Vol 23 Table F.2.

F.1.45 Inspection of the data also identified two Registered Waste Transfer sites located approximately 110m southeast of the site and 180m east and a licensed waste management facility located approximately 190m east.

Land quality data from local authority

F.1.46 Following confirmation from the London Borough (LB) of Lewisham that there were no records held by the council in relation to land quality site investigations, a search was undertaken of the LB of Lewisham planning website.

F.1.47 This search identified three developments within 250m of the site at Deptford Church Street that contained available information in relation to land quality.

F.1.48 In summary the investigations highlighted the presence of localised soil and groundwater contamination at the sites in question. Most notably some VOC (contamination) of the groundwater to the southwest of the site (on Giffin Street) was identified.

F.1.49 Given the distances involved and potential groundwater flow direction, none of the records are considered to be relevant to on-site soil quality.

Summary of contamination sources

F.1.50 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. historic contamination of underlying soils as a result of the clearance of previous housing (potential for backfilled basements) the main potential contaminants of concern are likely to be, but not limited to: metals, PAHs, (as have been recorded locally) and sulphates from coal ash and clinker
- b. potential UXO
- c. off- site shallow groundwater contamination from historic and existing industries (including former gas and chemical works, depots and former factories), contaminants of concern are likely to be, but not limited to BTEX, phenols and other VOCs.

F.2 Detailed Unexploded Ordnance (UXO) risk assessment

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Detailed Unexploded Ordnance (UXO) Risk Assessment

Study Site: Work Area PLM3X – Deptford Church Street

Document Number: 336-RG-TPI-PLM3X-000001

Client Name: Thames Water

6 Alpha Project Number: P2853_R15_V1.0

Date: 13th June 2012

Originator: Max Chainey (13th June 2012)

Quality Review: Lisa Askham (13th June 2012)

Released by: Lee Gooderham (22nd June 2012)

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Contents

Contents	1
Executive Summary	2
Assessment Methodology	3
Stage One – Site Location & Description	4
Stage Two – Review of Historical Datasets	5
Stage Three – Data Analysis	6
Stage Four – Risk Assessment	7
Stage Five – Risk Mitigation Measures	9

Figures

Figure One – Site Location

Figure Two – Site Boundary

Figure Three – Current Aerial Photography

Figure Four – 1945 Aerial Photography

Figure Five – WWII Luftwaffe Bombing Targets

Figure Six – WWII High Explosive Bomb Strikes

Figure Seven – London County Council Bomb Damage Mapping

Figure Eight – WWII High Explosive Bomb Density



EXECUTIVE SUMMARY

Study Site	The Client has specified the Study Site as Work Area PLM3X, located at National Grid Reference “537337, 177423”.
Key Findings	<p>In light of the research for this report, 6 Alpha has assessed the threat on this Site based on these pertinent facts:</p> <ul style="list-style-type: none"> • The Work Area is situated on what was predominantly developed land containing residential housing during World War Two (WWII), and is situated nearby to <i>Deptford Creek</i>. • Several WWII primary bombing targets have been identified within the vicinity of the Work Area, <i>Deptford Power Station</i> being the closest target to the Site. Additionally, numerous “opportunistic” bombing targets were found within 1,000m of the Work Area. • The Site is located within the <i>Deptford Metropolitan Borough</i>, which experienced a bombing density of 453 High Explosive (HE) bombs per 1,000 acres. This is a high bombing density for <i>London</i>. • There were no HE bomb strikes recorded within the Work Area, however five strikes are recorded within the buffered Site boundary. A further twelve HE bomb strikes were recorded within 100m of the buffered Site boundary and one V1 strike was recorded to the west. Given the residential development of the Site, it is likely that any unexploded bombs (UXBs) would have been witnessed and reported across much of the Site, however bomb damage debris may have obscured the observation of UXB entry holes. • Significant bomb damage was recorded within the Work Area to the south and west including “damage beyond repair”. Extensive bomb damage occurred throughout the buffered Site boundary, which ranged from “general blast damage; minor in nature” to “total destruction”. The damage recorded is concomitant with the V1 strike identified in the vicinity of the Work Area. • The Work Area has not been redeveloped since WWII, and thus this reduces the likelihood of earthworks removing the potential for unexploded ordnance (UXO) to be present. <p>The risk assessment and risk mitigation outlined below are based on the indicative engineering drawings and proposed works provided by <i>Thames Water</i>, and therefore it should be noted that any changes to the engineering drawings or proposed works may affect the risk assessment.</p>
Potential Threat Source	The threat is primarily posed by WWII <i>German</i> HE bombs, with a secondary threat from Incendiary Bombs (IBs) and <i>British</i> 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.
Risk Level	MEDIUM/HIGH
Recommended Risk Mitigation	<p>The following actions are recommended before undertaking any activity on the Study Site:</p> <ol style="list-style-type: none"> 1. Operational UXO Risk Management Plan; appropriate site management documentation should be held on site 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 UXO, what actions they should take to keep people and equipment away from the hazard and to alert site management. Posters and information of the general nature of the UXB threat should be held in the site office for reference and as a reminder. 3. Specialist UXO Banksman Support; Enabling works and open excavations should be supervised by a specialist UXO banksman to identify and dispose of any items of UXO.



ASSESSMENT METHODOLOGY

Approach	<p>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 <i>Construction Industry Research & Information Association</i> (CIRIA) best practice guide (C681) and by the <i>Health & Safety Executive</i> (HSE).</p> <p>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 <i>only</i> because it delivers the Client a risk reduced to As Low As Reasonably Practicable (ALARP) at best value.</p> <p>Potential UXO hazards have been identified through investigation of Local and National archives covering the Site, <i>Ministry of Defence</i> (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.</p> <p>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.</p> <p>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 <i>de minimis</i> and thus unnecessary. Because of this principle UXO risks will rarely be reduced to zero (nor need they be).</p>
Important Notes	<p>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.</p> <p>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.</p> <p>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.</p> <p>The background risk has been established in a Threat & Preliminary Risk Assessment Report that will be provided separately.</p> <p>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.</p>



STAGE ONE – SITE LOCATION AND DESCRIPTION

Study Site	<p>The Client has specified the Study Site as Work Area PLM3X. The Site is located at National Grid Reference 537337, 177423. 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.</p> <p>See <i>Figures 1</i> and <i>2</i> for the Site location.</p>																				
Location Description (Figure 3)	<p>The Work Area is situated to the south of the <i>City of London</i> within the <i>Deptford Metropolitan Borough</i>. Current aerial photography has identified the Work Area as land near to <i>Deptford Creek</i> with no structural developments on site.</p>																				
Proposed Engineering Works	<p><i>Thames Water</i> have specified a summary of the proposed engineering works, including working draft plans with drawing no. 100-DA-CNS-PLM3X-272105_AI; 100-DA-CNS-PLM3X-272106_AJ; and 100-DA-CVL-PLM3X-372020_AH. The proposed works may not represent the full scheme but rather those that may present an UXO risk:</p> <ul style="list-style-type: none"> • Construction of a 17m internal diameter drop shaft, approximately 46m deep. It is anticipated that the shaft would be constructed using diaphragm walls. The 5.0m diameter tunnel from <i>Greenwich</i> will be driven through the bottom of this shaft. • Construction of an interception chamber in the carriageway of <i>Deptford Church St</i>. • A length of connection culvert to transfer flows from the interception chamber to the drop shaft. A flap valve and penstock chamber will be constructed on the line of the culvert. • Provision of a control kiosk for the operation of the penstock. • A ventilation column approximately 10m high. <p>The main construction area will be located within the area of land between <i>Deptford Church St</i>, <i>Crossfield St</i> and <i>Coffey St</i>. This Site working area is approximately 3,600m². A short term working area will be required to enable the construction of the interception chamber in <i>Deptford Church St</i>.</p> <p>Within the construction compound there will be offices/welfare facilities, a storage area for construction materials and a storage and handling area for excavated material including slurry separation units.</p>																				
Ground Conditions	<p><i>Thames Water</i> have indicated the following ground conditions for the Work Areas as:</p> <table border="1" data-bbox="304 1285 1434 1547"> <thead> <tr> <th>Site Geology</th> <th>Depth Below Ground Level (m)</th> <th>Thickness (m)</th> </tr> </thead> <tbody> <tr> <td>Made Ground</td> <td>0.00</td> <td>3.00</td> </tr> <tr> <td>River Terrace Deposits</td> <td>3.00</td> <td>5.00</td> </tr> <tr> <td>Lambeth Group</td> <td>8.00</td> <td>5.00</td> </tr> <tr> <td>Thanet Sand</td> <td>13.00</td> <td>16.00</td> </tr> <tr> <td>Seaford Chalk</td> <td>29.00</td> <td>Proven to 16.00</td> </tr> </tbody> </table> <p>It is important to establish the ground conditions within this report to determine both the maximum <i>German</i> UXB bomb penetration depth (BPD) as well as the potential for other types of munitions to be buried on this Site.</p>			Site Geology	Depth Below Ground Level (m)	Thickness (m)	Made Ground	0.00	3.00	River Terrace Deposits	3.00	5.00	Lambeth Group	8.00	5.00	Thanet Sand	13.00	16.00	Seaford Chalk	29.00	Proven to 16.00
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Lambeth Group	8.00	5.00																			
Thanet Sand	13.00	16.00																			
Seaford Chalk	29.00	Proven to 16.00																			



STAGE TWO – REVIEW OF HISTORICAL DATASETS

Sources of Information Consulted	<p>The following primary information sources have been used in order to establish the background UXO threat:</p> <ol style="list-style-type: none"> 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	<p>According to the County Series (CS) & Ordnance Survey (OS) historical mapping, the following Site history can be recorded immediately prior to and post-WWII:</p> <p>1938 CS mapping – The Work Area is situated on developed land and contains residential housing and a “railway line”. It is situated immediately adjacent to <i>St Paul’s Church (Rectory)</i>.</p> <p>1949 OS mapping – There has been a reduction in the number of residential housing in the southern and western aspects of the Work Area. No other noticeable or significant changes have occurred.</p>
1945 Aerial Photography (Figure 4)	<p>The 1945 aerial photography confirms structural development on Site, and despite the lack of clarity in the aerial photography, it is possible to observe the reduction in the number of structures to the southern aspect of the Work Area. The rest of the Work Area appears intact, and thus the 1949 OS mapping positively correlates with the 1945 aerial photography.</p>
WWII Luftwaffe Bombing Targets (Figure 5)	<p>Primary targets have been identified in the vicinity of the Work Area. These included <i>Deptford Power Station</i> located 120m to the north of the Work Area, <i>South Metropolitan Gas Works</i> 380m to the northwest, a “gasholder station” located 340m to the west, a “pumping station” located 230m to the southwest and “water works and reservoirs” 480m to the south. “Opportunistic” targets include numerous scattered wharves, as well as a railway station and railway infrastructure, “depots”, “works”, a “shipbuilding factory” and a “reservoir” all located within 1,000m of the Site.</p>
WWII HE Bomb Strikes (Figure 6)	<p>Air Raid Precaution (ARP) reports indicate that no bomb strikes occurred within the Work Area. However, five bomb strikes occurred within the buffered Site boundary and twelve strikes occurred within 100m of the buffered Site boundary. Additionally, one V1 strike occurred approximately 70m to the west of the Site.</p>
WWII Bomb Damage (Figure 7)	<p><i>London County Council</i> (LCC) bomb damage maps indicate bomb damage throughout the southern and western aspect of the Work Area and buffered Site boundary, ranging from “blast damage; minor in nature” to “damage beyond repair”.</p>
WWII HE Bomb Density (Figure 8)	<p>The Study Site is located within the <i>Deptford Metropolitan Borough</i>, which recorded 453 HE bombs per 1,000 acres.</p> <p>This figure does not include incendiary devices, as they were often released in such large numbers that they were seldom recorded.</p>
Abandoned Bombs	<p>The Official Abandoned Bomb Register recorded no abandoned bombs on or within 1,000m of the Work Area.</p>



STAGE THREE – DATA ANALYSIS

Was the ground undeveloped during WWII?	No; the Work Area was fully developed with residential housing on Site.
Is there a reason to suspect that the immediate area was a bombing target during WWII?	Yes; the Work Area is surrounded by primary <i>Luftwaffe</i> bombing targets and is in close proximity to numerous “opportunistic” targets. Additionally, <i>Central London</i> was indiscriminately bombed during the “Blitz” and thus the immediate area was in an area targeted for bombing generally.
Is there firm evidence that ordnance landed on Site?	No; however there is evidence of a bomb strike on the boundary of the Work Area.
Is there evidence of damage sustained on Site?	Yes; structural damage ranges from “blast damage; minor in nature” to “seriously damaged” within the south of the Work Area, and “damage beyond repair” was recorded to structures within the north of the Work Area. Additionally, extensive bomb damage was sustained by structures throughout the buffered Site boundary from “blast damage; minor in nature” to “total destruction”.
Is there any reason to suspect that military training may have occurred at this location?	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?	Possibly; the Work Area contained residential housing throughout and was located adjacent to a major road (<i>Deptford Church Street</i>) and <i>Deptford Railway Station</i> , indicating a high volume of footfall. Therefore, it is likely that any UXB entry hole may have been witnessed and investigated. However, the LCC maps show significant bomb damage to many buildings within the Work Area and debris from bomb-damaged buildings may have masked potential UXB entry holes.
What is the expected UXO contamination?	The most likely source of UXO contamination is from <i>German</i> 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?	Unlikely; whilst all of the residential housing on the Site has been demolished, there has been no redevelopment carried out. The Site is currently undeveloped and is waste ground. Therefore it can be considered unlikely that previous earthworks would have removed the potential for UXO to be present.



STAGE FOUR – RISK ASSESSMENT

Explanation For Non-Division Of Site	With reference to working drawing plan no. 100-DA-CNS-PLM3X-272106, four additional Work Areas are highlighted. However, these Work Areas refer to relocated and suspended “bus stops”, and thus the works related to these areas are not deemed to pose an elevated level of risk.	
Threat Items	The threat is predominately posed by WWII <i>German</i> HE bombs and IBs. Additionally, <i>British</i> Anti Aircraft Artillery (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	<p>The general ground conditions (highlighted in Stage 1) of the Work Area that are relevant consist of Made Ground, Alluvium and River Terrace Deposits, and thus the most likely Bomb Penetration Depth (BPD) for a 250kg bomb is assessed to be a maximum of 7m bgl, dependant on the depth of any rock sediment.</p> <p>Whilst the <i>Luftwaffe</i> 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 <i>German</i> IBs and <i>British</i> AAA projectiles would have a significantly reduced penetration capability and would not be expected to be encountered at depths greater than 1m.</p>	
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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Delay the project 2. Disruption to local community/infrastructure 3. Incurring 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.
--------------------------------	---

<u>Activity</u>	WORK AREA		
	Probability (SHxEM=P)	Consequence (DxPSR=C)	Risk Rating (PxC=RR)
Enabling Works	2x1=2	3x3=9	2x9=18
Tunnelling	2x2=4	1x3=3	4x3=12
Shaft Installation	2x2=4	1x3=3	4x3=12
Open Excavations	2x2=4	2x3=6	4x6=24

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?	<p>Non-Intrusive Methods of Mitigation; The suitability of an effective non-intrusive method of mitigation is largely dependent on the depth and composition of Made Ground (3m at this Site) as any magnetometer results are highly likely to be affected by ferro-magnetic contamination due to previous construction activities within the Study Site location.</p> <p>Intrusive Methods of Mitigation; Intrusive magnetometry is expected to be possible (although limited) on this Site. 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.</p>
---	--

MITIGATION MEASURES TO REDUCE RISK TO 'ALARP'

Activity	Risk Mitigation Measures	Final Risk Rating
ALL ACTIVITIES	<p>The following actions are recommended before undertaking any activity on the Study Site:</p> <p>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.</p> <p>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. Posters and information of the general nature of the UXB threat should be held in the site office for reference and as a reminder.</p>	ALARP
ENABLING WORKS/OPEN EXCAVATIONS	<p>3. Specialist UXO Banksman Support; these activities should be supervised by a specialist UXO banksman to identify and dispose of any items of UXO.</p>	

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



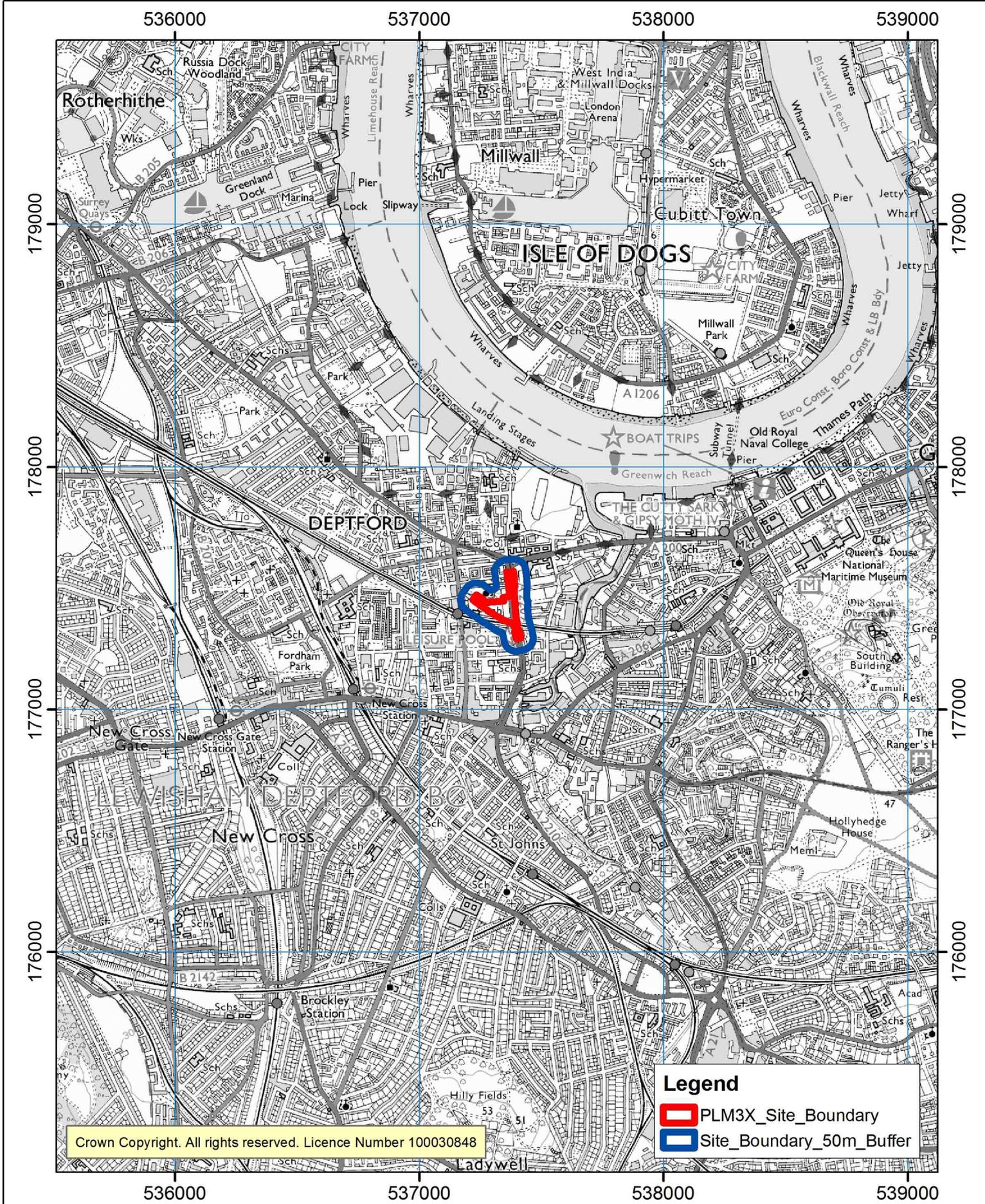
Figure One

Site Location

Thames Tideway Tunnel - Work Area PLM3X Site Location

Figure 1

British National Grid



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Checked by: Lee Gooderham

Date: 28th May 2012



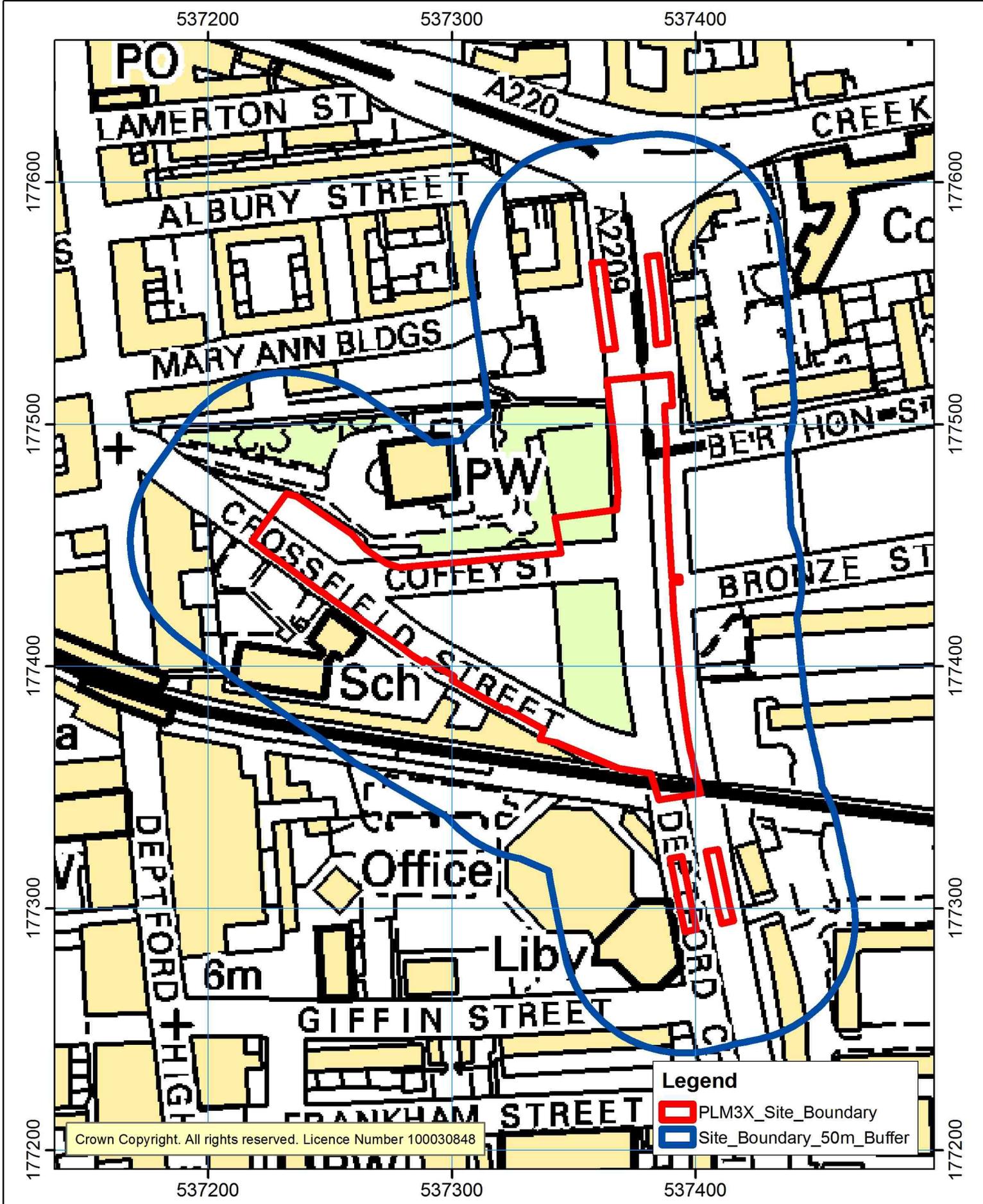
Figure Two

Site Boundary

Thames Tideway Tunnel - Work Area PLM3X Site Boundary

Figure 2

British National Grid



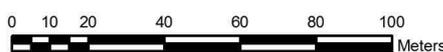
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Legend

