Thames Tideway Tunnel
Thames Water Utilities Limited

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

Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

Thames Tideway Tunnel
Thames Water Utilities Limited

Thames Water

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

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

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January 2013

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Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Errata

Section	Paragraph No.	Page No.	Errata / Clarification
Section 9 Noise and vibration	9.7.3	23	Incorrect reference to Elm Quay. Text should read “As Riverlight block F has a significant noise impact from the Heathwall Pumping Station development, the cumulative impact would be the same. There is a strong likelihood of a cumulative significant impact at Elm Quay and Embassy Gardens blocks A09 and A10, owing to the distance from the other sites”.

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Section 1: Introduction

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1 Introduction

1.1.1 This volume of the *Environmental Statement* of the Thames Tideway Tunnel project presents the results of the environmental impact assessment (EIA) of the proposed development at the Heathwall Pumping Station site.

1.1.2 The proposal at this site is to intercept the existing South West Storm Relief and Heathwall Pumping Station combined sewer overflows (CSOs), which currently discharge approximately 13 and 34 times in a typical year respectively. The total volume discharged from both CSOs is approximately 883,000m^3 in a typical year.

1.1.3 The site and environmental context are described in Section 2. The proposed development, comprising both the construction and operational phases, is described in Section 3. Those elements of the proposal for which development consent is sought are described followed by a description of the assumptions applied to the assessment of construction and operational effects. Finally in Section 3.6, the main alternatives which have been considered for this site are presented.

1.1.4 Sections 4 to 15 present the environmental assessments for each topic, which are presented alphabetically. The order of these topics and the structure of each assessment remains the same across different sites.

1.1.5 Figures and appendices for this site are appended separately (Vol 15 Heathwall Pumping Station figures and Vol 15 Heathwall Pumping Station appendices). In addition, there is a separate glossary and abbreviations document which explains technical terms used within this assessment.

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Section 2: Site context

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2 Site context

2.1.1 The proposed development site is located in the London Borough (LB) of Wandsworth. It comprises the Thames Water owned Heathwall Pumping Station and Middle Wharf which is designated as a safeguarded wharf. The site is defined by the limits of land to be acquired or used (LLAU) and covers an area of approximately 1.3 hectares. The site context and location is indicated in Vol 15 Figure 2.1.1 (see separate volume of figures).

2.1.2 The site is bounded to the north by the River Thames, to the east by open space with Elm Quay residential block beyond, to the south by Nine Elms Lane, and to the west by the Tideway Walk (Riverlight) development (under construction). Further to the west lies the Thames Tideway Tunnel Kirtling Street site. Vol 15 Plate 2.1.1 below provides an aerial view of the site. Photographs of the