- PLM3X_Site_Boundary
- Site_Boundary_50m_Buffer



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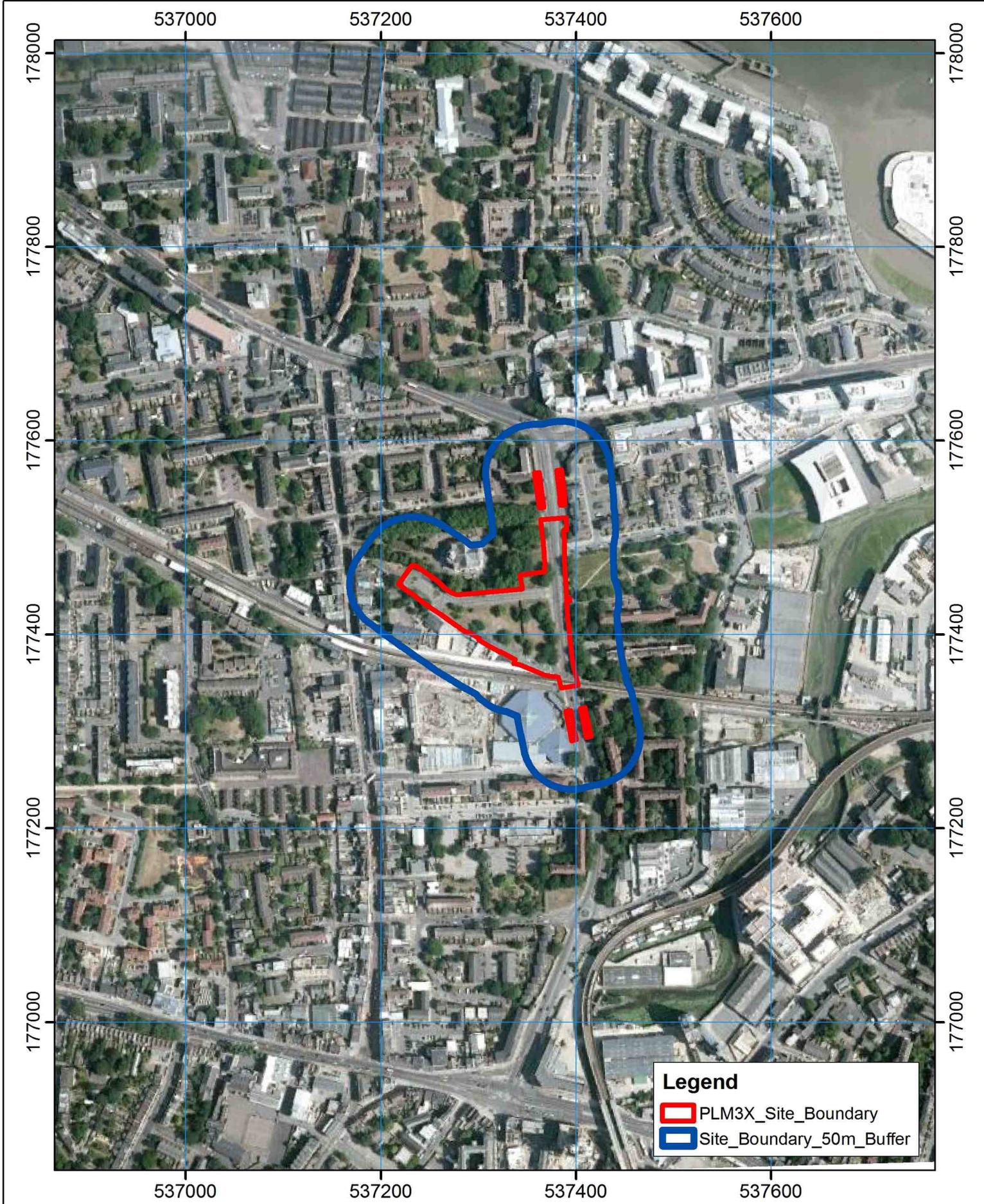
Figure Three

Current Aerial Photography

Thames Tideway Tunnel - Work Area PLM3X Current Aerial Photography

Figure 3

British National Grid



Legend

- PLM3X_Site_Boundary
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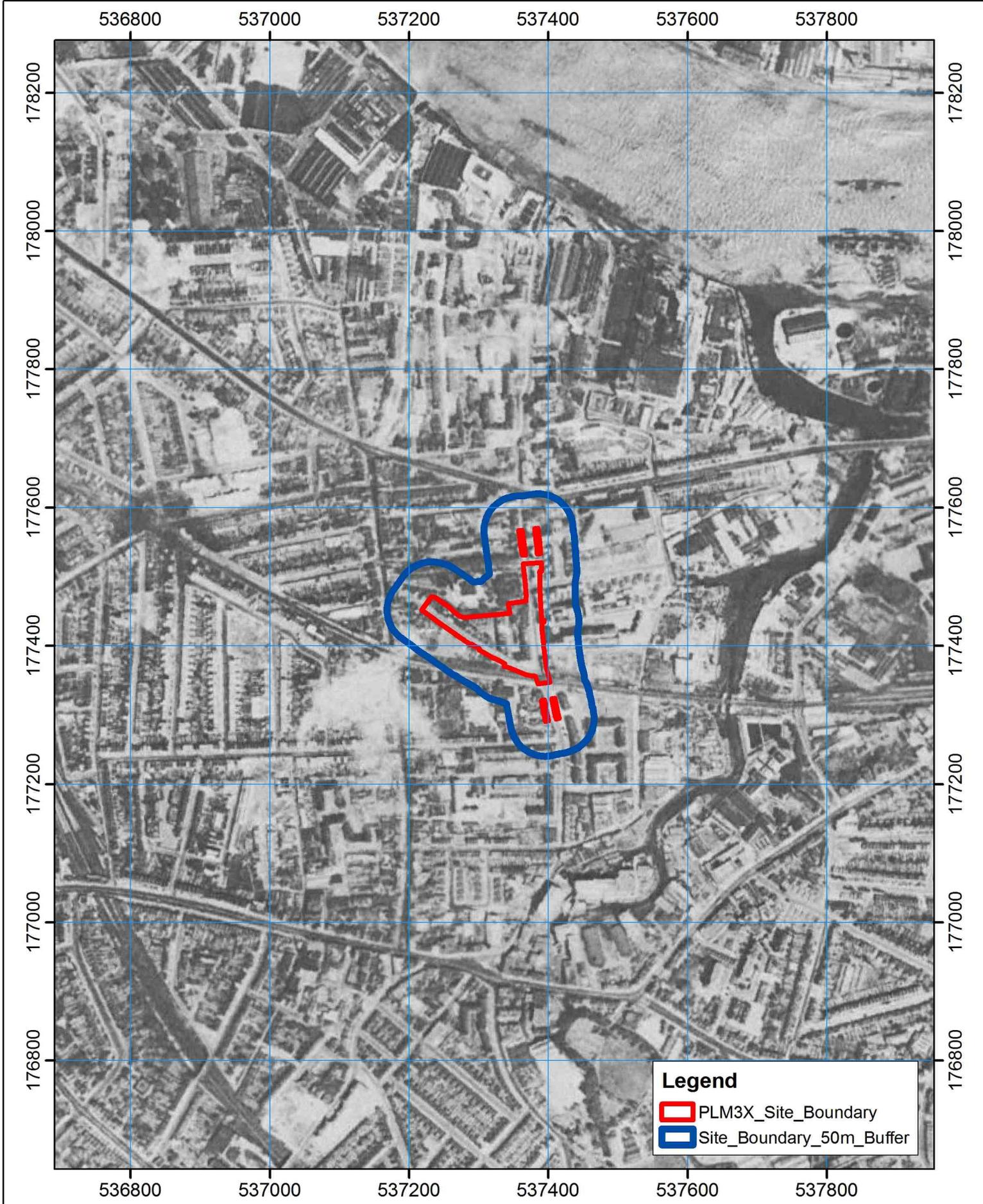
Figure Four

1945 Aerial Photography

Thames Tideway Tunnel - Work Area PLM3X 1945 Aerial Photography

Figure 4

British National Grid



Legend

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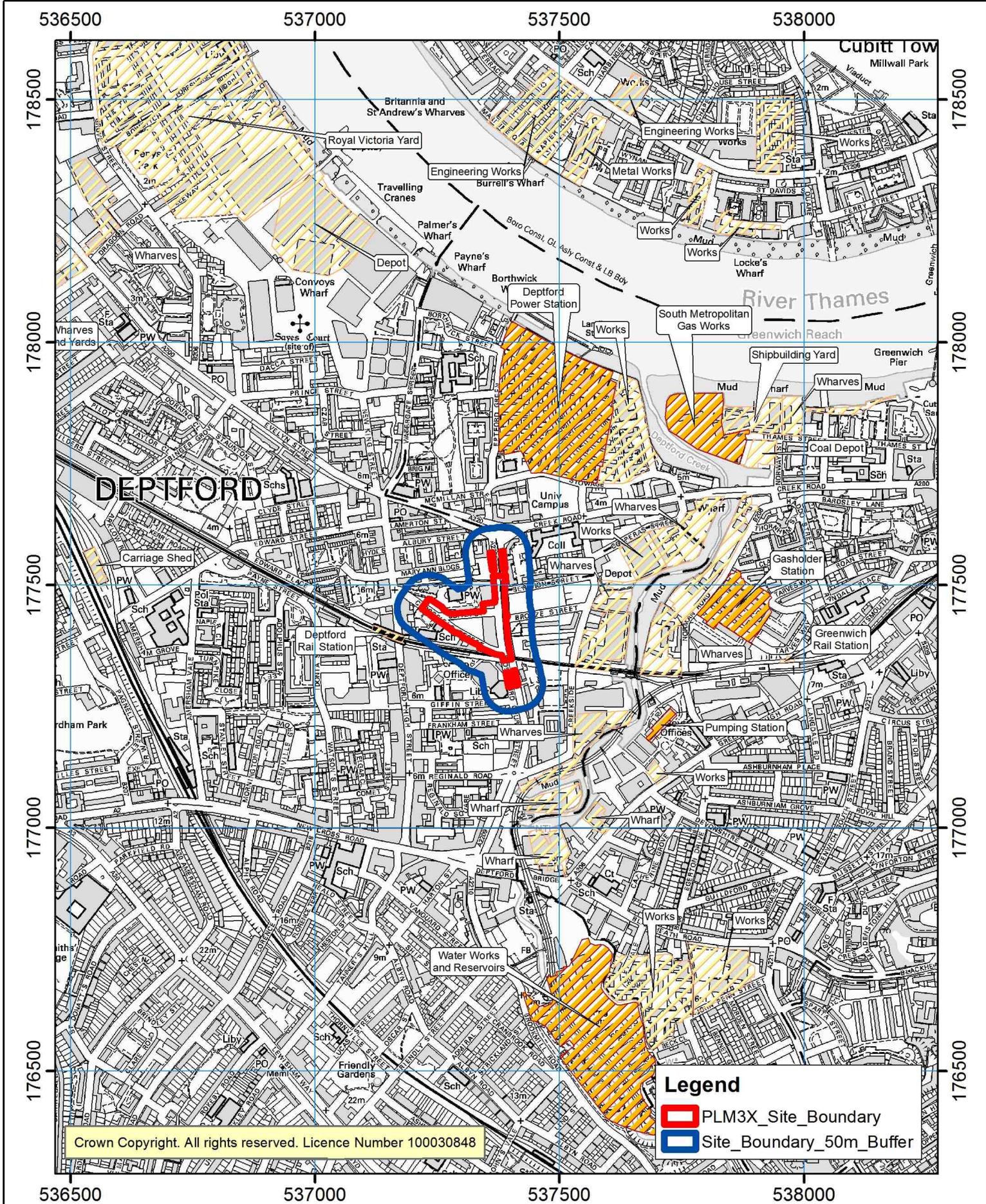
Figure Five

WWII Luftwaffe Bombing Targets

Thames Tideway Tunnel - Work Area PLM3X WWII Luftwaffe Bombing Targets

Figure 5

British National Grid



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Legend

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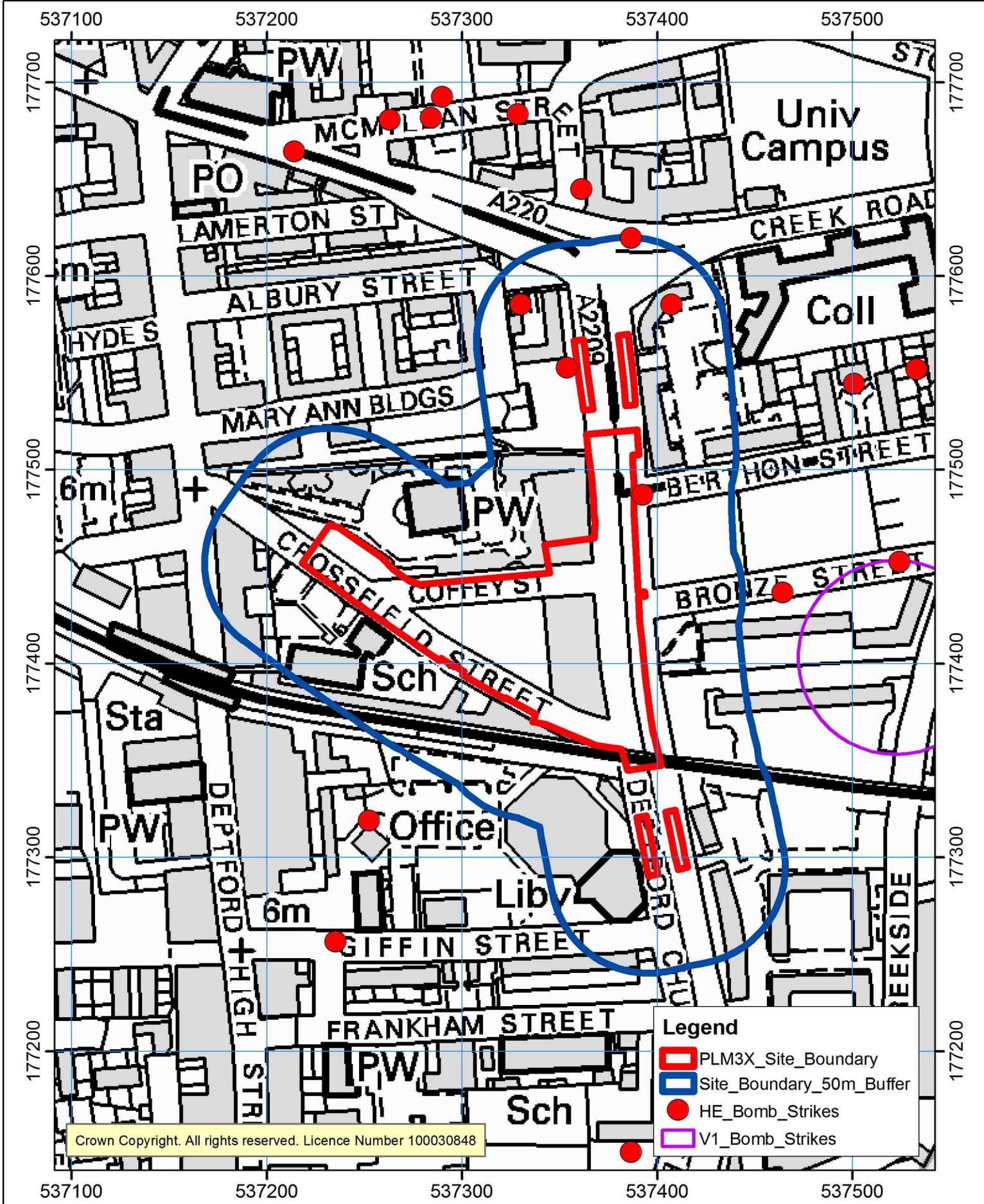
Figure Six

WWII High Explosive Bomb Strikes

Thames Tideway Tunnel - Work Area PLM3X WWII High Explosive Bomb Strikes

Figure 6

British National Grid



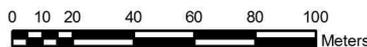
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Legend

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- Site_Boundary_50m_Buffer
- HE_Bomb_Strikes
- V1_Bomb_Strikes



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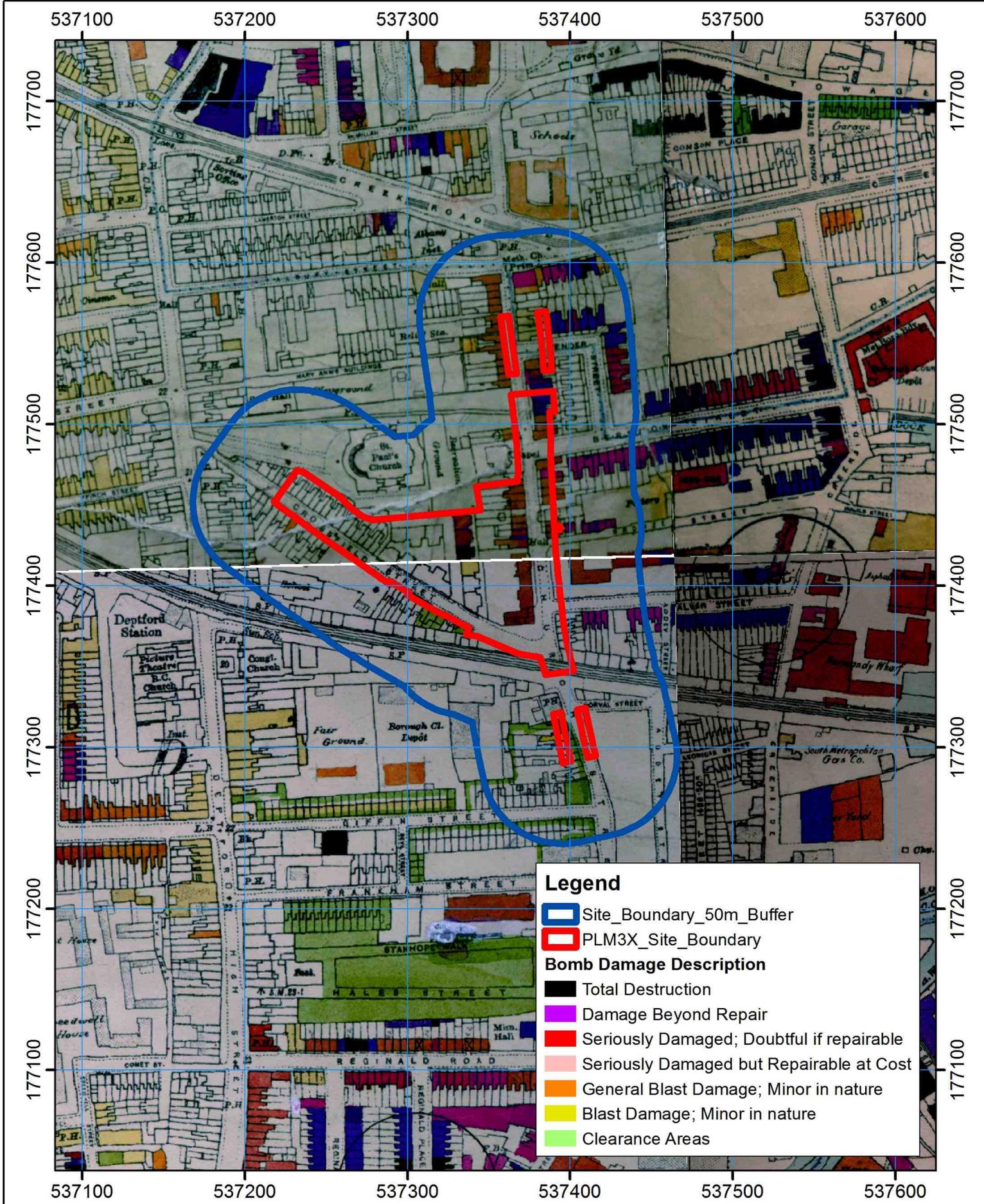
Figure Seven

London County Council Bomb Damage Mapping

Thames Tideway Tunnel - Work Area PLM3X London County Council Bomb Damage Map

Figure 7

British National Grid



Legend

- Site_Boundary_50m_Buffer
- PLM3X_Site_Boundary

Bomb Damage Description

- Total Destruction
- Damage Beyond Repair
- Seriously Damaged; Doubtful if repairable
- Seriously Damaged but Repairable at Cost
- General Blast Damage; Minor in nature
- Blast Damage; Minor in nature
- Clearance Areas



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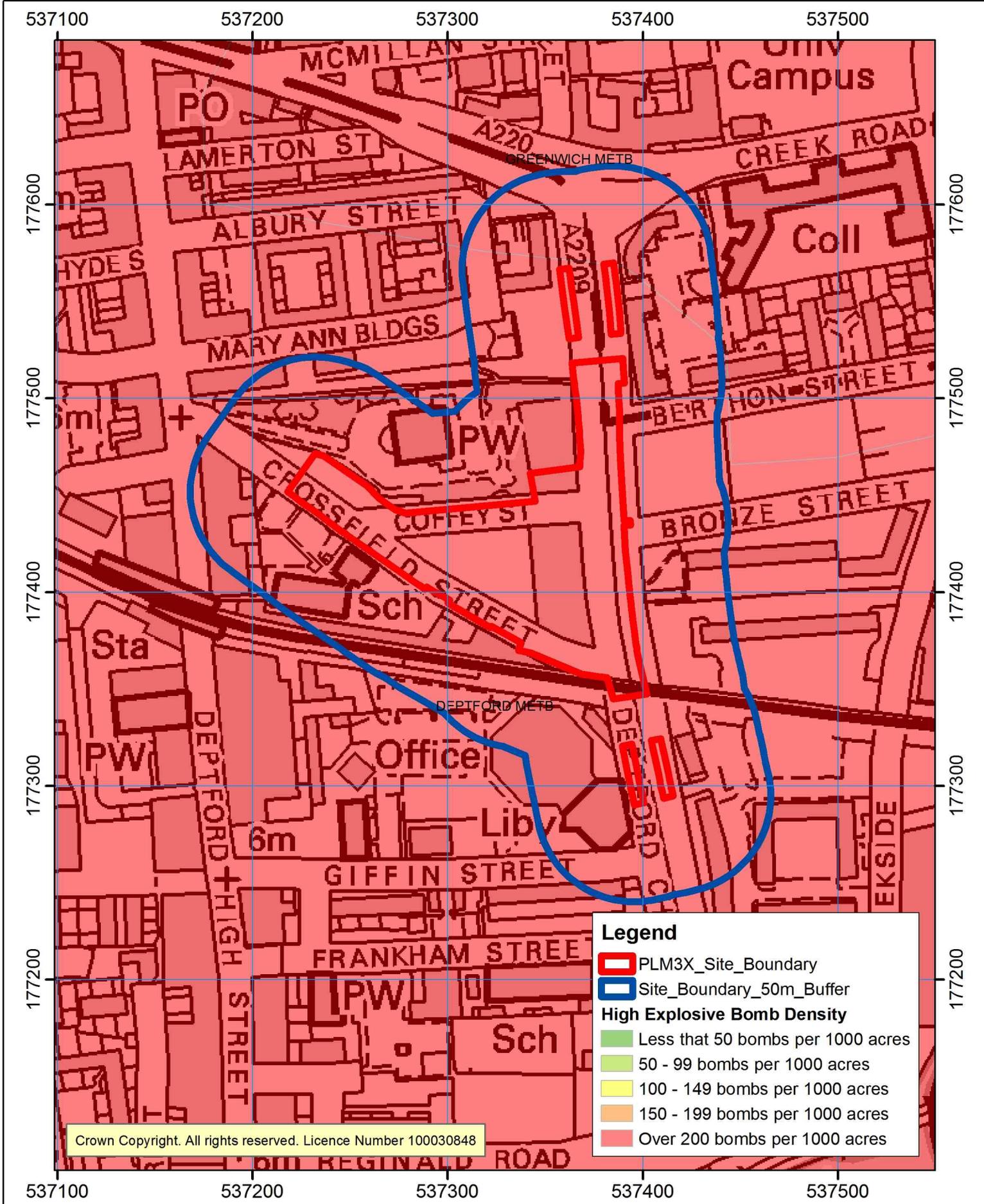
Figure Eight

WWII High Explosive Bomb Density

Thames Tideway Tunnel - Work Area PLM3X WWII High Explosive Bomb Density

Figure 8

British National Grid



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Legend

- PLM3X_Site_Boundary
- Site_Boundary_50m_Buffer

High Explosive Bomb Density

- Less that 50 bombs per 1000 acres
- 50 - 99 bombs per 1000 acres
- 100 - 149 bombs per 1000 acres
- 150 - 199 bombs per 1000 acres
- Over 200 bombs per 1000 acres



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References

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Thames Tideway Tunnel
Thames Water Utilities Limited



Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix G: Noise and vibration

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

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Environmental Statement

Volume 23 Deptford Church Street appendices

Appendix G: Noise and vibration

List of contents

	Page number
Appendix G : Noise and vibration	1
G.1 Baseline noise survey	1
G.2 Construction noise prediction results	9
References	23

List of plates

	Page number
Vol 23 Plate G.1 Noise – measurement location DCS01	7
Vol 23 Plate G.2 Noise – measurement location DCS02	7
Vol 23 Plate G.3 Noise – measurement location DCS03	8
Vol 23 Plate G.4 Noise – measurement location DCS04	8
Vol 23 Plate G.5 Noise – Average monthly daytime noise level over duration of construction – St. Joseph’s Primary School (DC1)	17
Vol 23 Plate G.6 Noise – Average monthly daytime noise level over duration of construction – 134-160 Deptford High Street (DC2)	18
Vol 23 Plate G.7 Noise – Average monthly daytime noise level over duration of construction – St Paul’s Church (DC3)	18
Vol 23 Plate G.8 Noise – Average monthly daytime noise level over duration of construction – 1-22 Berthon Street (DC4)	19
Vol 23 Plate G.9 Noise – Average monthly daytime noise level over duration of construction – Congers House (DC5)	19
Vol 23 Plate G.10 Noise – Average monthly daytime noise level over duration of construction – Farrer House (DC6)	20
Vol 23 Plate G.11 Noise – Average monthly daytime noise level over duration of construction – Resolution Way (DC7)	21

Vol 23 Plate G.12 Noise – Average monthly daytime noise level over duration of construction – Tidemill Academy (DC8)..... 22

List of tables

	Page number
Vol 23 Table G.1 Noise – survey equipment	1
Vol 23 Table G.2 Noise – weather conditions during baseline noise surveys.....	2
Vol 23 Table G.3 Noise – measurement locations.....	3
Vol 23 Table G.4 Noise – sampled noise survey results - DCS01.....	4
Vol 23 Table G.5 Noise – sampled noise survey results - DCS02.....	5
Vol 23 Table G.6 Noise – sampled noise survey results - DCS03.....	5
Vol 23 Table G.7 Noise – sampled noise survey results - DCS04.....	6
Vol 23 Table G.8 Noise – typical construction plant schedule	10

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 receptors to Deptford Church Street are the dwellings close to the site along with St Joseph's Primary School on Crossfield Street, and St Paul's Church to the north of Coffey Street.

Survey methodology

- G.1.3 The London Borough of Lewisham has been consulted regarding the noise assessment and monitoring locations, prior to completing the surveys.
- G.1.4 A baseline noise survey was completed on 14th July, 2011. The survey comprised short term attended measurements taken during the daytime and evening at all measurement locations.
- G.1.5 Measurements were undertaken during the interpeak periods of 10:00-12:00, 14:00-16:00 and 20:00-22:00 on a typical weekday, so that the baseline data is representative of the quieter periods where any disturbance from construction would be most noticeable.
- G.1.6 Vol 23 Table G.1 describes the survey equipment that was used to collect the baseline data at the site.

Vol 23 Table G.1 Noise – survey equipment

Item	Type	Manufacturer	Serial Number(s)	Laboratory Calibration Date
Baseline survey: 14 th July 2011				
Hand-Held Analyzer(s)	2250	Brüel & Kjær	2506362 2626233	25/05/2011* 15/02/2010**
½ " Microphone(s)	4189	Brüel & Kjær	2643144 2621212	13/05/2011* 15/02/2010**
B&K Sound Calibrator(s)	4231	Brüel & Kjær	2445811 2619374	14/10/2010* 21/02/2011**

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

**Hand-held analyser(s) and ½ " microphone(s) valid for two years 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 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 The prevailing weather conditions observed for the baseline surveys are described in Vol 23 Table G.2.

Vol 23 Table G.2 Noise – weather conditions during baseline noise surveys

Wind Speed (ms ⁻¹)	Wind Direction	Temperature (°C)	Precipitation	Description
Baseline survey – 14 th July, 2011 (daytime, 10:00-12:00)				
Maximum: 1.2-2.9 Average: 0.3-1.2	Variable	18-21	No	Breezy and overcast
Baseline survey – 14 th July, 2011 (daytime, 14:00-16:00)				
Maximum: 0.7-2.5 Average: 0.3-0.7	NNW	20-22	No	Overcast with a light breeze
Baseline survey – 14 th July, 2011 (evening, 20:00-22:00)				
Maximum: 0.3-1.5 Average: 0.0-0.4	NW	20-21	No	Overcast

Measurement locations

- G.1.10 Vol 23 Table G.3 details the measurement locations which are also presented in Vol 23 Figure G.1 Noise – measurement locations (see separate volume of figures), and shown in Vol 23 Plate G.1 to Vol 23 Plate G.4.

Vol 23 Table G.3 Noise – measurement locations

Measurement Location Number	Description	Co-ordinates	
		X	Y
DCS01	On public footpath adjacent to Coffey Street, near to main entrance to St Paul's Church	537242	177469
DCS02	On public footpath adjacent to Crossfield Street, opposite grounds of St Joseph's Primary School	537272	177423
DCS03	On public footpath adjacent to Bronze Street, opposite high rise residential flats (Congers House)	537421	177443
DCS04	Within grounds of St Paul's Church, south-west of main building	537309	177462

Results

G.1.11 The range of values for each of the parameters collected during the baseline surveys are summarised in Vol 23 Table G.4 to Vol 23 Table G.7.

Vol 23 Table G.4 Noise – sampled noise survey results - DCS01

Location Detail: DCS01, on public footpath adjacent to Coffey Street, near to main entrance to St Paul’s Church						
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)	86	48	54-58	53*	56	55
Evening (20.00-22.00)	70	43	53	53*	56	55

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

Vol 23 Table G.5 Noise – sampled noise survey results - DCS02

Location Detail: DCS02, on public footpath adjacent to Crossfield Street, opposite grounds of St Joseph’s 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)	78	49	52-59	56	59*	60
Evening (20.00-22.00)	68	45	51-54	53	56*	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 23 Table G.6 Noise – sampled noise survey results - DCS03

Location Detail: DCS03, On public footpath adjacent to Bronze Street, opposite high rise residential flats (Congers House)						
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)	84	51	59-61	60	63*	65
Evening (20.00-22.00)	85	49	59-60	60	63*	65

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

Vol 23 Table G.7 Noise – sampled noise survey results - DCS04

Location Detail: DCS04, Within private grounds of St Paul’s Church, south-west of main building						
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)	73	51	55-58	57	60*	60
Evening** (20.00-22.00)						

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

***There was no access to this location for the evening reference period therefore no data is available*

Plates of noise measurement locations

G.1.12 The following plates (Vol 23 Plate G.1 to Vol 23 Plate G.4) illustrate the noise measurement locations.

Vol 23 Plate G.1 Noise – measurement location DCS01



Note: On public footpath along Coffey Street, looking southeast (façade measurement)

Vol 23 Plate G.2 Noise – measurement location DCS02



Note: Grassed verge on public footpath adjacent to Crossfield Street, looking north towards public footpath along Coffey Street and St Paul's church

Vol 23 Plate G.3 Noise – measurement location DCS03



Note: On public footpath along Bronze Street, looking west towards Deptford Church Street intersection

Vol 23 Plate G.4 Noise – measurement location DCS04



Note: Within grounds of St Paul's church, looking west

G.2 Construction noise prediction results

- G.2.1 The construction noise prediction methodology follows the methodology provided in Volume 2 Environmental assessment methodology. .
- 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 23 Table G.8.
- G.2.4 Time histories of the predicted daytime construction noise levels across the programme of construction works are shown in Vol 23 Plate G.5 to Vol 23 Plate G.12.

Vol 23 Table G.8 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	98	30	BS5228-1: Table C.2, Item 7	Tracked excavator,
	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
	Hand-held percussive breaker	1	111	30	BS5228-1: Table C.1, Item 6	Hand-held pneumatic breaker,
	Compressor 250cfm	1	93	15	BS5228-1: Table C.5, Item 5	Compressor for hand-held pneumatic breaker, 1 t
	Generator 35kVA	1	94	100	BS5228-1: Table C.4, Item 78	Diesel generator,
	Circular saw cutting timber	1	107	10	BS5228-1: Table D.7, Item 72	Hand-held electric circular saw,
	Cutting equipment (diamond saw)	1	108	10	BS5228-1: Table C.4, Item 93	Angle grinder (grinding steel), 4.7 kg
	Waste collection via skip or tipper lorry	1	106	5	BS5228-1: Table C.8, Item 21	Skip wagon,
	Oxyacetylene cutting equipment	1	93	10	BS5228-1: Table C.3, Item 35	Hand-held gas cutter, 230 bar
	Site set up and general	Oxyacetylene cutting equipment	1	93	10	BS5228-1: Table C.3, Item 35

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
site	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,
	Cutting equipment (diamond saw)	2	108	10	BS5228-1: Table C.4, Item 93	Angle grinder (grinding steel), 4.7 kg
	Telescopic Handler/FLT	1	99	30	BS5228-1: Table C.2, Item 35	Telescopic handler, 10 t
	Wheel wash	1	91	20	BS5228-1: Table C.3, Item 13	Water jet pump,
	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
	Dewatering Pump	1	96	100	BS5228-1: Table C.4, Item 88	Water pump,
	JCB with hydraulic breaker	1	116	25	BS5228-1: Table C.5, Item 1	Backhoe mounted hydraulic breaker,
	Fuel delivery vehicle	1	104	5	BS5228-1: Table C.4, Item 15	Fuel tanker lorry,
	Well drilling Rig	1	107	50	Manufacturer	Bauer BBA well drilling rig,

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
Demolition	Service Crane 25T mobile Crane	1	98	30	BS5228-1: Table C.4, Item 43	Wheeled mobile crane, 35 t
General site equipment also applicable during this phase	22T Excavator c/w hydraulic hammer	1	118	30	BS5228-1: Table C.1, Item 9	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
Piling for culvert support General site equipment also applicable during this phase	100t crawler crane	1	103	60	BS5228-1: Table C.4, Item 52	Tracked mobile crane, 105 t
	25 tonne mobile crane	1	98	60	BS5228-1: Table C.4, Item 43	Wheeled mobile crane, 35 t
Diaphragm wall construction General site equipment	Small secant piling rig	1	107	60	BS5228-1: Table C.3, Item 16	Crane mounted auger
	Concrete deliveries (discharging)	1	103	20	BS5228-1: Table C.4, Item 18	Cement mixer truck (discharging),
	Diaphragm wall rig (grab)	1	114	5	BS5228-1: Table D.4, Item 10	D wall rig,
	Diaphragm wall rig	1	110	70	Manufacturer	Hydroraise D wall rig,

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
also applicable during this phase	(hydrofraise)					
	Concrete pump	1	95	20	BS5228-1: Table C.4, Item 24	Concrete pump + cement mixer truck (discharging), 8 t / 350 bar
	150t crawler crane	2	103	50	BS5228-1: Table C.4, Item 52	Tracked mobile crane, 105 t
	Diaphragm wall slurry treatment plant	1	100	100	Manufacturer	Slurry treatment plant,
	Waste water treatment plant	1	96	100	BS5228-1: Table C.4, Item 88	Water pump (diesel), 100 kg
	Compressor 400cfm	1	105	90	BS5228-1: Table D.6, Item 41	Compressor, 7m ³ /min
	Dumper	1	104	50	BS5228-1: Table C.4, Item 3	Dumper, 7 t
	Dewatering pump	4	96	100	BS5228-1: Table C.4, Item 88	Water pump (diesel), 100 kg
	Long reach excavator	1	106	80	BS5228-1: Table C.7, Item 1	Long reach tracked excavator, 21 m arm / 39 t
	20t excavator with breaker	1	118	50	BS5228-1: Table C.1, Item 9	Breaker mounted on excavator, 15 t
Shaft excavation						
General site equipment also applicable						

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
during this phase	100t crawler crane	1	103	50	BS5228-1: Table C.4, Item 52	Tracked mobile crane, 105 t
	80t crawler crane	1	103	50	BS5228-1: Table C.4, Item 52	Tracked mobile crane, 105 t
	25t excavator	1	105	80	BS5228-1: Table C.2, Item 19	Tracked excavator, 25 t
	Ventilation fans	1	100	100	Manufacturer	Ventilation fans,
	Dumper	1	104	50	BS5228 Table C 4, Item 3	Dumper, 7 t
	Concrete pump	1	103	20	BS5228-1: Table C.4, Item 18	Cement mixer truck (discharging),
	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,
Shaft secondary lining	Hand tools (e.g. drills and wrenches)	4	95	80	Estimated	Impact wrench and compressor,
	Concrete deliveries (discharging)	2	95	20	BS5228-1: Table C.4, Item 24	Concrete pump + cement mixer truck (discharging), 8 t / 350 bar
General site equipment also applicable during this phase						

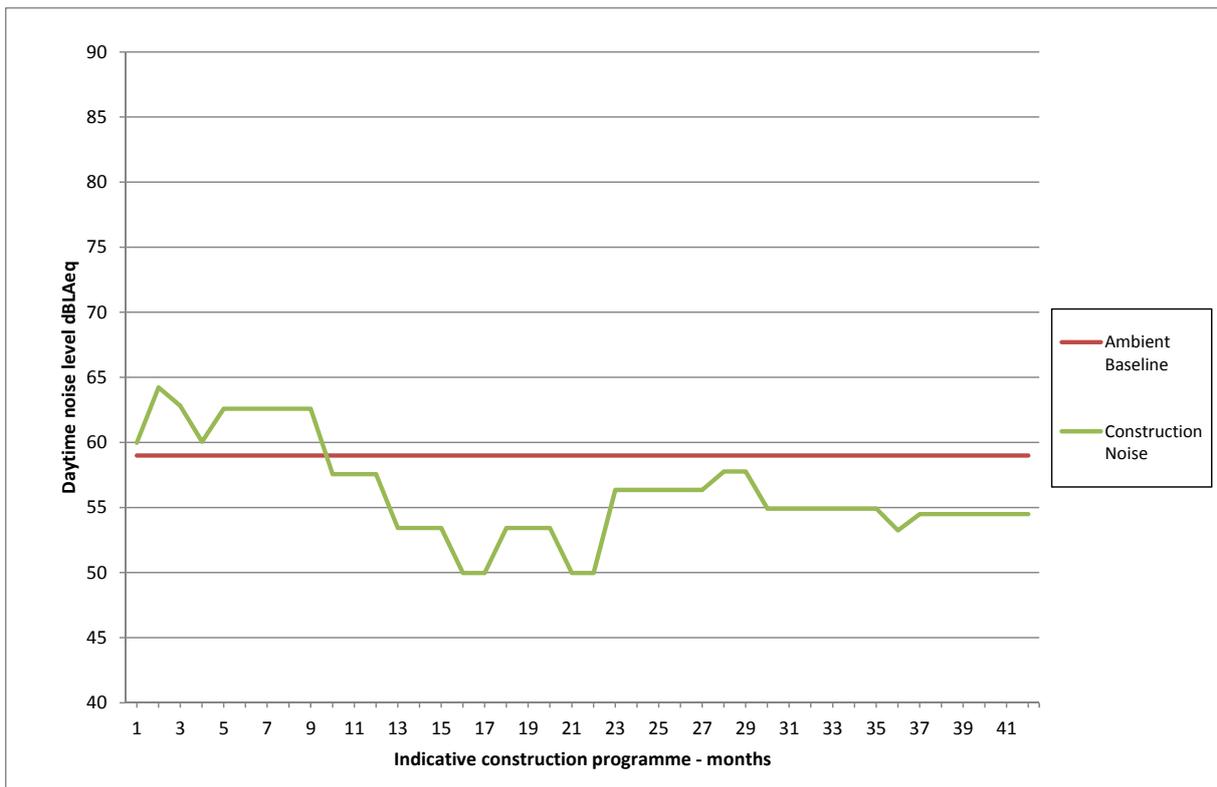
Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
Culvert and chamber works	Service crane - 100T mobile crane	1	99	50	BS5228-1: Table C.4, Item 41	Mobile telescopic crane, 100 t
	25t excavator	1	105	50	BS5228-1: Table C.2, Item 19	Tracked excavator, 25 t
	Fixed and portable concrete vibrators	2	106	20	BS5228-1: Table C.4, Item 33	Poker vibrator,
	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
	Dumper	1	104	50	BS5228-1: Table C.4, Item 3	Dumper, 7 t
	Hand tools (e.g. drills and wrenches)	4	95	80	Estimated	Impact wrench and compressor,
Landscaping	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
General site equipment NOT applicable during this phase	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

Construction activity	Plant	Unit No(s)	Activity LWA (dB)	% on-time	Data Source	Description of equipment used in the assessment
	Compressor for hand-held breaker	1	93	10	BS5228-1: Table D.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,
	Plate compactors	2	108	10	BS5228-1: Table C.2, Item 41	Vibratory plate (petrol),
	Vibrating rollers	1	101	20	BS5228-1: Table C.2, Item 38	Roller, 18 t

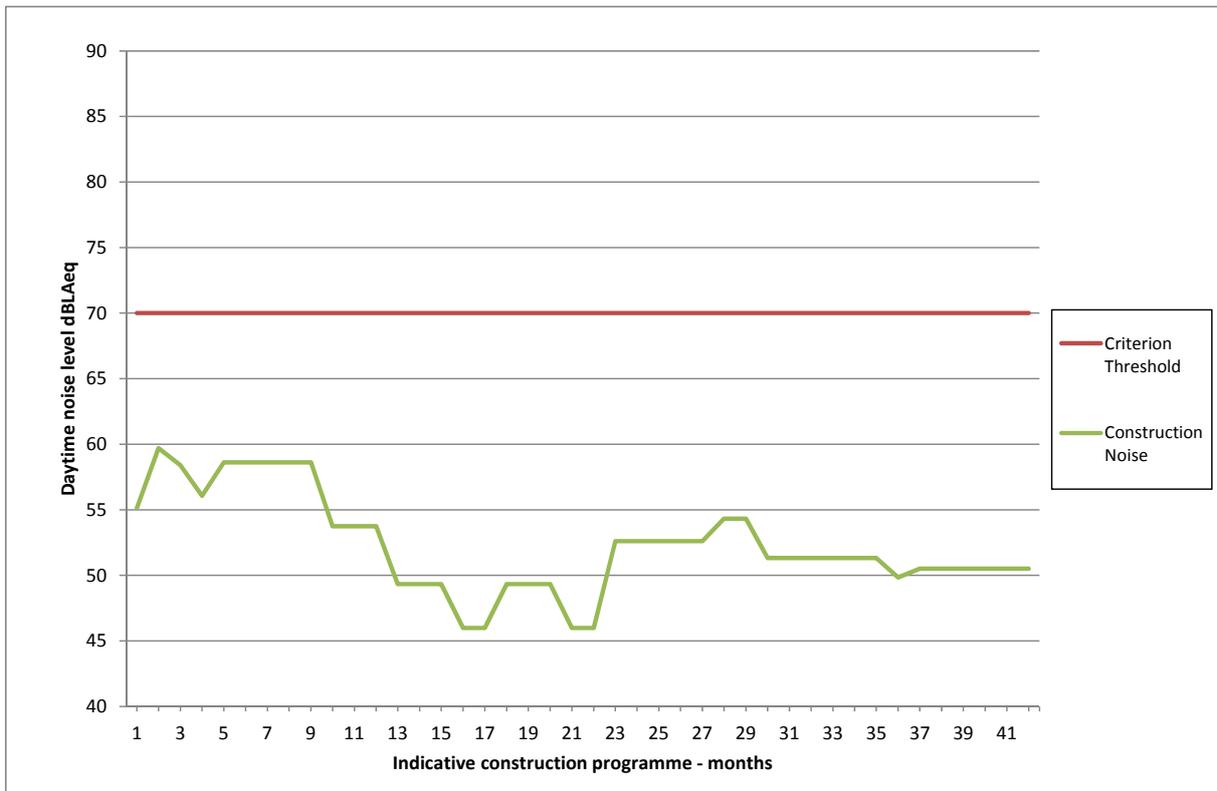
Note: This schedule provides an illustration of typical plant that could be used in the construction of the Thames Tideway Tunnel at this site. The appointed Contractor must comply with section 6 of the CoCP but may vary the method and plant to be used. This schedule therefore represents the most reasonable 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 figures 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 figures 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. 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 and not presented here.

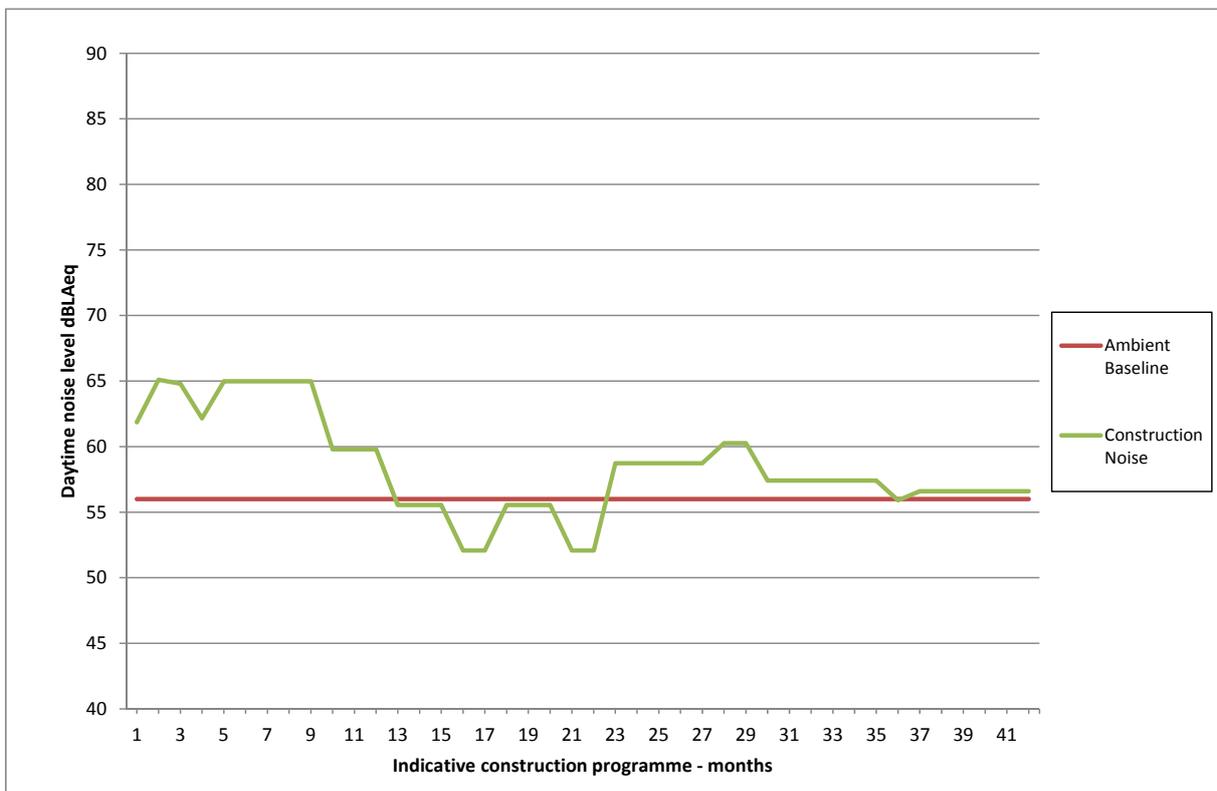
Vol 23 Plate G.5 Noise – Average monthly daytime noise level over duration of construction – St. Joseph’s Primary School (DC1)



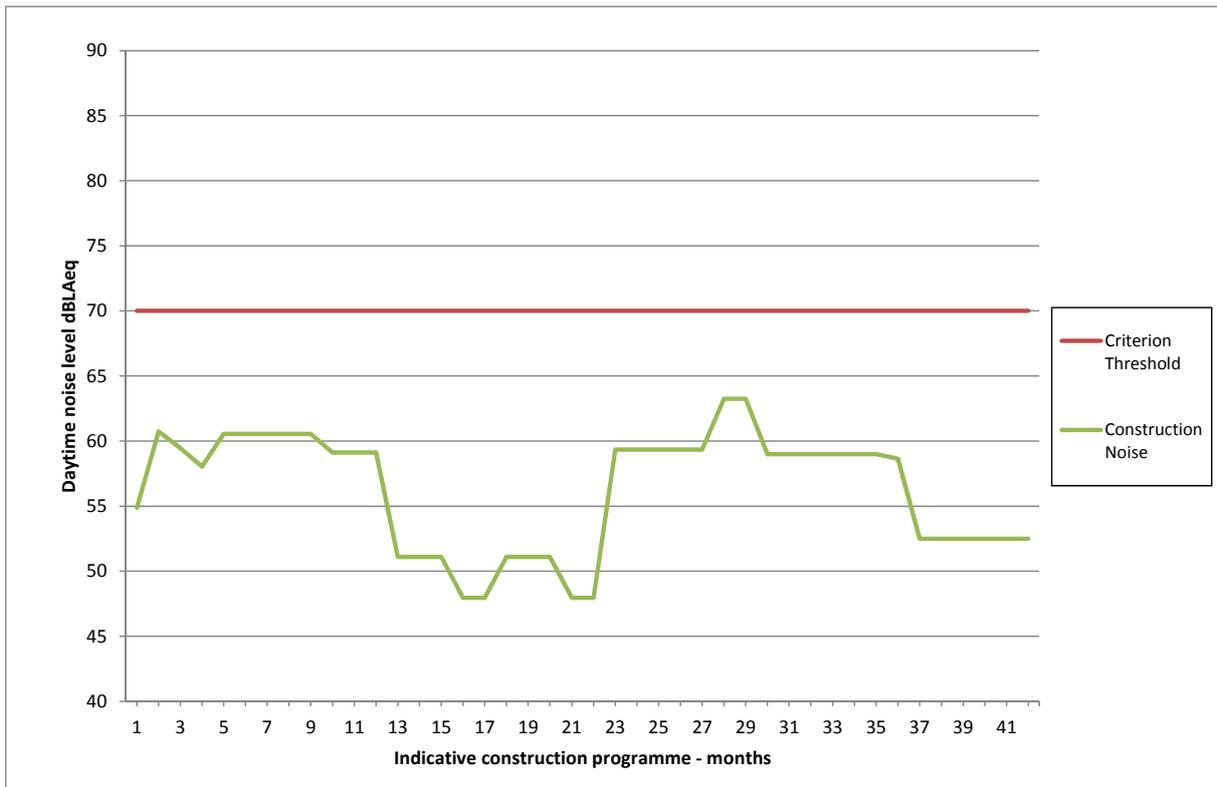
Vol 23 Plate G.6 Noise – Average monthly daytime noise level over duration of construction – 134-160 Deptford High Street (DC2)



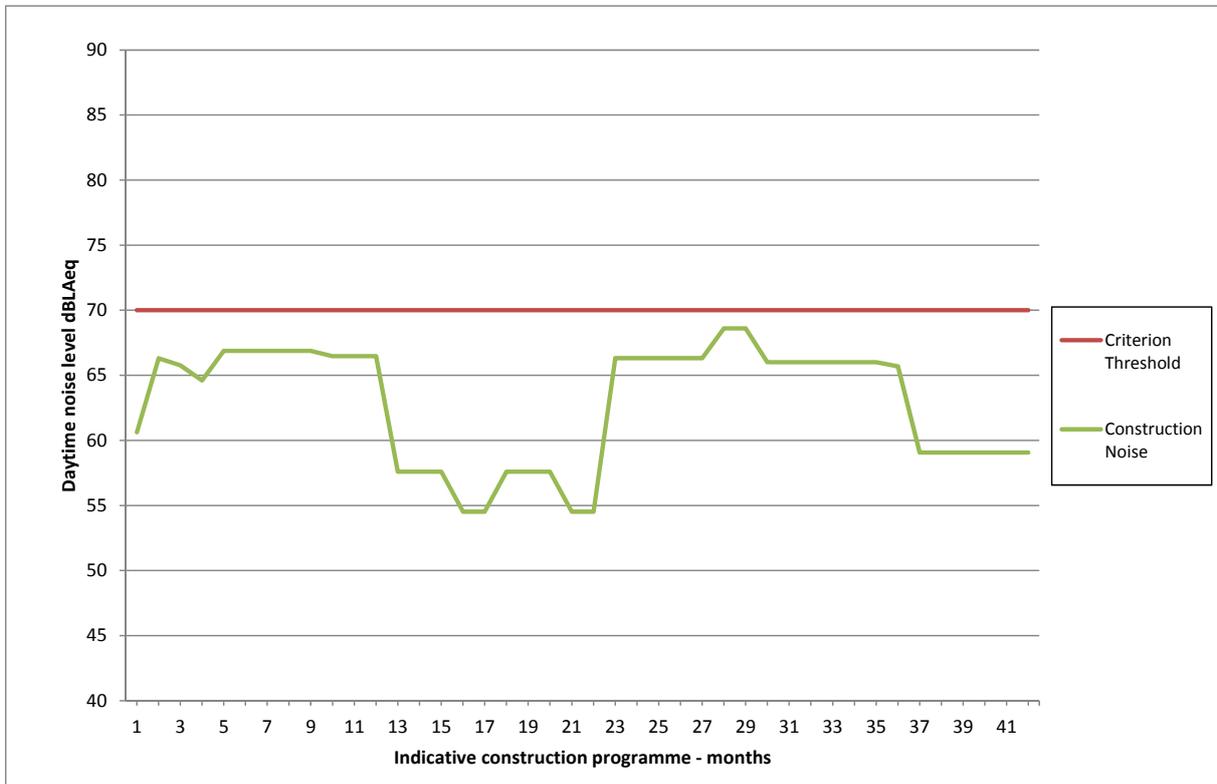
Vol 23 Plate G.7 Noise – Average monthly daytime noise level over duration of construction – St Paul’s Church (DC3)



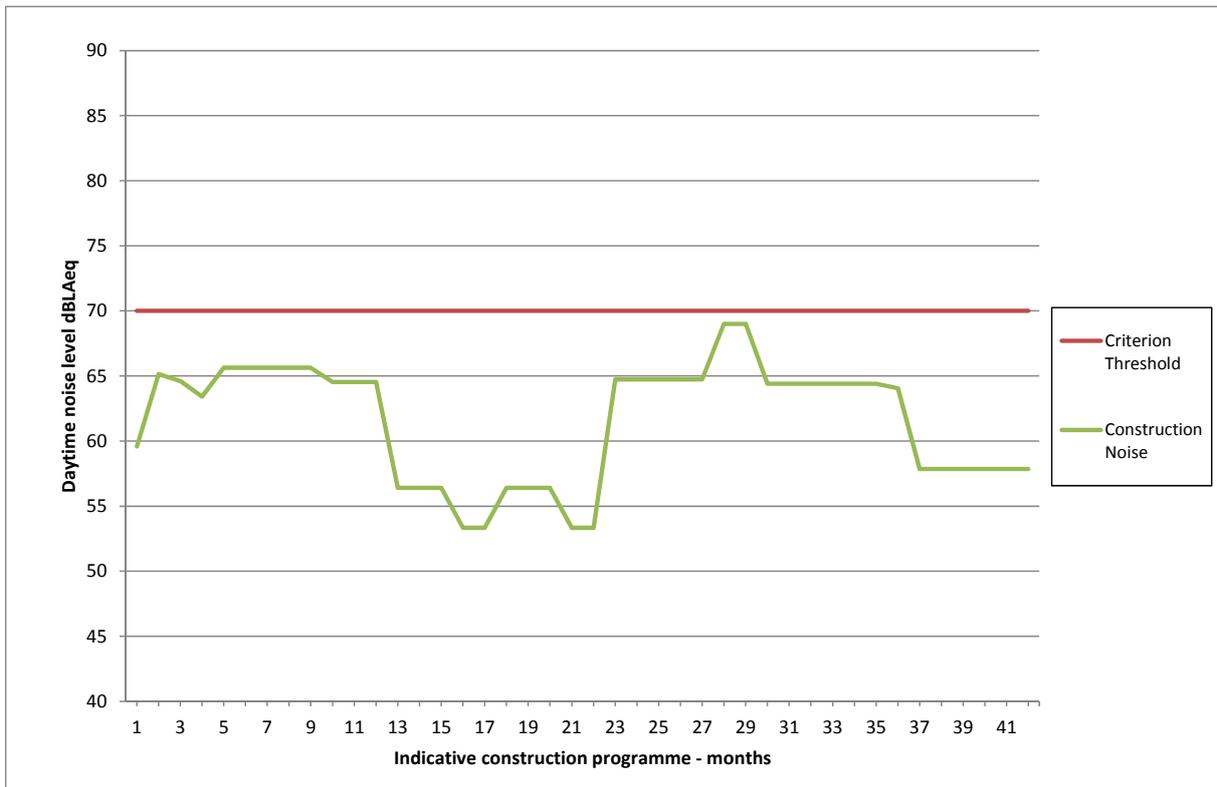
Vol 23 Plate G.8 Noise – Average monthly daytime noise level over duration of construction – 1-22 Berthon Street (DC4)



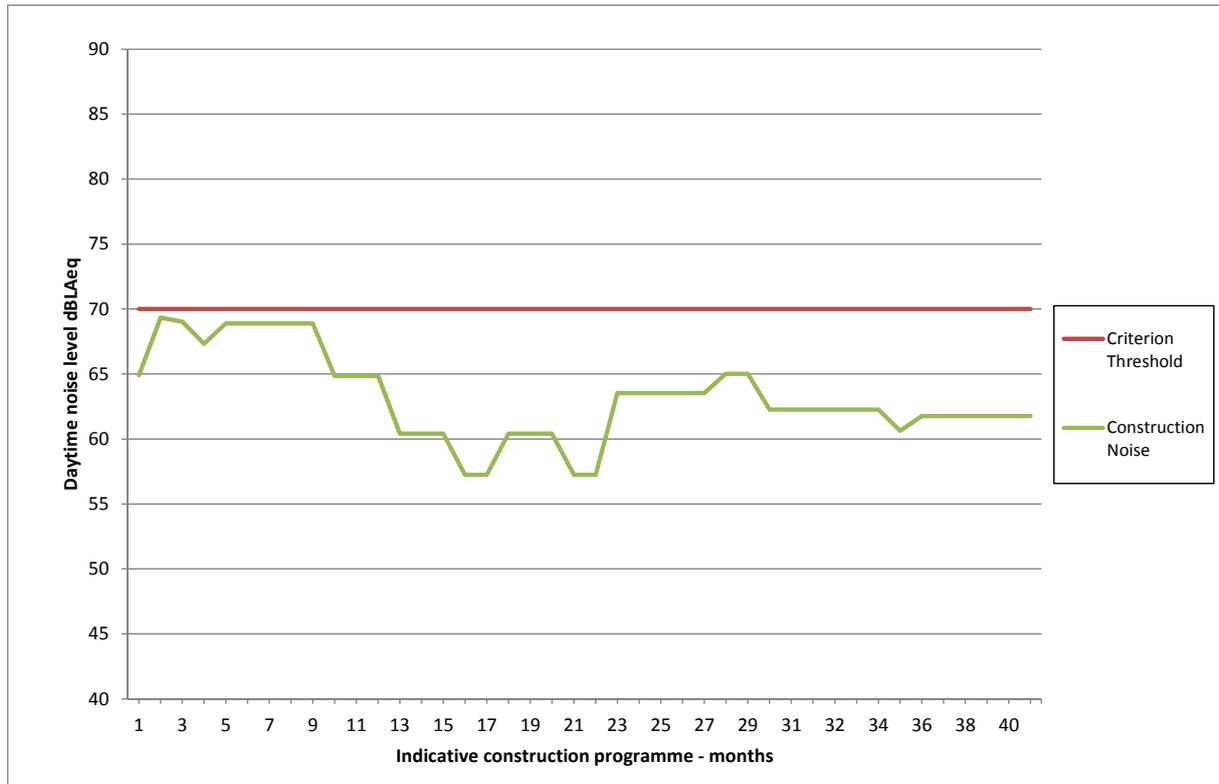
Vol 23 Plate G.9 Noise – Average monthly daytime noise level over duration of construction – Congers House (DC5)



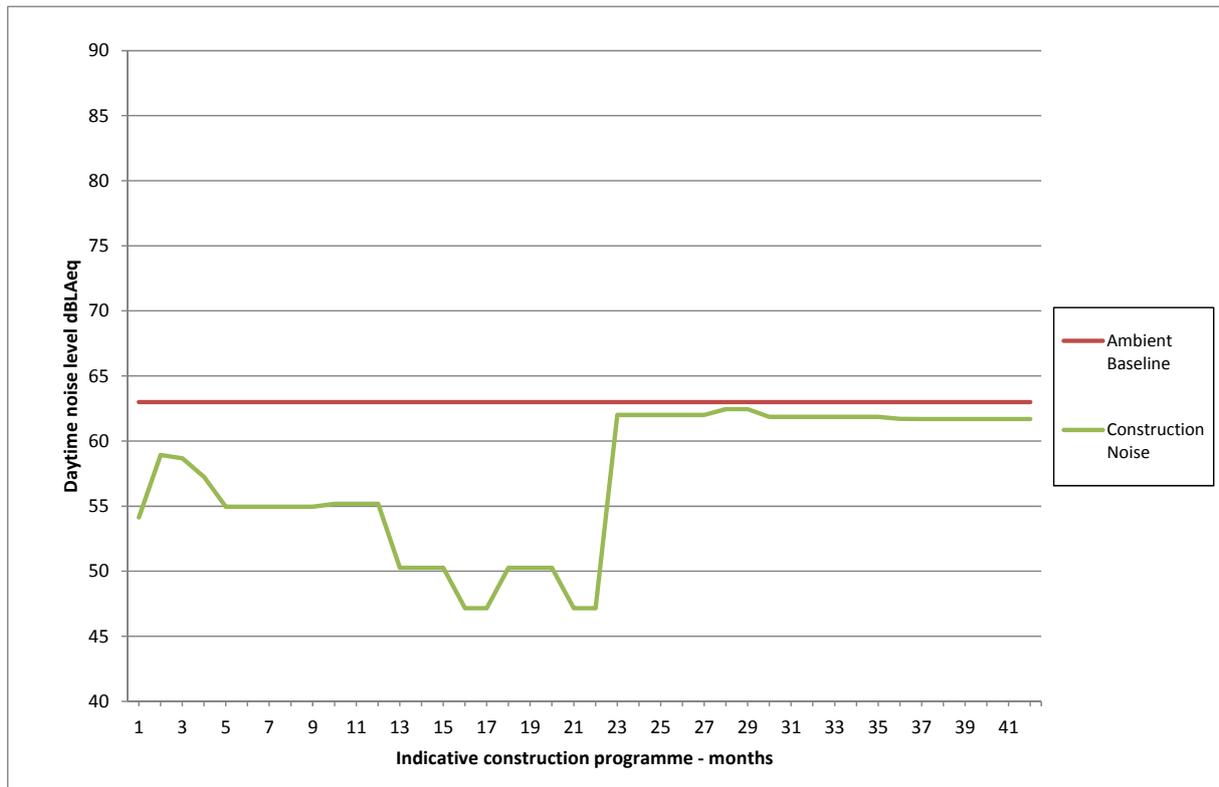
Vol 23 Plate G.10 Noise – Average monthly daytime noise level over duration of construction – Farrer House (DC6)



Vol 23 Plate G.11 Noise – Average monthly daytime noise level over duration of construction – Resolution Way (DC7)



Vol 23 Plate G.12 Noise – Average monthly daytime noise level over duration of construction – Tidemill Academy (DC8)



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: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix H: Socio-economics

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

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Environmental Statement

Volume 23 Appendices: Deptford Church Street site assessment

Appendix H: Socio-economics

List of contents

	Page number
Appendix H : Socio-economics	1
H.1 Baseline community profile	1
H.2 Baseline economic profile	5
H.3 Baseline usage surveys	8
References	17

List of tables

	Page number
Vol 23 Table H.1 Socio-economics – age breakdown by assessment area	2
Vol 23 Table H.2 Socio-economics – ethnicity by assessment area.....	2
Vol 23 Table H.3 Socio-economics – health indicators by assessment area.....	3
Vol 23 Table H.4 Socio-economics – lifestyle and income deprivation levels by assessment area.....	4
Vol 23 Table H.5 Socio-economics - employment by top nine sectors (2012).....	6
Vol 23 Table H.6 Socio-economics – businesses by size band (employees at site)..	7
Vol 23 Table H.7 Socio-economics – survey zones and duration of survey period	8
Vol 23 Table H.8 Socio-economics – usage levels by type at survey zones 1, 2 and 5	9
Vol 23 Table H.9 Socio-economics – demographic characteristics at survey zones 1, 2 and 5	11
Vol 23 Table H.10 Socio-economics – usage level by type at survey zone 3.....	12
Vol 23 Table H.11 Socio-economics – demographic characteristics at survey zone 3	13
Vol 23 Table H.12 Socio-economics – usage level and demographic characteristics at survey zone 4.....	15

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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 2001¹ (the last census for which data are availableⁱ), Department of Communities and Local Government Deprivation Indices 2010², London Public Health Observatory 2012³, and the Network of Public Health Observatories 2011⁴ (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 Lewisham).
- H.1.3 The main protected characteristic groups concentratedⁱⁱⁱ within a 250m and 1km assessment area surrounding the proposed construction site are:
- persons belonging to Black and Minority Ethnic (BME) groups
 - persons suffering from income deprivation and overall deprivation.

Resident population

- H.1.4 The resident population was approximately 2,225 within 250m of the site and approximately 27,650 within 1km at the time of the last census.

Gender and age

- H.1.5 Of the total population within 250m of the site 51.5% of residents are female, broadly in line with the proportions within 1km (51.1%) and the LB of Lewisham (51.8%) where females are also predominant.
- H.1.6 Vol 23 Table H.1 outlines age breakdown by assessment area, it illustrates that the proportion of under 16 year olds within 1km (21.0%) and at the LB of Lewisham level (21.2%) is broadly in line with the Greater London level (20.2%). Within 250m, the proportion of under 16 year olds (23.9%) is slightly higher than within the above assessment areas.
- H.1.7 The proportion of over 65 year olds within Greater London (12.4%) is approximately twice as high as within 250m (6.9%). The proportion of

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 in relation to this socio-economic impact assessment.

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

over 65 year olds within 1km (8.9%) and at a borough wide level (11.0%) is somewhat higher than within 250m.

Vol 23 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 Lewisham)	Greater London
Under 16 years old	23.9%	21.0%	21.1%	20.2%
Over 65 years old	6.9%	8.9%	11.0%	12.4%

Ethnicity

H.1.8 Vol 23 Table H.2 outlines ethnicity by assessment area, showing that within 250m of the site, White residents make up approximately half of the population (49.8%) with BME groups making up the remaining 50.2% residents. The proportion of BME residents within 250m (50.2%) is considerably higher than the Greater London average (28.8%).

H.1.9 Within 250m, the proportion of Black residents (34.4%) is slightly higher than within 1km (26.8%) and considerably higher than the Greater London average (10.9%). By contrast, the proportion of Asian residents within 250m (4.7%) and 1km (4.8%) are broadly in line and considerably lower than the Greater London average (12.1%).

Vol 23 Table H.2 Socio-economics – ethnicity by assessment area

Ethnicity	Assessment area			
	Immediate area (250m)	Wider local area (1km)	Borough wide (LB of Lewisham)	Greater London
White	49.8%	57.9%	65.9%	71.2%
BME	50.2%	42.1%	34.1%	28.8%
Asian	4.7%	4.8%	3.8%	12.1%
Black	34.4%	26.8%	23.4%	10.9%
Other	6.2%	6.4%	2.7%	2.7%
Mixed	4.9%	4.2%	4.2%	3.2%

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

Religion and belief

H.1.10 Within 250m and 1km of the site and at a borough wide level, Christians are the predominant religious group at 52.3%, 55.9% and 61.2% respectively. Muslims are the second most predominant religious group with 6.6% residents within 250m of the site and 6.8% within 1km of the

site, somewhat lower than the Greater London average of 8.5% Muslim residents.

- H.1.11 Within 250m those residents who do not follow a religion amount to 36.4%, this is somewhat higher than within 1km (32.6%) and higher still than the Greater London average (24.3%).

Health indicators

- H.1.12 Vol 23 Table H.3 outlines health indicators by assessment area, noting that within 250m of the site, the proportion of residents suffering from a long term limiting illness (14.1%) is slightly lower than that within 1km (14.4%), LB of Lewisham (15.6%) and Greater London (15.5%).
- H.1.13 Those residents who claim disability living allowance within 250m (5.2%), 1km (5.0%) and within the LB of Lewisham (5.2%) are slightly higher than at the Greater London level (4.5%).

Vol 23 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 Lewisham)	Greater London
Long term limiting sick	14.1%	14.4%	15.6%	15.5%
Disability living allowance	5.2%	5.0%	5.2%	4.5%

- H.1.14 In the Middle Layer Super Output Area (MSOA)^{iv5} which the construction site falls within, levels of adult obesity measured fall within the highest quintile (ie, the highest being the worst) and child obesity within the second highest quintile relative to Greater London as a whole.
- H.1.15 Data available at a borough level only indicates that adults undertaking physical activity fall within the middle quintile of all the London boroughs and children undertaking physical activity fall within the lowest (ie, lowest being the worst) of all London boroughs.
- H.1.16 Mortality rates caused by circulatory disease, strokes, respiratory disease, heart disease and cancer within the MSOA are all in the second highest (ie, the highest being the worst) quintile relative to other MSOAs across Greater London.
- H.1.17 Female life expectancy in the MSOA is in the second lowest quintile and male life expectancy falls within the lowest quintile (ie, the lowest being the worst) relative to Greater London. Average female life expectancy is 80.3 to 81.9 years and male life expectancy is 74.6 to 80.3 years old.

^{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.

Lifestyle and deprivation indicators

H.1.18 Vol 23 Table H.4 outlines lifestyle and income deprivation indicators by assessment area, showing that a reasonably high proportion of households within 250m of the site do not own cars (60.7%), slightly higher than within 1km (52.4%) and considerably higher than the Greater London average (37.5%).

Vol 23 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 Lewisham)	Greater London
No car households	60.7%	52.4%	42.8%	37.5%
Income	79.0%	52.9%	36.3%	30.8%
Overall	79.0%	49.3%	32.7%	24.5%

H.1.19 The incidence of deprivation^v, measured by income, is considerably higher within 250m (79.0%) than the Greater London proportion (30.8%). Overall deprivation within 250m (79.0%) is higher still relative to the Greater London level (24.5%) where one in four households is classed as suffering overall deprivation. Within 1km, levels of income deprivation (52.9%) and overall deprivation (49.3%) are moderately lower than within 250m, however they remain somewhat higher than the LB of Lewisham and Greater London averages.

^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 Deptford Church Street.
- H.2.2 Data is 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 is also provided at the overall borough level (which in this case is the London Borough [LB] of Lewisham) and for Greater London.
- H.2.3 Data is 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 250m of the site there are approximately 3000 jobs^{vii}. Vol 23 Table H.5^{viii} illustrates the breakdown of employment by sector, based on the UK Standard Industrial Classification (SIC) 2007⁷. It shows data for those sectors which account for more than 5% of total employment within approximately 250m. It can be seen that:
- Wholesale and Retail Trade accounts for 19% of employment within 250m, somewhat more than within both the LB of Lewisham and Greater London (both 16%).
 - Administrative and Support Service Activities account for 13% of employment within 250m, considerably more than within both the LB of Lewisham (7%) and Greater London (8%).
 - Other Service Activities account for 8% of employment within 250m, somewhat more than within the LB of Lewisham (5%) and double that within Greater London (4%).
 - Education accounts for 8% of employment within 250m, considerably less than within the LB of Lewisham (13%) but slightly more than within Greater London (7%).
 - Human Health and Social Work Activities account for 7% of employment within 250m, somewhat less than within the LB of Lewisham (11%) and slightly less than within Greater London (8%).
 - Transportation and Storage accounts for 7% of employment within 250m, somewhat more than within the both LB of Lewisham and Greater London (both 4%).

^{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. Manufacturing accounts for 6% of employment within 250m, double the proportion within both the LB of Lewisham and Greater London (both 3%).
- h. Construction accounts for 5% to 6% of employment within 250m at all three geographical levels.
- i. Professional, Scientific and Technical Activities account for 5% of employment within 250m, slightly less than within the LB of Lewisham (6%) but less than half that within Greater London (11%).

Vol 23 Table H.5 Socio-economics - employment by top nine sectors (2012)

Sector (Standard Industrial Code 2007)	Assessment area		
	Immediate area (250m)	Borough wide (LB of Lewisham)	Greater London
Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	19%	16%	16%
Administrative and Support Service Activities	13%	7%	8%
Other Service Activities	8%	5%	4%
Education	8%	13%	7%
Human Health and Social Work Activities	7%	11%	8%
Transportation and Storage	7%	4%	4%
Manufacturing	6%	3%	3%
Construction	5%	6%	5%
Professional, Scientific and Technical Activities	5%	6%	11%
Other (Including Unclassified)	22%	29%	34%

H.2.5 Within 250m of the site there are approximately 400 businesses (defined here as business locations^{ix}). The split of businesses by sector within approximately 250m broadly reflects the breakdown of employment by sector as set out in Vol 23 Table H.5, with a relatively high number of businesses engaged in Wholesale and Retail Trade (18%), Other Service Activities (10%), Professional, Scientific and Technical Activities (7%) and Administrative and Support Service Activities (6%).

H.2.6 Vol 23 Table H.6 illustrates the size of businesses in terms of the number of employees on site. At all geographical levels the businesses within the

^{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.

smallest size band (1 to 9 employees) account for the greatest proportion. Within approximately 250m of the site 89% of business units employ 1 to 9 employees, compared to 92% within the LB of Lewisham and 88% within Greater London. 11% of firms within approximately 250m employ more than 10 employees, slightly more than within the LB of Lewisham (8%) but slightly less than within Greater London (12%).

H.2.7 For the sectors accounting for the greatest proportion of jobs and businesses within approximately 250m the size banding of businesses varies. Within the Wholesale and Retail Trade and Other Services sectors 96% and 91% of firms respectively employ 1 to 9 employees, compared to an average across all sectors of 89%. In contrast only 77% of firms within the Administrative and Support Service Activities sector employ 1 to 9 employees, whereas 12% of businesses employ 10 to 24 employees. This sector also has a higher proportion of larger businesses within 250m, with 12% of firms employing 25 or more employees compared to 4% across all sectors.

Vol 23 Table H.6 Socio-economics – businesses by size band (employees at site)

Assessment area / sector	Size band (employees at site)					
	1-9	10-24	25-49	50-99	100-249	250+
Immediate area (250m)	89%	7%	2%	1%	1%	0%
<i>Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles</i>	96%	1%	1%	0%	0%	1%
<i>Other Service Activities</i>	91%	2%	5%	2%	0%	0%
<i>Administrative and Support Service Activities</i>	77%	12%	4%	0%	8%	0%
Borough wide (LB of Lewisham)	92%	5%	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 as follows.

Summer

- j. Wednesday 3rd August 2011, 12pm to 3pm (sunny, 26°C)
- k. Sunday 21st August 2011, 1pm to 4pm (sunny, 23°C to 25°C)
- l. Wednesday 7th September 2011, 7am to 10am (cloudy, 15°C), 12pm to 3pm (cloudy, 17°C), and 4pm to 7pm (cloudy, 15 to 17°C)
- m. Thursday 15th September 2011, 4pm to 6pm^x (partly sunny, 18°C)
- n. Sunday 22nd July 2012, 2pm to 5pm (sunny, 24°C)
- o. Tuesday 24th July 2012, 2.30pm to 5.30pm (sunny, 30°C)

Autumn

- a. Sunday 9th October 2011, 1pm to 4pm (sunny, 17°C)
- b. Friday 14th October 2011, 8am to 10am (sunny, 12°C to 14°C) and 1pm to 4pm (sunny, 15°C)

Survey zones

H.3.3 Vol 23 Figure H.1 (see separate volume of figures) shows the location of the survey areas listed in Vol 23 Table H.7 below.

Vol 23 Table H.7 Socio-economics – survey zones and duration of survey period

Name	Location	On-site survey times	Frequency
Survey zone 1	Crossfield Street Open Space: west	15 minutes (concurrent with zones 2 and 5)	Hourly
Survey zone 2	Crossfield Street Open Space: east	15 minutes (concurrent with zones 1 and 5)	Hourly
Survey zone 3	Sue Godfrey Local Nature Reserve and Ferranti Park	15 minutes	Hourly
Survey zone 4	St Paul's Churchyard	15 minutes	Hourly
Survey zone 5	Lawn east of St Paul's Churchyard	15 minutes (concurrent with zones 1 and 5)	Hourly

^x A supplementary survey was undertaken in lieu of poor weather conditions after 4pm on Wednesday 7th September

Site specific considerations

- H.3.4 Survey zones 1, 2 and 5 were surveyed at the same time owing to their layout, similar functionality, and proximity to each other.
- H.3.5 St. Paul’s Churchyard was closed to the public from 2.30pm onwards on Sunday 9th October 2011.

Key findings and observations

Survey zones 1, 2 and 5 – Crossfield Street Open Space and lawn east of St Paul’s Churchyard

- H.3.6 These zones were lightly used during the survey, with no users recorded during the majority of survey periods. No more than five users were recorded in the three spaces in total during any one 15 minute survey period.
- H.3.7 People generally used the spaces for between five and 30 minutes.
- H.3.8 Dog walking was the dominant activity observed in Zones 2 and 5. People were observed sitting and walking through Zone 1 but it was only used on four occasions during survey periods. Zone 1 was also littered on every survey visit, with several items of fly-tipped rubbish and rubbish bags containing autumn leaves remaining there throughout the weeks during which the surveys were conducted.
- H.3.9 During the survey programme as a whole, approximately 75% of users were recorded to be White, with Black users accounting for around 20%. The majority of users (approximately 65%) were young adults (aged 18 to 39 years old).
- H.3.10 See Vol 23 Table H.8 and Vol 23 Table H.9 for more details on use of these zones.

Vol 23 Table H.8 Socio-economics – usage levels by type at survey zones 1, 2 and 5

Date	Time of survey	Survey point	Number of Users					
			Walkers	Joggers	Dog walkers	Cyclists	Passive recreation	Active (informal) recreation
Summer								
Wednesday 3 rd August 2011	12:05 - 12:20	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	
	13:05 - 13:20	1 and 2	2	-	2	-	-	-
		5	-	-	-	-	-	
14:05 - 14:20	1 and 2	-	-	-	-	5	-	
	5	-	-	-	-	-	-	
Sunday 21 st August 2011	12:30 - 12:45	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	
	13:30 - 13:45	1 and 2	-	-	2	-	-	-
		5	-	-	-	-	-	-
	14:30 - 12:45	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	-

Environmental Statement

Date	Time of survey	Survey point	Number of Users					
			Walkers	Joggers	Dog walkers	Cyclists	Passive recreation	Active (informal) recreation
Wed 7 th September AM	07:05 - 07:20	1 and 2	-	-	1	-	-	-
		5	-	-	-	-	-	-
	08:05 - 08:20	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	-
	09:05 - 09:20	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	-
Wed 7 th September PM	12:00 - 12:15	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	-
	13:00 - 13:15	1 and 2	1	-	-	-	-	-
		5	-	-	-	-	-	-
	14:00 - 14:15	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	-
	16:00 - 16:15	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	-
	17:00 - 17:15	1 and 2	1	-	1	-	-	2
		5	-	-	-	-	-	-
	18:00 - 18:15	1 and 2	-	-	1	-	-	-
		5	-	-	-	-	-	-
	18:35 - 18:50	1 and 2	-	-	-	-	-	-
		5	-	-	1	-	-	-
Thursday 15 th September	16:00 - 16:15	1 and 2	-	-	-	1	-	-
		5	-	-	1	-	-	-
	17:00 - 17:15	1 and 2	-	-	2	-	-	-
		5	-	-	-	-	2	-
	18:00 - 18:15	1 and 2	-	-	1	-	-	-
		5	-	-	-	-	1	-
Sunday 22 nd Jul 2012	14:00 - 14:15	1 and 2	-	-	1	-	-	1
		5	-	-	-	-	-	-
	15:00 - 15:15	1 and 2	1	-	-	-	-	1
		5	-	-	-	-	-	-
	16:00 - 16:15	1 and 2	-	-	-	-	1	-
		5	-	-	-	-	-	-
Tuesday 24 th July 2012	14:30 - 14:45	1 and 2	-	-	-	-	-	-
		5	-	-	1	-	-	-
	15:30 - 15:45	1 and 2	1	-	-	-	-	-
		5	-	-	1	-	-	-
	16:30 - 16:45	1 and 2	-	-	1	-	-	3
		5	-	-	-	-	-	-
Autumn								
Sunday 9 th October	13:30 - 13:45	1 and 2	-	-	2	-	-	-
		5	-	-	-	-	-	-
	14:30 - 14:45	1 and 2	-	-	3	-	-	-
		5	-	-	-	-	2	-

Date	Time of survey	Survey point	Number of Users					
			Walkers	Joggers	Dog walkers	Cyclists	Passive recreation	Active (informal) recreation
	15:30 - 15:45	1 and 2	-	-	-	-	-	-
		5	-	-	1	-	-	-
Friday 14 th October	08:00 - 08:15	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	-	-
	09:00 - 09:15	1 and 2	-	-	-	-	1	-
		5	-	-	1	-	-	-
	13:30 - 13:45	1 and 2	-	-	-	-	-	-
		5	-	-	-	-	1	-
	14:30 - 14:45	1 and 2	-	-	1	-	-	-
		5	-	-	1	-	-	-
	15:30 - 15:45	1 and 2	-	-	-	-	2	-
		5	-	-	-	-	-	-

Vol 23 Table H.9 Socio-economics – demographic characteristics at survey zones 1, 2 and 5

Date	Time of survey	Age (number of users)			Gender (%)		Ethnicity (%)			
		0-17	18-39	40+	M	F	Black	E. Asian	S. Asian	White
Summer										
Wednesday 3 rd August (school holidays) 2011	12:05 - 12:20	-	2	-	-	100	-	-	-	100
	13:05 - 13:20	-	2	-	100	-	100	-	-	-
	14:05 - 14:20	3	2	-	40	60	100	-	-	-
Sunday 21 st August 2011	12:30 - 12:45	-	-	-	-	-	-	-	-	-
	13:30 - 13:45	-	2	-	100	-	-	-	-	100
	14:30 - 12:45	-	-	-	-	-	-	-	-	-
Wednesday 7 th September AM 2011	07:05 - 07:20	-	-	1	100	-	-	-	-	100
	08:05 - 08:20	-	-	-	-	-	-	-	-	-
	09:05 - 09:20	-	1	-	100	-	-	-	-	100
Wednesday 7 th September PM 2011	12:00 - 12:15	-	1	-	100	-	-	-	-	100
	13:00 - 13:15	-	2	-	100	-	50	-	-	50
	14:00 - 14:15	-	-	-	-	-	-	-	-	-
	16:00 - 16:15	-	-	-	-	-	-	-	-	-
	17:00 - 17:15	-	2	-	100	-	-	-	-	100
	18:00 - 18:15	-	1	-	100	-	-	-	-	100
Thursday 15 th September 2011	16:00 - 16:15	-	-	2	50	50	-	-	-	100
	17:00 - 17:15	1	2	2	100	-	20	-	-	80
	18:00 - 18:15	-	1	1	100	-	-	-	-	100
Sunday 22 nd July 2012	14:00 - 14:15	-	1	1	100	-	-	-	-	100
	15:00 - 15:15	-	2	-	100	-	-	-	-	100
	16:00 - 16:15	-	1	-	100	-	-	-	-	100

Date	Time of survey	Age (number of users)			Gender (%)		Ethnicity (%)			
		0-17	18-39	40+	M	F	Black	E. Asian	S. Asian	White
Tuesday 24 th July 2012	14:30 - 14:45	-	1	-	100	-	-	-	-	100
	15:30 - 15:45	-	2	-	50	50	-	-	-	100
	16:30 - 16:45	-	4	-	100	-	-	-	-	100
Autumn										
Sunday 9 th October 2011	13:30 - 13:45	-	2	-	50	50	-	-	-	100
	14:30 - 14:45	1	4	-	40	60	-	-	-	100
	15:30 - 15:45	-	1	-	100	-	-	-	-	100
Friday 14 th October AM 2011	08:00 - 08:15	-	-	1	100	-	-	-	-	100
	09:00 - 09:15	-	1	-	100	-	100	-	-	-
Friday 14 th October PM 2011	13:30 - 13:45	-	1	-	-	100	-	-	-	100
	14:30 - 14:45	-	-	2	50	50	-	-	-	100
	15:30 - 15:45	-	2	-	100	-	-	-	50	50

Survey zone 3 – Sue Godfrey Local Nature Reserve and Ferranti Park

- H.3.11 Sue Godfrey Local Nature Reserve is lightly used, predominantly as a thoroughfare by walkers and dog walkers (accounting for over 95% of total users), with the seating area observed to be used only on two occasions.
- H.3.12 Ferranti Park, located approximately 150m east of the proposed construction site, was more heavily used than the nature reserve although usage was also low or moderate at best.
- H.3.13 As a whole, users of this zone were of a diverse ethnic origin (White, Black, East and South Asians recorded on each survey day). Young adults made up the majority of users (60% of total recorded), with children (aged 0 to 17) using Ferranti Park for play and passive recreation accounting for approximately a quarter of recorded users.
- H.3.14 See Vol 23 Table H.10 and Vol 23 Table H.11 for more details on use of these zones.

Vol 23 Table H.10 Socio-economics – usage level by type at survey zone 3

Date	Time of survey	Number of users						
		Walkers	Joggers	Dog walkers	Cyclists	Child's play	Passive recreation	Active (informal) recreation
Summer								
Wednesday 3 rd August 2011	12:45 – 13:00	4	-	-	-	3	8	-
	13:45 - 14:00	4	-	-	-	3	8	-
	14:45 – 15:00	6	-	-	-	4	9	-
Sunday 21 st August 2011	13:10 - 13:25	6	-	-	1	-	-	-
	14:10 - 14:25	6	-	1	3	4	-	-
	15:10 - 15:25	9	-	-	1	-	-	-
Wednesday 7 th	07:45 - 08:00	6	-	-	-	-	-	-
	08:45 - 09:00	8	-	1	-	-	-	-

Environmental Statement

Date	Time of survey	Number of users						
		Walkers	Joggers	Dog walkers	Cyclists	Child's play	Passive recreation	Active (informal) recreation
September AM 2011	09:45 - 10:00	3	-	1	-	-	-	-
Wednesday 7th September PM 2011	12:40 - 12:55	8	-	1	1	-	-	1
	13:40 - 13:55	3	-	-	-	-	-	-
	14:40 - 14:55	5	-	-	-	-	-	-
	15:40 - 15:55	11	-	-	-	5	-	-
	16:40 - 16:55	-	-	-	-	6	-	-
	17:40 - 17:55	6	-	2	-	3	-	-
Thursday 15 th September 2011	16:40 - 16:55		-	2		10		
	17:40 - 17:55	2	-	2	4	-	1	-
Sunday 22 nd July 2012	14:20 - 14:35	2	-	1	-	4	4	-
	15:20 - 15:35	10	-	-	1	12	-	-
	16:20 - 16:35	4	-	1	-	11	6	-
Tuesday 24 th July 2012	14:50 - 15:05	11	-	-	-	1	8	-
	15:50 - 16:05	10	-	2	-	6	11	-
	16:50 - 17:05	10	-	1	-	6	8	-
Autumn								
Sunday 9 th October 2011	14:10 - 14:25	12	-	-	1	3	2	-
	15:10 - 15:25	12	-	1	-	2	1	
	16:10 - 16:25	15	-	2	-	15	1	-
Friday 14 th October AM 2011	08:20 - 08:35	26	-	1	-	-	-	-
	09:20 - 09:35	13	-	2	-	2	-	-
Friday 14 th October PM 2011	14:15 - 14:30	1	-	2	1	2	6	-
	15:15 - 15:30	8	1	1	-	-	-	-
	16:10 - 16:25	8	-	2	-	-	-	-

Vol 23 Table H.11 Socio-economics – demographic characteristics at survey zone 3

Date	Time of survey	Approximate age (number of users)			Gender (approximate %)		Ethnicity (approximate %)			
		0-17	18-39	40+	M	F	Black	E. Asian	S. Asian	White
Summer										
Wednesday 3 rd August 2011	12:45 - 13:00	6	9	-	33	67	33	-	-	77
	13:45 - 14:00	6	9	-	87	13	40	-	-	60
	14:45 - 15:00	8	11	-	63	37	42	-	-	58
Sunday 21 st August 2011	13:10 - 13:25	-	5	2	50	50	33	-	-	67
	14:10 - 14:25	5	9	-	71	29	7	-	-	93
	15:10 - 15:25	-	5	5	80	20	-	-	-	100
Wednesday 7th	07:45 - 08:00	-	2	4	33	67	50	-	-	50
	08:45 - 09:00	1	5	3	44	56	-	11	-	89

Date	Time of survey	Approximate age (number of users)			Gender (approximate %)		Ethnicity (approximate %)			
		0-17	18-39	40+	M	F	Black	E. Asian	S. Asian	White
September AM 2011	09:45 - 10:00	-	3	1	50	50	-	-	-	100
Wednesday 7th September PM 2011	12:40 - 12:55	-	11	-	82	18	18	-	-	82
	13:40 - 13:55	-	3	-	67	33	-	-	-	100
	14:40 - 14:55	-	5	-	100	-	-	-	-	100
	15:40 - 15:55	6	8	2	31	69	44	-	-	56
	16:40 - 16:55	3	3	-	83	17	50	-	-	50
	17:40 - 17:55	2	5	4	100	-	18	-	-	82
Thursday 15 th September 2011	16:40 - 16:55	5	3	4	42	58	-	-	25	75
	17:40 - 17:55	-	2	7	89	11	44	-	-	56
Sunday 22 nd July 2012	14:20 - 14:35	4	6	1	46	64	64	9	-	27
	15:20 - 15:35	10	11	2	48	52	0	-	-	100
	16:20 - 16:35	10	9	3	50	50	50	-	5	45
Tuesday 24 th July 2012	14:50 - 15:05	1	19	-	70	30	10	-	15	75
	15:50 - 16:05	9	20	-	52	48	28	-	-	72
	16:50 - 17:05	11	14	-	44	56	44	-	-	56
Autumn										
Sunday 9 th October 2011	14:10 - 14:25	2	16	-	39	61	17	22	11	50
	15:10 - 15:25	4	12	-	31	69	19	38	5	38
	16:10 - 16:25	17	14	2	33	67	24	30	9	36
Friday 14 th October AM 2011	08:20 - 08:35	9	16	2	52	48	15	12	7	69
	09:20 - 09:35	1	13	3	53	47	12	-	-	88
Friday 14 th October PM 2011	14:15 - 14:30	1	6	5	50	50	-	-	42	58
	15:15 - 15:30	2	7	1	20	80	50	-	-	50
	16:10 - 16:25	3	7	-	60	40	40	-	20	40

Survey zone 4 – St Paul’s Churchyard

- H.3.15 The churchyard was observed to be mostly used as a pedestrian thoroughfare (over 85% of users) between Deptford Church Street and Deptford High Street and for passive recreation. Heaviest periods of usage were early morning and late afternoon by pedestrians, peaking at 18 users walking through in one 15 minute observation.
- H.3.16 Users were mostly White (around 60% of those recorded) and young adults made up approximately 70% of the total number recorded during the surveys.
- H.3.17 See Vol 23 Table H.12 for further details on users recorded at St Paul’s Churchyard.

Vol 23 Table H.12 Socio-economics – usage level and demographic characteristics at survey zone 4

Date	Time of survey	Approximate age (number of users)			Gender (%)		Ethnicity (%)			
		0-17	18-39	40+	M	F	Black	E. Asian	S. Asian	White
Summer										
Wednesday 3 rd August (school holidays) 2011	12:25 - 12:40	-	11	-	82	18	-	-	-	100
	13:25 - 13:40	-	9	2	55	45	9	-	-	100
	14:25 - 14:40	-	8	-	75	25	25	-	-	75
Sunday 21 st August 2011	12:50 - 13:05	2	6	5	93	7	46	-	-	54
	13:50 - 14:05	-	4	-	50	50	25	-	-	75
	14:50 - 15:05	-	5	6	64	36	18	-	-	82
Wednesday 7 th September AM 2011	07:25 - 07:40	-	2	-	100	-	-	-	-	100
	08:25 - 08:40	-	9	3	58	42	8	-	-	92
	09:25 - 09:40	-	2	3	60	40	60	-	-	40
Wednesday 7 th September PM 2011	12:20 - 12:35	2	7	-	25	75	78	-	-	22
	13:20 - 13:35	2	7	-	45	55	22	22	-	56
	14:20 - 14:35	-	10	-	70	30	40	-	-	60
	15:20 - 15:35	-	1	3	75	25	-	-	-	100
	16:20 - 16:35	-	2	2	100	-	50	-	-	50
	17:20 - 17:35	-	3	-	100	-	33	33	-	33
Thursday 15 th Sept 2011	16:20 - 16:35	-	7	7	79	21	14	-	-	86
	17:20 - 17:35	-	2	5	33	66	29	-	-	71
Sunday 22 nd July 2012	14:40 - 14:55	-	1	4	60	40	-	-	-	100
	15:40 - 15:55	-	4	6	60	40	30	-	-	70
	16:40 - 16:55	-	9	1	90	10	-	-	-	100
Tuesday 24 th July 2012	14:00 - 14:15	-	15	2	47	53	-	-	18	82
	15:00 - 15:15	-	4	1	60	40	20	-	-	80
	16:00 - 16:15	-	9	-	78	22	34	-	22	44
Autumn										
Sunday 9 th October 2011	14:10 - 14:25	3	4	-	57	43	71	-	-	29
	15:10 - 15:25	The survey zone was closed and was therefore not used								
	16:10 - 16:25									
Friday 14 th October AM 2011	08:45 - 08:55	3	15	-	44	56	7	7	7	75
	09:40 - 09:55	2	4	-	50	50	-	-	-	100
Friday 14 th October PM 2011	14:15 - 14:30	1	2	1	25	75	-	-	50	50
	15:15 - 15:30	2	7	-	22	78	44	-	-	56
	16:10 - 16:25	3	2	-	20	80	20	-	40	40

Other findings

- H.3.18 The publicly accessible playground at Mary Ann Buildings, to the north of St Paul's Churchyard, was informally surveyed during most of the survey visits and was rarely seen to be used.

References

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Thames Tideway Tunnel
Thames Water Utilities Limited



Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix I: Townscape and visual

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

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Thames Tideway Tunnel
Environmental Statement
Volume 23 Deptford Church Street appendices
Appendix I: Townscape and visual

List of contents

	Page number
Appendix I : Townscape and visual	1
I.1 Introduction	1

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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



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Appendix J: Transport

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Thames Tideway Tunnel
Environmental Statement
Volume 23 Deptford Church Street appendices
Appendix J: Transport

List of contents

	Page number
Appendix J : Transport	1
J.1 Introduction	1

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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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Thames Tideway Tunnel
Thames Water Utilities Limited



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Appendix K: Water resources - groundwater

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Thames Tideway Tunnel

Environmental Statement

Volume 23 Appendices: Deptford Church Street site assessment

Appendix K: Water resources – groundwater

List of contents

	Page number
Appendix K : Water resources – groundwater	1
K.1 Geology	1
K.2 Hydrogeology	3
K.3 Groundwater level monitoring	5
K.4 Groundwater abstractions and protected rights	7
K.5 Groundwater source protection zones	9
K.6 Environmental designations	9
K.7 Groundwater quality and land quality assessment.....	9
K.8 Groundwater status	17
K.9 Data sources.....	18

List plates

	Page number
Vol 23 Plate K.1 Groundwater – confined chalk licensing	8

List of tables

	Page number
Vol 23 Table K.1 Groundwater - anticipated geological succession	1
Vol 23 Table K.2 Groundwater- anticipated ground conditions.....	1
Vol 23 Table K.3 Groundwater - anticipated hydrogeological units	3
Vol 23 Table K.4 Groundwater – monitoring boreholes	5
Vol 23 Table K.5 Groundwater – summary level data	5
Vol 23 Table K.6 Groundwater - licensed abstractions.....	9
Vol 23 Table K.7 Groundwater- groundwater quality results	11

Vol 23 Table K.8 Groundwater - desk based baseline data sources 18

Appendix K: Water resources – groundwater

K.1 Geology

K.1.1 A summary of the anticipated geological succession at the Deptford Church Street site is shown in Vol 23 Table K.1.

Vol 23 Table K.1 Groundwater - anticipated geological succession

Period	Series	Group	Formation
Quaternary	Holocene	Superficial deposits	Made ground
	Pleistocene		River Terrace Deposits
	Palaeocene	Lambeth	Lower Shelly Beds
			Lower Mottled Beds
			Upnor
	No group	Thanet Sand	
Cretaceous	Upper Cretaceous	White Chalk Subgroup	Seaford Chalk**

* Not a Formation but an important depositional feature

** Subdivided into the Haven Brow, Cuckmere and Belle Tout members.

K.1.2 The superficial and solid geology in the vicinity of the site, as published by the British Geological Survey – BGS (BGS, 2009)¹, is shown in Vol 23 Figure 13.4.1 and Vol 23 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.

K.1.4 The depths and thicknesses of the geological layers have been based on the nearest Phase 1 boreholes located within 410m from the Deptford Church Street site: these are boreholes SR1019, SR1018D and SR1020. The locations of these boreholes around the site are shown in Vol 23 Figure 13.4.1 (see separate volume of figures). The depths and thicknesses of geological layers encountered are summarised in Vol 23 Table K.2.

Vol 23 Table K.2 Groundwater- anticipated ground conditions

Formation	Top elevation* (mATD)**	Depth below river bed (m)	Thickness (m)
Made Ground	105.75	0.00	2.90
River Terrace	102.85	2.90	5.50

Formation	Top elevation* (mATD)**	Depth below river bed (m)	Thickness (m)
Deposits			
Lambeth Group***	97.35	8.40	4.50
Thanet Sand	92.85	12.90	16.00
Seaford Chalk	76.85	28.90	Not proven

* Based on an assumed ground level of 105.75mATD.

** mATD = metres above tunnel datum.

*** The Lambeth Group was not present in ground investigation boreholes drilled on site

- K.1.5 The combined sewer overflow (CSO) drop shaft at Deptford Church Street would extend down to approximately 57.81mATD and would pass through the Made Ground, River Terrace Deposits, Lambeth Group, Thanet Sands and into the Seaford Chalk. The base slab would extend to approximately 54.81mATD and be founded in the Seaford Chalk.
- K.1.6 The Made Ground, containing sandy gravelly silt with occasional brick and concrete fragments, is expected to be 2.9m thick at the Deptford Church Street site. The on site borehole SA4031 gave a Made Ground thickness of 1.6m and SR4117 gave a thickness of 2m.
- K.1.7 The River Terrace Deposits are formed by 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 Deptford Church Street site. The on site borehole SA4031 gave a River Terrace Deposit thickness of 12.1m and SR4117 gave a thickness of 13.2m.
- K.1.8 The ground investigation boreholes close to the site show that the Lambeth Group thickness varying considerably over short distances. The River Terrace Deposits rest unconformablyⁱ on the Lower Shelly Beds at SR1020 and on the Lower Mottled Beds at SR1018D and SR1019. The Lambeth Group may be, therefore, between 4.5m thick or absent at the site.
- K.1.9 Two boreholes, SA4031 and SR4117 were drilled at the Deptford Church Street site. Both these boreholes did not encounter the Lambeth Group. Instead the River Terrace Deposits were found to overlie the Thanet Sand directly.
- K.1.10 The Lower Shelly Beds (LSB) of the Lambeth Group comprises dark grey to black clay with abundant shells.
- K.1.11 The Lower Mottled Beds (LMB) of the Lambeth Group comprises silty clay and clay, generally un-bedded, fissured and blocky, with up to 50% silt and sand.

ⁱ Unconformably – lying on a surface between successive strata which represents a missing interval in the geologic record of time, and produced either by an interruption in deposition or by the erosion of depositionally continuous strata followed by renewed deposition.

- K.1.12 The Upnor Formation (UPN) is a variably bioturbated fine- to medium-grained sand with glauconite, rounded flint pebbles and minor clay, with distinctive pebble beds at the base and top.
- K.1.13 The Thanet Sand Formation is described by the BGS as “marine glauconitic clayey silts and fine sands, varying in thickness” (BGS, 2012) and only occurs in the London Basin (British Geological Survey, 2000)². The Thanet Sand is expected to be 16.0m thick at the Deptford Church Street site. The on site borehole SA4031 gave a Thanet Sand thickness of 14.7m and SR4117 gave a thickness of 12.6m.
- K.1.14 The base of the Thanet Sands is a unit known as the 'Bullhead Bed', consisting of very clayey sand, sandy clay or slightly sandy, clayey gravel and expected to be 0.22m thick at the Deptford Church Street site. The on site borehole SA4031 gave a Bulhead Bed thickness of 0.3m and SR4117 gave a thickness of 0.1m.
- K.1.15 The Seaford Chalk is the upper unit of the White Chalk, comprising firm to soft non-nodular Chalk with flint beds. Thin marl seams are found in the lower 8m and absent higher up. A hard ground marks the top of the Seaford Chalk. The total thickness of the Seaford Chalk was not proven through the available ground investigation.
- K.1.16 In terms of geological structure, it is noted that there is a series of N-S and SSW-NNE trending faults are identified between Battersea and Chelsea bridges – referred to as the Chelsea Embankment (Albert Bridge) Fault Zone - intersecting the tunnel alignment at near to the perpendicular (Royse, 2008)³. It is reported that there is up to 5m vertical displacement of strata over this zone (Royse, 2008), resulting in uplift of the top of the Lambeth Group deposits into the proposed tunnel invert on the east side of Albert Bridge and tunnel construction at Chelsea Embankment. The Deptford Church Street is to the east of this fault zone, however, there may be minor faulting and fractures local to the site, together with localised displacement. Faults may also enhance or impede groundwater movement.

K.2 Hydrogeology

- K.2.1 A summary of the anticipated hydrogeological conditions at the Deptford Church Street site is shown in Vol 23 Table K.3.

Vol 23 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
Lambeth	Lower Shelly Beds Lower Mottled Beds	Aquitards*/aquifers

Group	Formation		Hydrogeology
	Upnor		Lower aquifer
No group	Thanet Sand		
White Chalk Subgroup	White Chalk	Undivided mainly Seaford Chalk	

* *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, 2012)⁴.*

- K.2.2 The Alluvium overlies the River Terrace Deposits or upper aquifer and is likely to be in hydraulic continuity with the upper aquifer.
- 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).
- K.2.4 The lower aquifer comprises the Upnor and the Thanet Sand formations (both classified as secondary aquifers by the EA), and the Seaford Chalk (classified as a principal aquifer by the EA). A principal aquifer is described by the EA as “layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer” (EA website, 2012).
- K.2.5 Hydraulic continuity between the upper and lower aquifers is likely at the Deptford Church Street site.
- K.2.6 The hydrogeological properties of the Chalk (principal aquifer) are defined by its transmissivity [the ability of rock to transmit water and is a function of its permeability and aquifer thickness] and storativity [the amount of water which the aquifer releases per unit change in water level]. The Chalk in the area around Deptford Church Street is expected to have a very high transmissivity value of between 1200m²/d and 3000m²/d (average of 2000m²/d). The storativity value is expected to be approximately 1 x10⁻⁴ (EA and ESI, 2010)⁵.
- K.2.7 The type of White Chalk present in the face of tunnel excavation is Seaford Chalk, and either Cuckmere Member and Belle Tout Member (TT, 2010). The Seaford Chalk forms a highly transmissive aquifer, with rapid preferential flow commonly established along fissures and enhanced fractures, often along or above flint and marl layers within the Chalk. Transmissivity and groundwater storage therefore vary considerably both laterally and vertically.

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 observation monitoring boreholes, mainly within the lower aquifer, across London which records are available dating back over 50 years.
- K.3.2 As there were no monitoring boreholes specifically dedicated to the Deptford Church Street site, information on groundwater levels for this assessment was collected from four off site ground investigation boreholes located within 440m from the site (PR1023, SR1018D, SR1019 and SR1020) as shown in Vol 23 Figure 13.4.3. These boreholes have response zonesⁱⁱ and monitor groundwater levels in the River Terrace Deposits, Thanet Sands and Seaford Chalk. The response zone depths, the monitored strata and the frequency of monitoring are detailed in Vol 23 Table K.4. The manual dip and logger data collected from these monitoring boreholes is shown in Vol 23 Table K.5.

Vol 23 Table K.4 Groundwater – monitoring boreholes

Borehole	Response zone depths mATD	Strata	Monitoring
PR1023 (U*)	98.49 - 93.49	River Terrace Deposits	Fortnightly dips and logger
PR1023 (L**)	91.49 - 78.99	Thanet Sand Formation	Fortnightly dips and logger
SR1018D	86.39 - 79.39	Thanet Sand Formation	Fortnightly dips and logger
SR1019	68.62 - 61.62	Seaford Chalk	Fortnightly dips
SR1020	75.36 – 66.36	Seaford Chalk	Fortnightly dips and logger

*U – Upper aquifer and **L – Lower aquifer

Vol 23 Table K.5 Groundwater – summary level data

Borehole	Period of record	Maximum month year		Minimum month year		Average over the period of record	
		mbgl	mATD	mbgl	mATD	mbgl	mATD
PR1023(U)	19/11/2009 – 12/04/2012	6.22 (Jan. 2011)	97.77 (Jan. 2011)	7.01 (Apr. 2011)	96.98 (Apr. 2011)	6.51	97.48
PR1023(L)	01/10/2009 – 12/04/2012	6.06 (April 2010)	97.93 (April 2010)	7.00 (Apr. 2012)	96.99 (Apr. 2012)	6.45	97.54

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

Borehole	Period of record	Maximum month year		Minimum month year		Average over the period of record	
		mbgl	mATD	mbgl	mATD	mbgl	mATD
SR1018D	01/10/2009 – 12/04/2012	6.11 (Jan. 2011)	97.78 (Jan. 2011)	6.85 (Apr. 2012)	97.03 (Apr. 2012)	6.38	97.50
SR1019	02/04/2009 – 10/07/2012	7.48 (May 2009)	97.64 (May 2009)	8.29 (Mar. 2012)	96.83 (Mar. 2012)	7.85	97.27
SR1020	22/10/2009 – 12/04/2012	7.33 (Jan. 2011)	98.03 (Jan. 2011)	7.90 (April 2012)	97.46 (April 2012)	7.59	97.77
TQ37/254A	04/12/1986 – 20/09/2011	4.72 (June 1995)	98.91 (June 1995)	6.89 (August 2010)	96.74 (August 2010)	5.89	97.70

- K.3.3 The recorded water levels in the River Terrace Deposits at PR1023 range from 96.98mATD to 97.77mATD. These water levels remain below the top of the formation at 102.85mATD, indicating that the River Terrace Deposits are unconfined and not fully saturated at this location.
- K.3.4 The water levels (piezometric headⁱⁱⁱ) in the Thanet Sands are monitored at two locations. The recorded water levels at SR1018D range from 97.03mATD to 97.78mATD and at PR1023 range from 96.99mATD to 97.93mATD. The recorded water levels are very similar and remain above the top of the formation at 92.85mATD, indicating that the Thanet Sands are fully saturated at this location. The recorded water levels are also very similar to recorded water levels in the River Terrace Deposits at PR1023. This suggests that these units are in hydraulic continuity.
- K.3.5 The water levels (piezometric head) in the Seaford Chalk at SR1019 and SR1020 range from 96.83mATD to 97.64mATD. The recorded water levels remain above the top of the formation at 76.85mATD, indicating that the Seaford Chalk is fully saturated at this location. The recorded water levels are also very similar to recorded water levels in the River Terrace Deposits and Thanet Sands at PR1023. This suggests that these units are in hydraulic continuity.
- K.3.6 The nearest EA groundwater level monitoring boreholes are located approximately 0.4km east from the Deptford Church Street site, reference numbers TQ37/254A, TQ37/254BL and TQ37/254BU. These boreholes record levels in the lower aquifer (mainly Chalk) and the locations are shown on Vol 23 Figure 13.4.4 (see separate volume of figures). These three boreholes show very similar water levels; therefore the manual dip and logger data collected from TQ37/254A only is shown in Vol 23 Table K.5. The recorded water levels here are approximately similar to levels

ⁱⁱⁱ Piezometric head – the level or pressure head to which confined groundwater would rise to in a piezometer if it is open to the atmosphere.

recorded in the River Terrace Deposits and Thanet Sands at PR1023 and in the Chalk at SR1019, suggesting that these units are in hydraulic continuity.

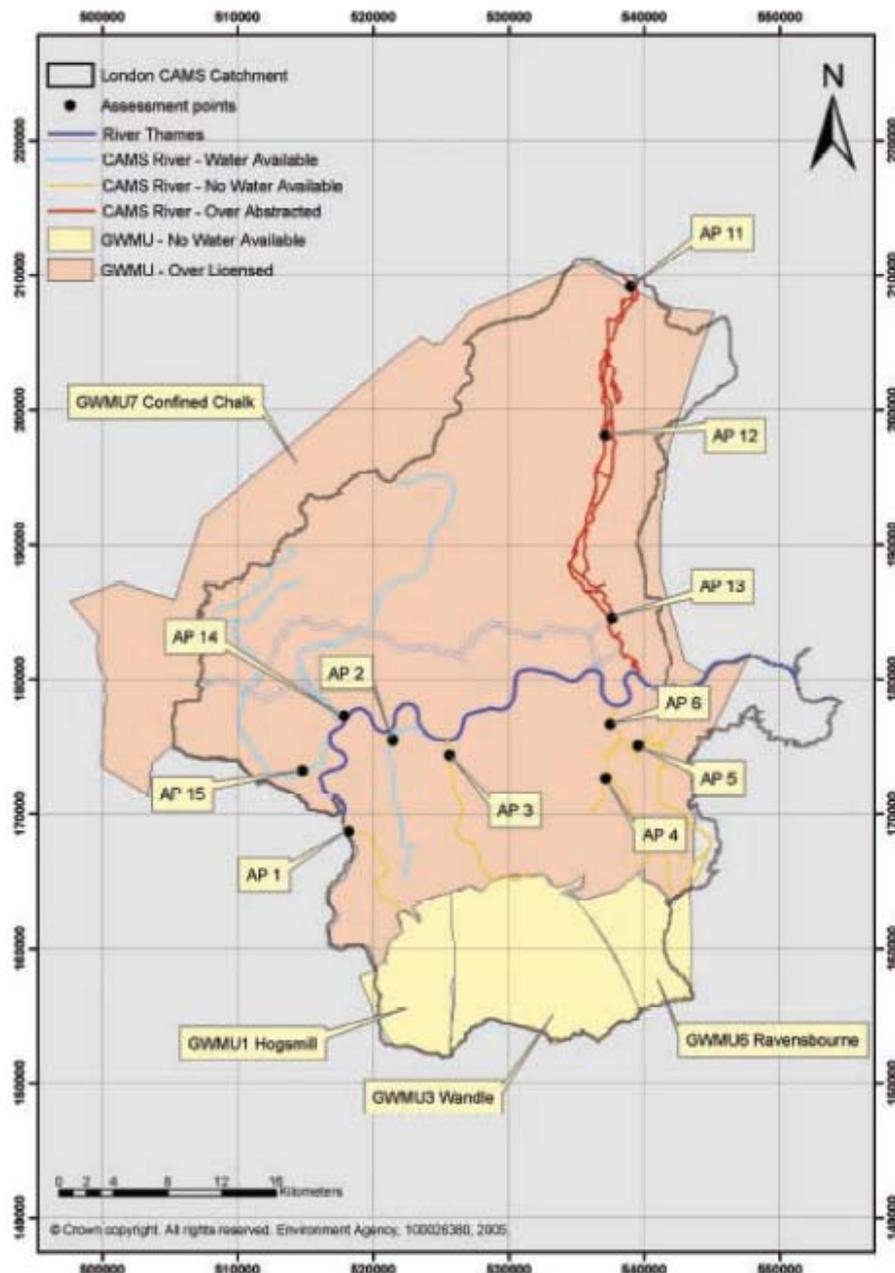
- K.3.7 A plot of groundwater levels within the River Terrace Deposits, Thanet Sands and the Chalk in the vicinity of the site is shown in Vol 23 Figure 13.4.3 (see separate volume of figures). In addition, a groundwater level hydrograph from the EA monitoring borehole and from the five groundwater level monitoring boreholes is shown in Vol 23 Figure 13.4.4 (see separate volume of figures).
- K.3.8 The EA have produced regional groundwater contour plots which display the groundwater flowing to the northwest across site (EA, 2011)⁶. The piezometric head in monitoring borehole SR1019 correspond with this groundwater flow direction. However, the major groundwater licensed abstraction (see Section K.4) is likely to reverse the regional groundwater flow direction here, flowing to the southeast. As the River Terrace Deposits, the Thanet Sands and the Seaford Chalk appear to be in hydraulic continuity, the groundwater flow direction in the River Terrace Deposits is likely to be in a southeasterly direction in this area.

K.4 Groundwater abstractions and protected rights

Groundwater licensing policy

- K.4.1 The London Catchment Abstraction Management Strategy (CAMS) (EA, 2006)⁷ does not identify a condition status for the upper aquifer.
- K.4.2 The EA identifies a condition status for the lower aquifer and defines a policy through its London CAMS, which restricts new abstractions in central, east and south London and further abstraction in areas approaching their sustainable limit (EA, 2006)⁸. The Deptford Church Street site is located within the confined Chalk groundwater management unit GWM7, which is classified as being over-licensed (see Vol 23 Plate K.1) (EA, 2006). Within this area, there is a limit on the availability of groundwater resources such that large abstractions (>1-2MI/d) would generally not be granted unless the applicant can demonstrate that the resources are available (EA, 2006). In addition, large abstractions may also have a time limit shorter than the London CAMS common end date of 2013 (EA, 2006).
- K.4.3 The estimated dewatering volumes required at Deptford Church Street from the lower aquifer of less than 200m³/d and within the most restrictive abstraction licensing limit set by the EA of 0.2MI/d (200m³/d) for Central and South London (EA, 2006). Therefore a detailed local assessment is unlikely to be required by the EA.

Vol 23 Plate K.1 Groundwater – confined chalk licensing



**Reproduced from EA, 2006*

Note: GWMU – groundwater management unit, AP – assessment point

Licensed abstractions

- K.4.4 The EA licenses abstraction from groundwater within London for all sources in excess of 20m³/d. Groundwater abstractions within 1km of the site have been identified.
- K.4.5 There are no licensed groundwater abstractions from the River Terrace Deposits or upper aquifer located within 1km of the Deptford Church Street site; however there is one licensed groundwater abstraction from the Chalk or lower aquifer.

K.4.6 Licence number 28/39/43/0019 is located < to the south of the Deptford Church Street site and is held by Thames Water Utilities Limited. The groundwater abstracted is used for public supply purposes and is abstracted from six licensed abstraction points.

Vol 23 Table K.6 Groundwater - licensed abstractions

Licence number	Licence holder	Purpose	Aquifer
28/39/43/0019	Thames Water Utilities Ltd	Public water supply	Chalk

K.4.7 There are no known unlicensed groundwater abstractions recorded within a 1km radius of the Deptford Church Street site.

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 The Deptford Church Street site straddles a modelled SPZ 2 (defined as 400 days travel time to the source) and a modelled SPZ 3 (defined as the total capture zone) for a major public water supply abstraction from the Chalk is located <1km to the south. The SPZ's are shown in Vol 23 Figure 13.4.2 (see Section K.1). The distance from the site to the boundary of SPZ 1 (defined by 50 day travel time to the source) is approximately 160m. This source is located up the regional hydraulic gradient expected beneath the site; however abstraction at this source is likely to reverse the regional groundwater flow direction here to flow towards the southeast.

K.6 Environmental designations

K.6.1 There are no environmental designations relevant to groundwater such as SSSI, SAC and SNCIs within 1km of the Deptford Church Street site.

K.7 Groundwater quality and land quality assessment

K.7.1 Historic land use mapping of Deptford Church Street, reviewed as part of the land quality assessment, identified no on site potentially contaminative land uses but several at nearby sites (Vol 23 Section 8). There is a borough council depot and railway line located within 15m of the site and historically there was an oil refinery and gas works located within 250m of the site. 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 23 Table K.7 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 on site and within 0.9km (SA4031, SR6902D, SR4117, SR1019, SR1018D, SR1024, PR1023, SR1021C, SR1026, SR1044B, SR1041, SR1040 and SR1042) (for locations see Vol 23 Figure 13.4.1 in separate volume of figures) and within the River Terrace Deposits and Chalk. Any exceedances of the UK drinking water standards (The Water Supply Regulations, 2000)⁹ or relevant Environmental Quality Standards – EQS (River Basin Districts Typology..., 2010)¹⁰ are shaded in blue in this table.

- K.7.3 The data shows exceedances of the relevant standards with respect to chloride, iron, manganese, nickel, polycyclic aromatic hydrocarbons (PAH's) and sulphate within the River Terrace Deposits at SA4031 and SR6902 (both on site), with respect to aluminium and iron within the Chalk at SR6902D and SR4117 (both on site) and with respect to total aromatic hydrocarbons, heavy metals, hydrocarbons, PAH's, electrical conductivity, chloride, magnesium, sodium, sulphate, pesticides, herbicides and turbidity within the Chalk at various ground investigation points at distance from the site. PAH's may be formed during a range of human activities, including incomplete combustion of carbon-based fuels and other industrial processes (EA, 2010)¹¹. In addition, PAH's are considered to be Priority Hazardous Substances under the Water Framework Directive (Commission of the European Communities, 2009)¹².
- K.7.4 The data suggests that only slightly brackish conditions exist within the River Terrace Deposits at SA4031 on site, although there are more saline conditions present to the east of the site in both the River Terrace Deposits (SR1024) and within the Chalk at SR1040, SR1041 and SR1042, due to the closeness of the tidal Thames in this area.
- K.7.5 The EA monitors groundwater quality at number of points across London. The nearest EA monitoring is at the Greenwich Deepwater Terminal. The distance of this location from the site (approximately 3km) makes it unreliable as predictor of water quality conditions around the site.
- K.7.6 The land quality data from the ground investigation boreholes used in the groundwater quality assessment show exceedances of the human health screening values¹³ (soil guideline values designed to be protective of human health) within the River Terrace Deposits at SR1019 with respect to hydrocarbons and PAH's and within the Thanet Sands at SR1025B and SR1026 with respect to hydrocarbons. Further detail is provided in the land quality assessment (see Vol 23 Appendix F).

Environmental Statement

Source of data*				SI	TT	SI	TT	SI	TT	SI	SI	TT	SI	TT	TT	TT	TT	TT	TT	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	
Name				SA403 1	SA403 1	SR690 2D	SR690 2D	SR411 7	SR411 7	SR101 9	SR101 8D	SR408 7	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	PR102 3	SR102 1C	SR102 5B	SR102 6	SR104 4B	SR104 1	SR104 1	SR104 0	SR104 0	SR104 2	SR104 2	
Hydrogeological unit**				RTD	RTD	RTD	CK	RTD	CK	CK	CK	CK	SCK	SCK	SCK	SCK	SCK	SCK	SCK	LCK	CK	CK	CK	LCK	LCK	SCK	LCK	SCK	LCK	RTD	
Distance from site	EQS Criteria			6m	6m	23m	23m	26m	26m	234m	409m	426m	438m	438m	438m	438m	438m	438m	438m	441m	474m	564m	579m	821m	873m	873m	894m	894m	907m	907m	
Chemical	Value	Units	Source	14/2/2 012	18/7/2 012	8/2/20 12	2009	2009	10/8/2 012	2009	2009	17/7/2 012	2009	2009	15/8/2 011	1/1/1/2 011	11/1/2 012	23/3/2 012	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	
as NH4		as NH4	Regs 20																												
Anthracene	0.1	ug/l	SW WFD 2010	-	<0.02	-	<0.05	-	<0.02	<0.015	<0.1	<0.01	<0.015	-	-	-	<0.01	-	<0.01	-	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Antimony Total	5	ug/l	DWS 2010	-	0.7	-	0.7	-	0.7	-	-	0.5	-	-	-	-	1.6	-	0.6	-	-	-	-	-	-	-	-	-	-	-	
Aromatics >C7-C8	50	ug/l	WFD 2010	-	-	-	-	-	-	<10	<10.0	-	<10	-	-	-	-	-	-	<10	<10.0	<10.0	<10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Aromatics >EC10-EC12	-	ug/l	None	-	-	-	-	-	-	<10	<10.0	-	<10	-	-	-	-	-	-	<10	<10.0	<10.0	<10	<0.1	1	<1	2	3	6	9	
Aromatics >EC12-EC16 (Aqueous)	-	ug/l	None	-	-	-	-	-	-	<10	<10.0	-	<10	-	-	-	-	-	-	792	<10.0	<10.0	<10	2	3	1	4	6	7	5	
Aromatics >EC16-EC21 (Aqueous)	-	ug/l	None	-	-	-	-	-	-	<10	<10.0	-	<10	-	-	-	-	-	-	1690	<10.0	<10.0	<10	4	7	3	5	10	9	8	
Aromatics >EC21-EC35 (Aqueous)	-	ug/l	None	-	-	-	-	-	-	<10	10.0	-	<10	-	-	-	-	-	-	<10	<10.0	<10.0	<10	8	15	9	10	18	20	15	
Aromatics >EC8-EC10	-	ug/l	None	-	-	-	-	-	-	<10	<10.0	-	<10	-	-	-	-	-	-	<10	<10.0	<10.0	<10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Aromatics C6-C7	1	ug/l	DWS 2010	-	-	-	-	-	-	<10	<10.0	-	<10	-	-	-	-	-	-	<10	<10.0	<10.0	<10	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Arsenic Total	10	ug/l as As	DWS 2010	2.5	<1.0	2.8	1.6	2.1	<1.0	<0.75	<5.0	<1.0	1.41	64.4	111	18	-	210	-	6.4	5.34	8.0	<5.0	114	<1	<1	<1	<1	<1	5	<1
Atrazine { }	0.1	ug/l	DWS 2010	<0.01	<0.008 00	<0.01	<0.008 00	<0.01	<0.008 00	-	-	<0.008 00	-	<0.003 00	0.0040 0	<0.003 00	-	<0.008 00	-	<0.008 00	-	-	-	-	-	-	-	-	-	-	-
Barium Dissolved	100	ug/l as Ba	SW Regs 96	-	63	-	40	-	67	-	-	66	-	-	-	-	630	-	150	-	-	-	-	-	-	-	-	-	-	-	
Barium Total	100	ug/l as Ba	SW Regs 96	-	67	-	39	-	68	-	-	63	-	-	-	-	620	-	160	-	-	-	-	-	-	-	-	-	-	-	
Bentazone	0.1	ug/l	DWS 2010	<0.1	<0.008 00	<0.1	<0.008 00	<0.1	<0.008 00	-	-	<0.008 00	-	<0.008 00	<0.008 00	<0.008 00	-	<0.008 00	-	<0.008 00	-	-	-	-	-	-	-	-	-	-	-
Benz[a]-Anthracene	-	ug/l	None	-	<0.02	-	<0.05	-	<0.02	-	-	<0.01	-	-	-	-	<0.01	-	<0.01	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	1	ug/l	DWS 2010	<1	<0.07	<1	0.15	<1	<0.07	<10	<5.0	<0.07	<10	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<10	<5.0	<5.0	<10	<0.2	<1	<1	<1	<1	<1	<1	
Benzene (Ethylbenzene)	20	ug/l	FW List II	-	<0.06	-	0.07	-	<0.06	-	-	<0.06	-	-	-	0.07	-	<0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo (a) anthracene	-	ug/l	None	-	-	-	-	-	-	<0.009	<0.1	-	<0.009	-	-	-	-	-	-	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Benzo[a]Pyrene	0.01	ug/l	DWS 2010	<1	<0.02	<1	<0.06	<1	<0.02	<0.009	<0.1	<0.01	<0.009	<0.005 00	<0.005 00	<0.005 00	<0.01	0.0098 0	<0.01	<0.005 00	0.0355	<0.1	<0.1	0.0352	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Benzo[b]Fluoranthene	0.03	ug/l	WFD D 10	-	<0.02	-	<0.05	-	<0.02	<0.023	<0.1	<0.01	<0.023	-	-	-	<0.01	-	<0.01	-	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Benzo[g,h,i]Perylene	0.002	ug/l	WFD D 10	-	<0.02	-	<0.06	-	<0.02	<0.016	<0.1	<0.01	<0.016	-	-	-	<0.01	-	<0.01	-	0.0258	<0.1	<0.1	0.0297	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Benzo[k]Fluoranthene	0.03	ug/l	WFD D 10	-	<0.02	-	<0.05	-	<0.02	<0.027	<0.1	<0.01	<0.027	-	-	-	<0.01	-	<0.01	-	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Bicarbonate	-	mg/l as HCO3	None	430	-	390	-	380	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bifenthrin	-	ug/l	None	-	<0.005 00	-	<0.005 00	-	-	-	-	<0.005 00	-	-	-	-	<0.005 00	-	-	-	-	-	-	-	-	-	-	-	-	-	
Boron Dissolved	1000	ug/l as B	DWS 2010	-	260	-	90	-	47	-	-	110	-	-	-	-	210	-	-	-	-	-	-	-	-	-	-	-	-	-	
Boron Total	1000	ug/l as B	DWS 2010	0.27	290.0	0.1	84.0	0.2	78.0	-	180.0	140.0	45.8	210.0	230.0	220.0	-	220.0	-	280.0	204	530.0	150.0	217	380	<100	<100	510	<100	110	220
Bromate	10	ug/l as BrO3	DWS 2010	<0.5	<0.5	<0.5	<0.5	<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	0.05	<1.5	<0.02	<1.5	<0.02	<1.5	<0.22	<1.0	<1.5	<0.22	<1.5	3.9	<1.5	12	8	<1.5	<1.5	<0.22	<1.0	<1.0	<0.22	<2	<2	<2	<2	<2	<2	
Calcium Dissolved	250	mg/l as Ca	DWS 2010	230	-	150	-	200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Calcium Total	250	mg/l as Ca	DWS 2010	-	250	-	150	-	140	-	-	200	-	180	190	190	-	230	-	210	-	-	-	-	-	-	-	-	-	-	-
Carbendazim	0.1	ug/l	FW List II	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Carbendazim / Benomyl	0.1	ug/l	FW List II	-	<0.005 00	-	<0.005 00	-	<0.005 00	-	-	<0.005 00	-	-	-	-	-	<0.005 00	-	<0.005 00	-	-	-	-	-	-	-	-	-	-	
Carbetamide	-	ug/l	None	<0.1	<0.010 00	<0.1	<0.010 00	<0.1	<0.010 00	-	-	<0.010 00	-	-	-	-	-	<0.010 00	-	<0.010 00	-	-	-	-	-	-	-	-	-	-	
Carbon Dioxide	-	ug/l	None	18,000	40700	-	-	-	10500	-	-	22	-	-	-	-	33800	-	31800	-	-	-	-	-	-	-	-	-	-	-	

Environmental Statement

Source of data*				SI	TT	SI	TT	SI	TT	SI	SI	TT	SI	TT	TT	TT	TT	TT	TT	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI
Name				SA403 1	SA403 1	SR690 2D	SR690 2D	SR411 7	SR411 7	SR101 9	SR101 8D	SR408 7	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	PR102 3	SR102 1C	SR102 5B	SR102 6	SR104 4B	SR104 1	SR104 0	SR104 0	SR104 2	SR104 2		
Hydrogeological unit**				RTD	RTD	RTD	CK	RTD	CK	CK	CK	CK	SCK	SCK	SCK	SCK	SCK	SCK	SCK	LCK	CK	CK	CK	LCK	LCK	SCK	LCK	SCK	LCK	RTD	
Distance from site	EQS Criteria			6m	6m	23m	23m	26m	26m	234m	409m	426m	438m	438m	438m	438m	438m	438m	438m	441m	474m	564m	579m	821m	873m	873m	894m	894m	907m	907m	
Chemical	Value	Units	Source	14/2/2 012	18/7/2 012	8/2/20 12	2009	2009	10/8/2 012	2009	2009	17/7/2 012	2009	15/8/2 011	1/11/2 011	11/1/2 012	23/3/2 012	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	
Carbon Organic Dissolved	-	mg/l as C	None	.0	3.7	-	5.7	-	0.6	-	-	2.1	-	-	-	-	1.7	-	2.6	-	-	-	-	-	-	-	-	-	-	-	
Carbon tetrachloride	3	ug/l	DWS 2010	<1	<0.070	<1	<0.070	<1	<0.070	-	-	<0.070	-	<0.07	<0.07	<0.07	-	<0.070	-	<0.070	-	-	-	-	-	-	-	-	-	-	
Carbonate	-	mg/l	None	<10	-	<10	-	<10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chlorfenvinphos	0.1	ug/l	DWS 2010	<0.01	<0.009 00	<0.01	<0.009 00	<0.01	<0.009 00	-	-	<0.009 00	-	<0.009 00	<0.009 00	<0.009 00	-	<0.009 00	-	<0.009 00	-	-	-	-	-	-	-	-	-	-	
Chloride	250	mg/l as Cl	DWS 2010	600	317	140	173	88	160	-	-	350	-	787	827	966	-	1120	-	1370	-	-	-	-	250	440	210	900	350	110	1300
Chloroform	100	ug/l	WS Regs 20	<1	<0.600	2	<0.600	1	<0.600	-	-	0.93	-	<0.6	<0.6	<0.6	-	<0.600	-	<0.600	-	-	-	-	-	-	-	-	-	-	
Chlorotoluron	0.1	ug/l	DWS 2010	<0.1	-	<0.1	-	<0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chlortoluron	2	ug/l	FW List II	-	<0.010 00	-	<0.010 00	-	<0.010 00	-	-	<0.010 00	-	<0.050 00	<0.100 00	<0.050 00	-	<0.010 00	-	<0.010 00	-	-	-	-	-	-	-	-	-	-	
Chromium Dissolved	50	ug/l as Cr	DWS 2010	-	15	-	13	-	14	-	-	16	-	-	-	-	213	-	19	22	-	-	-	-	-	-	-	-	-	-	
Chromium Total	50	ug/l as Cr	DWS 2010	19	-	18	-	12	-	2.64	6.0	-	6.32	62	28	34	-	75	-	-	12.3	6.0	<5.0	6.12	<5	<5	<5	<5	<5	<5	
Chrysene	-	ug/l	None	-	<0.02	-	<0.05	-	<0.02	<0.013	<0.1	<0.01	<0.013	-	-	-	0.01	-	<0.01	-	<0.1	<0.1	-	<0.01	<0.01	0.02	<0.01	0.02	<0.01	<0.01	
Clopyralid	-	ug/l	None	<0.1	<0.019 00	<0.1	<0.019 00	<0.1	<0.019 00	-	-	<0.019 00	-	<0.019 00	<0.019 00	<0.019 00	-	<0.019 00	-	<0.019 00	-	-	-	-	-	-	-	-	-	-	
Conductivity @ 20°C	2500	uS/cm	WS Regs 20	-	-	-	-	-	-	1820	-	-	955	-	-	-	-	-	-	-	4800	2340	-	1200	1970	1110	3040	1510	769	4920	
Copper Total	2000	ug/l as Cu	DWS 2010	3.7	<5.5	2.2	<5.5	1.5	<5.5	<1.6	<5.0	<5.5	9.58	7.2	<5.5	<5.5	-	26	-	<5.5	1.61	<5.0	<5.0	4.71	<2	<2	<2	<2	2	<2	<2
Coumaphos	0.1	ug/l	DWS 2010	-	<0.005 00	-	<0.005 00	-	-	-	-	0.0070 0	-	-	-	-	<0.005 00	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cresols	-	ug/l	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.4	<0.1	
Cyanazine	0.1	ug/l	DWS 2010	<1	<0.008 00	<1	<0.008 00	<1	<0.008 00	-	-	<0.008 00	-	<0.060 00	<0.120 00	<0.060 00	-	<0.008 00	-	<0.008 00	-	-	-	-	-	-	-	-	-	-	
Cyanide (Free)	50	ug/l as CN	DWS 2010	-	-	-	-	-	-	<20.0	-	<50.0	-	-	-	-	-	-	-	<50.0	<20.0	<20.0	<50.0	<20	<20	<20	<20	<20	<20	<20	
Cyanide (Total)	50	ug/l as CN	DWS 2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<40	<40	<40	<40	<40	<40	<40	
Cypermethrin	0.000 1	ug/l	WFD 2010	<0.1	<0.100	<0.1	<0.100	<0.1	<0.100	-	-	<0.100	-	0.11	<0.1	<0.1	-	<0.100	-	<0.100	-	-	-	-	-	-	-	-	-	-	
Cypermethrin ID	-	Code	None	-	<5.00	-	<5.00	-	-	-	-	<5.00	-	-	-	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dalapon	-	ug/l	None	<1	<0.050 00	<1	<0.050 00	<1	-	-	-	<0.050 00	-	<0.050 00	<0.050 00	<0.050 00	-	<0.050 00	-	<0.050 00	-	-	-	-	-	-	-	-	-	-	
Diazinon	0.1	ug/l	DWS 2010	<0.01	<0.009 00	<0.01	<0.009 00	<0.01	<0.009 00	-	-	<0.009 00	-	<0.009 00	<0.009 00	<0.009 00	-	<0.009 00	-	<0.009 00	-	-	-	-	-	-	-	-	-	-	
Dibenz-[A,H]-Anthracene	-	ug/l	None	-	<0.02	-	<0.05	-	<0.02	<0.016	<0.1	<0.01	<0.016	-	-	-	<0.01	-	<0.01	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Dichloromethane	20	ug/l	WFD 2010	<50	<3.0	<50	<3.0	<50	<3.0	-	-	-	-	<3	<3	<3	-	<3.0	-	<3.0	-	-	-	-	-	-	-	-	-	-	
Dichlorprop	0.1	ug/l	DWS 2010	<0.1	<0.011 00	<0.1	<0.011 00	<0.1	<0.011 00	-	-	<0.011 00	-	0.5680 0	<0.011 00	<0.011 00	-	<0.011 00	-	<0.011 00	-	-	-	-	-	-	-	-	-	-	
Diuron	0.1	ug/l	DWS 2010	<0.1	<0.010 00	<0.1	<0.010 00	<0.1	<0.010 00	-	-	<0.010 00	-	<0.005 00	0.0060 0	<0.005 00	-	<0.010 00	-	<0.010 00	-	-	-	-	-	-	-	-	-	-	
Enterococci (Species)	-	Nr/10 0ml	None	-	-	-	8	-	0	-	-	0	-	-	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-		
Escherichia coli (Confirmed)	0	Nr/10 0ml	WS Regs 20	-	0	-	1	-	0	-	-	1	-	-	-	0	-	0	-	-	-	-	-	-	-	-	-	-	-		
Ethofumesate	-	ug/l	None	-	<0.01	-	<0.01	-	<0.01	-	-	<0.01	-	-	-	<0.01	-	<0.01	-	<0.01	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	-	ug/l	None	-	-	-	-	-	-	<10	<5.0	-	<10	-	-	-	-	-	-	<10	<5.0	<5.0	<10	<1	<1	<1	<1	<1	<1	<1	
Fenuron	-	ug/l	None	-	<0.01	-	0.03	-	<0.01	-	-	<0.01	-	-	-	-	<0.01	-	<0.01	-	-	-	-	-	-	-	-	-	-	-	
Fluoranthene	0.2	ug/l	EEC MAC	-	0.07	-	<0.05	-	<0.02	<0.014	<0.1	<0.01	<0.014	-	-	-	0.01	-	<0.01	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	0.02	
Fluorene	-	ug/l	None	-	<0.02	-	<0.06	-	<0.02	0.0908	<0.1	<0.01	<0.014	-	-	-	<0.01	-	<0.01	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Fluoride	1.5	mg/l as F	DWS 2010	<1.0	0.53	<1.0	0.37	<1.0	0.33	-	-	0.256	-	0.21	0.19	0.24	-	0.193	-	0.29	-	-	-	-	-	-	-	-	-		
Glyphosate	-	ug/l	None	<0.1	<0.014 00	<0.1	-	<0.1	<0.014 00	-	-	<0.014 00	-	<0.014 00	<0.014 00	<0.014 00	-	<0.014 00	-	<0.014 00	-	-	-	-	-	-	-	-	-		

Environmental Statement

Source of data*				SI	TT	SI	TT	SI	TT	SI	SI	TT	SI	TT	TT	TT	TT	TT	TT	TT	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI
Name				SA403 1	SA403 1	SR690 2D	SR690 2D	SR411 7	SR411 7	SR101 9	SR101 8D	SR408 7	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	PR102 3	SR102 1C	SR102 5B	SR102 6	SR104 4B	SR104 1	SR104 1	SR104 0	SR104 0	SR104 2	SR104 2	SR104 2		
Hydrogeological unit**				RTD	RTD	RTD	CK	RTD	CK	CK	CK	CK	SCK	SCK	SCK	SCK	SCK	SCK	SCK	LCK	CK	CK	CK	LCK	LCK	SCK	LCK	SCK	LCK	SCK	LCK	RTD		
Distance from site	EQS Criteria			6m	6m	23m	23m	26m	26m	234m	409m	426m	438m	438m	438m	438m	438m	438m	438m	438m	441m	474m	564m	579m	821m	873m	873m	894m	894m	907m	907m	907m		
Chemical	Value	Units	Source	14/2/2 012	18/7/2 012	8/2/20 12	2009	2009	10/8/2 012	2009	2009	17/7/2 012	2009	15/8/2 011	1/11/2 011	11/1/2 012	23/3/2 012	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009		
GRO C4-C12	-	ug/l	None	-	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	-	-	-	
Hardness Total - As CaCO3	-	mg/l as CaCO3	None	-	750	-	580	-	380	-	-	530	-	-	-	-	774	-	860	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Indeno[1,2,3-Cd]-Pyrene	0.002	ug/l	WFD D 10	-	<0.02	-	<0.05	-	<0.02	<0.014	<0.1	<0.01	<0.014	-	-	-	<0.01	-	<0.01	-	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Iodide Ion	-	ug/l as I	None	-	32	-	13	-	9	-	-	110	-	-	-	-	16	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Irgarol 1051	-	ug/l	None	-	<0.005 00	-	<0.005 00	-	-	-	-	<0.005 00	-	-	-	-	<0.005 00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Iron Dissolved	200	ug/l as Fe	DWS 2010	-	210.0	-	2,100.0	-	<18.0	-	-	2,000.0	-	-	-	-	180,000.0	-	920.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Iron Total	200	ug/l as Fe	DWS 2010	-	230.0	-	2,100.0	-	<18.0	-	-	1,800.0	-	-	-	-	490,000.0	-	900.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Isoproturon (Diip1,3Dithiolan-2-Ylidemalonate)	0.1	ug/l	DWS 2010	<0.1	<0.008 00	<0.1	<0.008 00	<0.1	<0.008 00	-	-	<0.008 00	-	<0.003 00	<0.003 00	<0.003 00	-	<0.008 00	-	<0.008 00	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lambda Cyhalothrin	-	ug/l	None	-	<5.00	-	<5.00	-	-	-	-	<5.00	-	-	-	-	<5.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lead Total	10	ug/l	WS Regs 20	<0.3	<5	<0.3	<5	<0.3	<5	0.579	<5.0	<5	3.5	<5	8	<5	-	15	-	<5	<0.4	<5.0	<5.0	0.561	<4	<4	<4	<4	<4	<4	<4	<4		
Lithium Dissolved	-	ug/l as Li	None	-	<0.6	-	<0.6	-	<0.6	-	-	<0.6	-	-	-	-	<0.6	-	<0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lithium Total	-	ug/l as Li	None	-	<0.6	-	<0.6	-	<0.6	-	-	<0.6	-	-	-	-	<0.6	-	<0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Magnesium Dissolved	50	mg/l as Mg	EEC MAC	-	18	-	14	-	8.1	-	-	14	-	-	-	-	53	-	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Magnesium Total	50	mg/l as Mg	EEC MAC	24.85	17	17	13	18	8.2	-	-	14	-	41	42	48	-	60	-	65	-	-	-	-	16	26	14	50	24	17	76	-	-	
Manganese Dissolved	50	ug/l as Mn	DWS 2010	-	1,600.0	-	630.0	-	34.0	-	-	360.0	-	-	-	-	780.0	-	13.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Manganese Total	50	ug/l as Mn	DWS 2010	-	1,600.0	-	620.0	-	35.0	-	-	350.0	-	-	-	-	2,600.0	-	12.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
MCPA {2-methyl-4-chlorophenoxyacetic acid }	0.1	ug/l	DWS 2010	<0.1	<0.009 00	<0.1	<0.009 00	<0.1	<0.009 00	-	-	<0.009 00	-	<0.009 00	<0.009 00	<0.009 00	-	<0.009 00	-	<0.009 00	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mecoprop { }	0.1	ug/l	DWS 2010	<0.1	<0.010 00	<0.1	<0.010 00	<0.1	<0.010 00	-	-	<0.010 00	-	<0.010 00	<0.010 00	<0.010 00	-	<0.010 00	-	<0.010 00	-	-	-	-	-	-	-	-	-	-	-	-	-	
Mercury Total	1	ug/l Hg	WS Regs 20	<0.05	<0.002	0.38	0.013	0.52	<0.002	<0.01	<0.05	0.007	<0.01	0.05	0.026	<0.002	-	0.055	-	0.002	<0.01	<0.05	<0.05	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		
Metazachlor	-	ug/l	None	<0.1	<0.008 00	<0.1	<0.008 00	<0.1	<0.008 00	-	-	<0.008 00	-	<0	<0	<0	-	<0	-	<0.008 00	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methane	-	ug/l	None	-	<10	-	99	-	14	-	-	-	-	-	-	-	<10.0	-	<10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Molybdenum Total	0	ug/l	GW Regs 98	-	<5	-	<5	-	8	-	-	8	-	-	-	-	13	-	54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
MTBE (Methyl Tert-Butyl Ether)	-	ug/l	None	-	-	-	-	-	-	<10	<5.0	-	<10	-	-	-	-	-	-	<10	<5.0	<5.0	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Multi Residual Scan	-	ug/l	None	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.100 00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Naphthalene	1.2	ug/l	WFD D 10	-	<0.03	-	<0.07	-	<0.03	0.24	<0.1	0.02	<0.1	-	-	-	0.08	-	<0.02	-	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Nickel Total	20	ug/l as Ni	DWS 2010	31	14	8	<4	16	5	36.1	7.0	18	4.55	17	11	5	-	46	-	11	11.5	21.0	<5.0	7.81	<10	<10	<10	<10	<10	<10	<10	<10		
Nitrate - N	11.3	mg/l as N	WS Regs 20	<2.0	5.39	<1.0	<0.068	21	0.887	<0.067 7	<0.5	<0.068	0.833	5.15	4.42	3.98	-	5.01	-	6.51	<0.067 7	<0.5	<0.5	5.23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.9		
Nitrogen Total Oxidised	11.3	mg/l as N	WS Regs 20	-	6.03	-	<0.081	-	0.628	-	-	0.164	-	-	-	-	4.62	-	6.32	-	-	-	-	-	-	-	-	-	-	-	-	-		
Orthophosphate	-	mg/l as P	None	-	0.23	-	<0.18	-	<0.18	-	-	<0.18	-	-	-	-	0.19	-	<0.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Oxamyl	-	ug/l	None	-	0.0080 0	-	<0.005 00	-	-	-	-	<0.005 00	-	-	-	-	<0.005 00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
o-Xylene	-	ug/l	None	-	-	-	-	-	-	<10	<5.0	-	<10	-	-	-	-	-	-	-	<10	<5.0	<5.0	<10	-	-	-	-	-	-	-	-		

Environmental Statement

Source of data*				SI	TT	SI	TT	SI	TT	SI	SI	TT	SI	TT	TT	TT	TT	TT	TT	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI		
Name				SA403 1	SA403 1	SR690 2D	SR690 2D	SR411 7	SR411 7	SR101 9	SR101 8D	SR408 7	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	PR102 3	SR102 1C	SR102 5B	SR102 6	SR104 4B	SR104 1	SR104 1	SR104 0	SR104 0	SR104 2	SR104 2	
Hydrogeological unit**				RTD	RTD	RTD	CK	RTD	CK	CK	CK	CK	SCK	SCK	SCK	SCK	SCK	SCK	SCK	LCK	CK	CK	CK	LCK	LCK	SCK	LCK	SCK	LCK	RTD	
Distance from site	EQS Criteria			6m	6m	23m	23m	26m	26m	234m	409m	426m	438m	438m	438m	438m	438m	438m	438m	441m	474m	564m	579m	821m	873m	873m	894m	894m	907m	907m	
Chemical	Value	Units	Source	14/2/2012	18/7/2012	8/2/2012	2009	2009	10/8/2012	2009	2009	17/7/2012	2009	15/8/2011	1/11/2011	11/1/2012	23/3/2012	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	
PAH 16 Total	0.1	ug/l	DWS 2010	-	-	-	-	-	-	0.52	0.0	-	<0.1	-	-	-	-	-	-	5.95	0.0	0.0	0.278	-	-	-	-	-	-	-	
PAHs Total	0.1	ug/l	DWS 2010	-	14	-	<0.89	-	<0.34	-	-	0.02	-	-	-	-	0.12	-	<0.01	-	-	-	-	-	-	-	-	-	-	-	
Pentachlorophenol	9	ug/l	WHO 2004	<3	-	<3	-	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Permethrin (Cis + Trans)	0.01	ug/l	WFD D 10	<0.01	<0.10000	<0.01	<0.10000	<0.01	-	-	-	<0.10000	-	<0.10000	<0.10000	-	-	-	<0.10000	-	-	-	-	-	-	-	-	-	-	-	
pH	10	pH units	DWS 2010	7.9	-	-	-	-	-	7.61	7.8	-	7.93	-	-	-	-	-	-	8.01	7.7	7.9	8.48	-	7.5	7.2	7.6	7.3	8.1	7.2	
Phenanthrene	-	ug/l	None	-	0.03	-	<0.06	-	<0.02	0.0873	<0.1	<0.01	<0.022	-	-	-	<0.01	-	<0.01	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	0.02	<0.01	0.02	<0.01	
Phenol	0.5	ug/l	EEC MAC	<3	-	7	-	4	-	<2.0	<10.0	-	<2.0	-	-	-	-	-	<2.0	<10.0	<10.0	<2.0	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.4	<0.1	
Phenol (Pentachlorophenol (PCP))	-	ug/l	None	-	<0.00900	-	<0.00900	-	-	-	-	<0.00900	-	<0.00900	<0.00900	<0.00900	-	<0.00900	-	-	-	-	-	-	-	-	-	-	-	-	
Phenols Total For SWAD (7 Compounds)	-	ug/l	None	-	<8.0	-	<8.0	-	<8.0	-	-	<8.0	-	<800.0	<15.0	41.0	-	<8.0	-	<8.0	-	-	-	-	-	-	-	-	-	-	
Polynuclear Aromatic Hydrocarbons (Total)	0.1	ug/l	DWS 2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Potassium Dissolved	-	mg/l as K	None	-	27	-	11	-	5.7	-	-	12	-	-	-	-	37	-	40	-	-	-	-	-	-	-	-	-	-	-	
Potassium Total	-	mg/l as K	None	46	27	20	10	26	6.4	-	-	13	-	30	32	33	-	40	-	38	-	-	-	-	-	-	-	-	-	-	
Preparation (Purge And Trap)	-	Text	None	-	Prepared	-	Prepared	-	Prepared	-	-	Prepared	-	-	-	-	-	-	-	Prepared	-	-	-	-	-	-	-	-	-	-	
Propazine	0.1	ug/l	DWS 2010	<0.01	<0.00500	<0.01	<0.00500	<0.01	<0.00500	-	-	<0.00500	-	<0.04000	<0.08000	<0.04000	-	<0.00500	-	<0.00500	-	-	-	-	-	-	-	-	-	-	
Propetamphos	0.1	ug/l	DWS 2010	<0.1	<0.00500	<0.1	<0.00500	<0.1	<0.00500	-	-	<0.00500	-	<0.00500	<0.00500	<0.00500	-	<0.00500	-	<0.00500	-	-	-	-	-	-	-	-	-	-	
Pyrene	-	ug/l	None	-	0.04	-	<0.06	-	<0.02	<0.015	<0.1	<0.01	<0.015	-	-	0.02	-	<0.01	-	-	<0.1	<0.1	-	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	0.04	
Selenium	10	ug/l as Se	DWS 2010	-	3.4	-	0.4	-	0.8	<1	<5.0	<0.4	2.08	-	-	-	2.3	-	2.1	-	3.63	16.0	8.0	13.7	<3	<3	<3	<3	<3	<3	
Silicate Reactive Dissolved - As SiO2	-	mg/l	None	-	21.00000	-	27.00000	-	16.00000	-	-	14.00000	-	-	-	-	65.00000	-	-	-	-	-	-	-	-	-	-	-	-	-	
Simazine	0.1	ug/l	DWS 2010	<0.01	<0.00400	<0.01	<0.00400	<0.01	<0.00400	-	-	<0.00400	-	<0.00900	<0.00900	<0.00900	-	<0.00400	-	<0.00400	-	-	-	-	-	-	-	-	-	-	
Sisumxylene	-	ug/l	None	-	-	-	-	-	-	<10	-	<10	-	-	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	-	
Sodium Total	200	mg/l as Na	DWS 2010	190	200	140	150	110	39	-	-	140	-	390	420	480	-	570	-	540	-	-	-	-	140	360	92	480	340	86	590
Strontium Dissolved	-	ug/l as Sr	None	-	0.82	-	0.028	-	0.88	-	-	0.89	-	-	-	-	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	
Strontium Total	-	ug/l as Sr	None	-	0.83	-	1.1	-	0.9	-	-	0.85	-	-	-	-	1.1	-	1.1	-	-	-	-	-	-	-	-	-	-	-	
Sulphate	250	mg/l as SO4	DWS 2010	420	443	160	164	80	79.9	515	170	165	155	192	195	222	-	211	-	258	205	440	100	208	73	240	59	170	89	71	160
Sulphide	-	ug/l	None	-	<29.0	-	7,290.0	-	<29.0	-	-	<29.0	-	-	-	-	<29.0	-	<29.0	-	-	-	-	-	<10	<10	<10	<10	<10	<250	<250
Sum of BTEX	-	ug/l	None	-	-	-	-	-	-	<10	-	<10	-	-	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	-	
Terbutryn	0.1	ug/l	DWS 2010	<0.01	<0.00500	<0.01	<0.00500	<0.01	<0.00500	-	-	<0.00500	-	<0.04000	<0.08000	<0.04000	-	<0.00500	-	0.00600	-	-	-	-	-	-	-	-	-	-	
Tetrachloroethylene	-	ug/l	None	<1	<0.09	<1	<0.09	<1	<0.09	-	-	<0.09	-	<0.09	0.22	<0.09	-	<0.09	-	0.24	-	-	-	-	-	-	-	-	-	-	
Tetrachlorothioanisole	-	ug/l	None	-	<0.00500	-	<0.00500	-	-	-	-	<0.00500	-	-	-	-	<0.00500	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tin Total	0	ug/l as Sn	GW Regs 98	-	<5	-	<5	-	<5	-	-	<5	-	-	-	-	<5	-	<5	-	-	-	-	-	-	-	-	-	-	-	
Titanium	0	ug/l as Ti	GW Regs 98	-	98.0	-	78.0	-	49.0	-	-	74.0	-	-	-	-	84.0	-	87.0	-	-	-	-	-	-	-	-	-	-	-	
Toluene (Methylbenzene)	50	ug/l	WFD 2010	-	<0.55	-	1.17	-	<0.55	<10	<5.0	<0.55	<10	-	-	-	<0.55	-	<0.55	-	<10	<5.0	<5.0	<10	<1	<1	<1	<1	<1	<1	
Total Aliphatic TPH	-	ug/l	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	25	13	27	10	17	62	
Total Aliphatics & Aromatics >C12-C44 (Aqueous)	-	ug/l	None	-	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	16900	-	-	<10	-	-	-	-	-	-	-	
Total Aliphatics >C12-	-	ug/l	None	-	-	-	-	-	-	<10	10.0	-	<10	-	-	-	-	-	-	13400	<10.0	20.0	<10	-	-	-	-	-	-	-	

Environmental Statement

Source of data*				SI	TT	SI	TT	SI	TT	SI	SI	TT	SI	TT	TT	TT	TT	TT	TT	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI		
Name				SA403 1	SA403 1	SR690 2D	SR690 2D	SR411 7	SR411 7	SR101 9	SR101 8D	SR408 7	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	SR102 4	PR102 3	SR102 1C	SR102 5B	SR102 6	SR104 4B	SR104 1	SR104 1	SR104 0	SR104 0	SR104 2	SR104 2	
Hydrogeological unit**				RTD	RTD	RTD	CK	RTD	CK	CK	CK	CK	SCK	SCK	SCK	SCK	SCK	SCK	SCK	LCK	CK	CK	CK	LCK	LCK	SCK	LCK	SCK	LCK	RTD	
Distance from site	EQS Criteria			6m	6m	23m	23m	26m	26m	234m	409m	426m	438m	438m	438m	438m	438m	438m	438m	441m	474m	564m	579m	821m	873m	873m	894m	894m	907m	907m	
Chemical	Value	Units	Source	14/2/2 012	18/7/2 012	8/2/20 12	2009	2009	10/8/2 012	2009	2009	17/7/2 012	2009	15/8/2 011	1/11/2 011	11/1/2 012	23/3/2 012	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	2009	
C35 (Aqueous)																															
Total Aliphatics C5-C12	-	ug/l	None	-	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	-	
Total Aliphatics C5-C35	-	ug/l	None	-	-	-	-	-	-	<10.0	-	-	<10.0	-	-	-	-	-	-	<10.0	20.0	-	-	-	-	-	-	-	-	-	
Total Aromatic TPH	-	ug/l	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	26	14	20	37	42	38		
Total Aromatics >EC12-EC35 (Aqueous)	-	ug/l	None	-	-	-	-	-	-	<10	-	<10	-	-	-	-	-	-	-	3570	-	<10	-	-	-	-	-	-	-		
Total Aromatics C5-C35	1	ug/l	DWS 2010	-	-	-	-	-	-	10.0	-	-	-	-	-	-	-	-	-	<10.0	<10.0	-	-	-	-	-	-	-	-		
Total Aromatics C6-C12	1	ug/l	DWS 2010	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	<10	-	-	<10	-	-	-	-	-	-	-		
Total Chemical Oxygen Demand	-	mg/l	None	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10.0000	<10.0000	<10.0000	13.0000	19.0000	<10.0000	24.0000		
Total Hydrocarbons C5-C35	-	ug/l	None	-	-	-	-	-	-	10.0	-	-	-	-	-	-	-	-	-	<10.0	20.0	-	-	-	-	-	-	-	-		
Total Monohydric Phenols	-	ug/l	None	-	-	-	-	-	-	<10.0	-	-	-	-	-	-	-	-	-	<10.0	<10.0	-	-	-	-	-	-	-	-		
Total Monohydric Phenols (W)	-	ug/l	None	-	-	-	-	-	<15.0	-	-	<15.0	-	-	-	-	-	-	<15.0	-	-	<15.0	-	-	-	-	-	-	-		
Trichloroethene (Trichloroethylene)	10	ug/l	DWS 2010	<1	0.75	<1	<0.07	<1	<0.07	-	-	<0.07	-	<0.07	<0.07	<0.07	-	<0.07	-	0.15	-	-	-	-	-	-	-	-	-		
Trietazine	-	ug/l	None	<0.01	<0.00800	<0.01	<0.00800	<0.01	<0.00800	-	-	<0.00800	-	<0.02000	<0.04000	<0.02000	-	<0.00800	-	<0.00800	-	-	-	-	-	-	-	-	-		
Trifluralin	0.1	ug/l	DWS 2010	<0.01	<0.01000	<0.01	<0.01000	<0.01	<0.01000	-	-	<0.01000	-	<0.01000	<0.01000	<0.01000	-	<0.01000	-	-	-	-	-	-	-	-	-	-	-		
Turbidity	1	FTU	WS Regs 20	2	0.41	<1	112	<1	0.4	-	-	12.1	-	3.96	346	21.1	-	221	-	8.52	-	-	-	-	-	-	-	-	-		
Uranium	0	ug/l as U	GW Regs 98	-	1.6	-	0.8	-	1.2	-	-	1.9	-	-	-	-	1.6	-	1.7	-	-	-	-	-	-	-	-	-	-		
Volatile Hydrocarbons (C5-C12)	-	mg/l	None	-	-	-	-	-	-	<0.01000	-	-	-	-	-	-	-	-	-	<0.01000	<0.01000	-	-	-	-	-	-	-	-		
Xylene (Meta & Para){1,3+1,4-Dimethylbenzene}	30	ug/l	WFD 2010	<1	<0.09	<1	0.24	<1	<0.09	<10	<5.0	<0.09	<10	0.14	<0.09	<0.09	<0.180	<0.09	<0.09	<10	<5.0	<5.0	<10	<1	<1	<1	<1	<1	<1		
Xylene (ortho)	30	ug/l	SW Regs 98	-	<0.09	-	0.09	-	<0.09	-	-	<0.09	-	-	-	<0.09	-	<0.09	-	-	-	-	-	-	-	-	-	-	-		
Zinc Total	50	ug/l as Zn	DWS 2010	8	<5	9	8	6	<5	<5	29.0	<5	10.2	11	7	<5	-	29	-	<5	<5	9.0	<5.0	<5	<1	5	<1	30	14	2	1

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: SCK – Seaford Chalk, LCK – Lewes Nodular Chalk, 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)¹⁴ shows that the Superficial Deposits (River Terrace Deposits and Alluvium), Lambeth Group, Thanet Sands and Chalk Formation in the area of the Deptford Church Street site are designated as the Greenwich Chalk and Tertiaries groundwater body.
- K.8.3 The baseline assessment for groundwater status classification for the Greenwich Chalk and Tertiaries shows poor quantitative status with respect to impact on surface waters and saline intrusions, good quantitative status with respect to groundwater dependent terrestrial ecosystems and resource balance for 2009. The baseline assessment also shows poor chemical status with respect to saline intrusions and drinking water protected area status and good chemical status with respect to general chemical assessment, groundwater dependent terrestrial ecosystems and impact on surface water chemical/ ecological status.
- K.8.4 The predicted quantitative and 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)¹⁴.
- K.8.6 The Thames Tideway Tunnel project would prevent deterioration of the current and predicted status of groundwater and would adhere to the key actions identified in the RBMP to achieve good status by 2021 or 2027, as follows (EA, 2009):
- 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 Deptford Church Street site assessment is given in Vol 23 Table K.8.

Vol 23 Table K.8 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 (SPZ)	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	Final ES
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 15 th October 2012)	

** LBs – London Borough,*

References

- ¹ British Geological Survey. *British geology onshore digital maps 1:50 000 scale*. Received from Thames Tideway Tunnel (February 2009).
- ² British Geological Survey. *The Physical Properties of Minor Aquifers in England and Wales*. Hydrogeology Group, Technical Report WD/00/04, Environment Agency R&D Publication 68 (2000).
- ³ Royse, K.R.. *The London Chalk model*. British Geological Survey. Commissioned Report CR/08/125 (2008).
- ⁴ Environment Agency. *Environment Agency Website*. Accessed April 2012. Available at: <http://www.environment-agency.gov.uk/homeandleisure/117020.aspx>
- ⁵ Environment Agency and ESI. *London Basin Aquifer Conceptual Model*. ESI Report Reference 60121R1 (June 2010).
- ⁶ Environment Agency. *Groundwater levels contours in Chalk*. Received from Environment Agency (June 2011).
- ⁷ 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>.
- ⁸ Environment Agency. See citation above.
- ⁹ *The Water Supply (Water Quality) Regulations, 2000*. Available at: <http://www.legislation.gov.uk/ukxi/2000/3184/contents/made>.
- ¹⁰ *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/>.
- ¹¹ Environment Agency. *REACH Annex XVII Restrictions Polycyclic-aromatic Hydrocarbons (PAHs) Guidance Note Part 1* (October 2010). Available at: http://www.environment-agency.gov.uk/static/documents/Business/Part_1_PAH_Guidance_Note.pdf.
- ¹² Commission of the European Communities. *Directive of the European Parliament and of the Council on environmental quality standards in the field of water policy and amending Directive 2000/60/EC* (2009). Available at: http://ec.europa.eu/environment/water/water-dangersub/pdf/com_2006_397_en.pdf?lang=_e.
- ¹³ Environment Agency. *Soil Guideline Value Reports* (2009). Available at: <http://www.environment-agency.gov.uk/research/planning/64015.aspx>.
- ¹⁴ 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: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix L: Water resources - surface water

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

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Thames Tideway Tunnel

Environmental Statement

Volume 23 Deptford Church Street appendices

Appendix L: Water resources – surface water

List of contents

	Page number
Appendix L : Water resources – surface water	1
L.1 Introduction	1

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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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This page is intentionally blank

Thames Tideway Tunnel

Environmental Statement

Volume 23 Deptford Church Street appendices:

Appendix M: Water resources – flood risk

List of contents

	Page number
Appendix M : Water resources – flood risk	1
M.1 Policy considerations.....	1
References	4

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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 Deptford Church Street is provided below.

Local policy

Strategic Flood Risk Assessment

- M.1.4 The site lies within the London Borough (LB) of Lewisham. LB of Lewisham has produced a Level 1 Strategic Flood Risk Assessment (SFRA) (JBA, 2008)². This outlines the main flood sources to the borough.
- M.1.5 The LB of Lewisham SFRA confirms that the Thames Tidal Defence network reduces the annual probability of flooding from the Thames to less than 0.1% AEP (1 in 1000 year). The risk of flooding is a residual risk associated with a breach in the defences. In addition, the proposed site is located upstream of the Thames Barrier, therefore it benefits from the operation of this structure.
- M.1.6 According to the SFRA:
- The site is underlain by Reading and Thanet Sands bedrock, which in turn is overlain by River Terrace Deposits (Alluvium) and drift geology.
 - The site is within the Flood Warning Area of the Tidal Thames from the Limehouse Basin to Blackfriars Bridge, and Environment Agency (EA) Flood Zones 1, 2 and 3.
 - The site is located within an area which has had between 1 and 10 historical sewer flooding events.
 - In terms of providing safe refuge areas during the construction phase, rest and reception centres have been identified as Leisure Centres, Churches, Schools and Community Centres.
- M.1.7 The SFRA promotes the use of Sustainable Drainage Systems (SuDS) suitable to specific site locations within the Borough, depending on underlying geology. .

Surface Water Management Plan

- M.1.8 The Council, in partnership with the Greater London Authority (GLA), Thames Water and the EA has produced a Surface Water Management Plan (SWMP) (Halcrow and MWH, 2011)³ as part of the Drain London

project. The SWMP sets out the preferred surface water management strategy for the borough.

- M.1.9 According to the SWMP:
- a. The site does not lie within a Critical Drainage Area (CDA)ⁱ.
 - b. The site does not lie along an identified flow path for the 1% AEP + 30% climate change rainfall event.

Regional policy

Thames Estuary 2100

- M.1.10 The site lies within the London City 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 mitigate the impact of climate change.
- M.1.11 The TE2100 Plan identifies the local sources of flood risk at this location as including:
- a. tidal flood risk from the River Thames
 - b. urban drainage sources
 - c. risk of groundwater flooding from superficial strata which is possibly connected to high water levels in the River Thames.
- M.1.12 Flood mitigation from these sources include:
- a. the Thames Barrier and secondary tidal defences along the Thames frontage (both making up the Thames Tidal Defence network)
 - b. Combined Sewer Overflows (CSOs) for mitigation of urban drainage
 - c. flood forecasting and warning.
- M.1.13 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 defences and floodplain management should be introduced. There is also the vision to increase flood risk awareness within the area.
- M.1.14 The TE2100 Plan states that measures will be needed to control tributary tidal and fluvial flooding on the Ravensbourne River and that there is a risk of urban drainage flooding in this policy unit.

London Regional Flood Risk Appraisal

- M.1.15 For the reach between Hammersmith Bridge and the Thames Barrier (City Reach) the London Regional Flood Risk Appraisal (RFRA) (Greater London Authority, 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

ⁱ Area susceptible to surface water flooding.

such a way as to take opportunities to reduce flood risk and include resilience.

- M.1.16 There is particular concern surrounding confluences and the interactions between tidal and fluvial flows in the future due to climate change. This should be taken into consideration during the re-development process.
- M.1.17 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 JBA. *London Borough of Lewisham Level 1 Strategic Flood Risk Assessment*. (July 2008).

³ Halcrow and MWH. *LB of Lewisham Surface Water Management Plan Final Report*. (July 2011).

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

⁵ Greater London Authority. *London Regional Flood Risk Appraisal*. (October 2009)

Thames Tideway Tunnel
Thames Water Utilities Limited



Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.23**

Volume 23: Deptford Church Street appendices

Appendix N: Development schedule

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Thames Tideway Tunnel
Environmental Statement
Volume 23 Deptford Church Street appendices
Appendix N: Development schedule

List of contents

	Page number
Appendix N : Development schedule	1
N.1 Summary.....	1

List of tables

	Page number
Vol 23 Table N.1 Development schedule for Deptford Church Street.....	3

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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 23 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 23 Table N.1 Development schedule for Deptford Church Street

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		2016 (Site Year 1 of construction)	2017 (peak construction traffic year)	2023 (Year 1 of operation)		
Giffin Street Regeneration Area, Giffin Street Note: not Mayoral referral development but included due proximity to site (potential new receptors).	50m south	DC/08/69668	Lewisham Programme Management & Property	Alterations and the change of use of the Giffin Business Centre to education use and the redevelopment of the public car park to provide a part 2/3/4/6 storey building incorporating a primary school and games area; public library; Council service centre; café; community work/office space, a new access road, car parking spaces; 412m ² of commercial/creative floorspace (B1/D1); 8 one bedroom and 30 two bedroom flats; associated landscaping and works to upgrade Giffin Square all on land between Giffin Street & Resolution Way, including former Minzell Works, Council offices, public toilets & car park	A	Under construction	Under construction	100% complete & operational	Information provided by LB Lewisham. Construction expected until 2017.	2016 & 2017: Cumulative 2023: Base case
Creekside Village East (Thanet Wharf), Copperas Street	Approx 220m northeast	DC/06/63352/X	Ampurius Nuhomes Investments Ltd	The demolition of existing buildings/structures on land bounded by Copperas Street, Deptford Creek and Creekside SE8 and the construction of 4 blocks of 9 to 22 storeys, to provide 11,466 m ² of commercial floorspace, including a nursery and healthcare centre and uses within Use Classes B1, A1, A3, A4 and D1 and 9,000 m ² of cultural/dance space, archive, exhibition areas and associated facilities for Trinity Laban and 430 residential units, underground car and cycle parking, open space, the reprofiling of the Creek walls and associated landscaping and Creekside walk.	C	Under construction	Under construction	100% complete & operational	ES states construction will take 36 months (3 years). LB of Lewisham have advised that construction will be completed in 2018/19.	2016 & 2017: Cumulative 2023: Base case
Greenwich Reach East	Approx 500m northeast	05/138 6/F	Greenwich Reach 2000 Ltd	Redevelopment comprising of 980 residential units class A uses, retail, food/drinks, class D1/D2 (non residential institution/assembly/leisure), B1 (business use), ancillary plant, servicing parking 712 cars works to extend/upgrade riverside walk, landscaping, alterations to vehicular/pedestrian access, highway layout, associated enabling work (schedule two dated 22/11/05).	B	100% complete & operational	100% complete & operational	100% complete & operational	No information available from planning application documentation. On the basis that the application has been permitted, it has been assumed that it will be built by Site Year 1 of construction.	Base case (all years)
Site of old Seagar Distillery and Norfolk House, 4-12 Deptford Bridge	Approx 500m south	DC/08/69448	Freshplant Ltd	The redevelopment of Seager Buildings Site, Deptford Bridge/Brookmill Road and the Norfolk House Site, Brookmill Road SE8, to provide a ground plus 26-storey residential tower, a part 5/part 6 storey building fronting Brookmill Road, a 5 storey stepped building rising to 11 storeys, a 3 storey courtyard building, two storey roof extension on Holland House fronting Deptford	A	100% complete & operational	100% complete & operational	100% complete & operational	Anticipated to be complete 2012/13 based on a 35 month construction period. Permission was granted in 2009.	Base case (all years)

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		2016 (Site Year 1 of construction)	2017 (peak construction traffic year)	2023 (Year 1 of operation)		
				Bridge and the retention of International House, comprising 207 private residential units, 96 affordable homes, 7 live/work units and a total of 4,697 m ² of commercial floorspace, including a café/restaurant, gymnasium, retail unit and art gallery, together with 60 basement car parking spaces, associated motor bike/scooter and 393 bicycle spaces and landscaping.						
Greenwich Industrial Estate (land bounded by Norman Road, Greenwich High Road and Waller Way, Greenwich)	Approx 500m southeast	11/027 1/F	Cathedral (Movement Greenwich)	Redevelopment of the site for a mixed use development comprising of 181 residential units, 358 student residential units, 1,332sqm of education/office floorspace (B1/D1), 1,382sqm health club (leisure (D2) floorspace), 11 incubator/start up business units totalling 635sqm, 200sqm extension to the rear of the Greenwich West Community Centre, a 360sqm nursery (DI), 480sqm of retail foodstore floorspace (AI) and 37sqm café/bike shop (AI/A3). A 104 bed 3 star hotel and a 30 room boutique hotel and associated restaurant (which includes external works to the existing North Pole public house) together with an onsite energy centre, improvements to the existing public realm at Waller Way and new public realm, public art and onsite landscaping. A total of 57 car parking spaces plus 2 car club spaces and 439 cycle spaces.	B	100% complete & operational	100% complete & operational	100% complete & operational	ES states two year construction programme. Assume completion by Site Year 1 of construction on this basis.	Base case (all years)
Convoys Wharf	Approx 700m northwest	DC/02/52533	Convoys Investment S.A R.L and News International	Revised outline application for the comprehensive redevelopment of Convoys Wharf to provide a mixed-use development of up to 445,200m ² comprising: up to 337,980m ² (3,514 units) residential (Classes C2 & C3) up to 19,100m ² employment space including up to 2,200m ² for 3 potential energy centres (Classes B1, live/work units & B8) wharf with associated vessel moorings (Class B2 & sui generis) (32,200m ²) up to 6,400m ² retail (Classes A1 & A2) up to 4,520m ² restaurants/cafes and drinking establishments (Classes A3 & A4) up to 15,000m ² community/non residential institutions and assembly and leisure (Class D1) up to 30,000m ² hotel (Class C1) up to 2,700m ² leisure (Class D2) a river bus facility 2,318 car parking spaces together with vehicular access from Grove Street and amended access arrangements from New King Street.	C	Phases 1 & 2 under construction Phase 3 not yet under construction	Phase 1, 2 & 3 – under construction	100% complete and operational	Information sourced from Convoys Wharf website: http://www.convoyswharf.com/appdocuments.html Phase 1 - The core area and adjoining residential blocks to east and south including works to the existing jetty and new water taxi jetty. Construction: 2013-2017 Phase 2 - The core area and adjoining residential blocks to north and west, the School, the Wharf and new jetty (Parcel F) and hotel. Construction: 2014-2019 Phase 3 - The Wharf-related and employment area, together with the remaining residential blocks. Construction: 2017- 2022	2016: Cumulative = Phases 1 & 2 2017: Cumulative = Phases 1, 2 and 3 2023: Base case (all phases)

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		2016 (Site Year 1 of construction)	2017 (peak construction traffic year)	2023 (Year 1 of operation)		
Bardsley Lane (land at Creek Road/Bardsley Lane, Greenwich)	Approx 850m northeast	05/122 2/F	Hyde Housing Ltd. and Andrew Thompson Standard Property Investment	Demolition of existing buildings & redevelopment to provide 106 residential units, A1, A2, A3 & A4 uses together with Class B1 & D1 uses, a nightclub (sui generis) in the basement area, basement parking provision & improvements to existing open space.	B	100% complete & operational	100% complete & operational	100% complete & operational	No information available from planning application documentation. On the basis that the application has been permitted, it has been assumed that it will be built by Site Year 1 of construction.	Base case (all years)
Land opposite North Greenwich Pier, Greenwich Peninsula	Approx 930m northeast	12/086 0/F 12/159 5/V	Skylon Flyer Ltd	12/0860F: Installation of a 35 metre high amusement attraction for a temporary period. 12/1595/V: Variation of condition 1 of planning permission dated 21/06/12 (ref: 12/0860/F) to extend the temporary time limit condition to 31 October 2012 in connection with the temporary installation of a 35 metre high amusement attraction.	B	100% complete & operational	100% complete & operational	100% complete & operational	Professional judgement – scale of development would suggest a construction period of max. one year. On this basis it is assumed to be complete/operational by Site Year 1 of construction.	Base case (all years)
Land at Stockwell Street and John Humphries House, Greenwich	Approx 1km east	11/022 6/F	University of Greenwich	Construction of a part 2/part 3/part 4 storey building with basement for Education use (D1) with ground floor Retail and Exhibition Space (all or any of use classes A1, A2, A3 and D1), and associated works.	A	100% complete & operational	100% complete & operational	100% complete & operational	Anticipated to be complete by 2014 following a 34 month construction period started in August 2011.	Base case (all years)
Heathside and Lethbridge Estate	Approx 1km southeast	DC/09/72554/X	Family Mosaic Housing / LB Lewisham	The redevelopment of the Heathside and Lethbridge Estates, Blackheath Hill and Lewisham Road, SE10 seeking outline planning permission (Phases 2-6) for up to 512 square metres of retail floorspace, 768 square metres of community floorspace, an energy centre and 1,054 residential units in buildings ranging from 3 to 17 storeys in height, together with car and cycle parking, associated highway infrastructure, public realm works and provision of open space and detailed planning permission (Phase 1) for the redevelopment of land fronting onto Blackheath Hill for 138 residential units in buildings ranging from 4 to 7 storeys in height, together with car and cycle parking, associated highway infrastructure, public realm works and provision of open space.	A	Under construction	Under construction	Under construction	LB of Lewisham have advised that construction will complete in 2023/24.	Cumulative (all years)

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

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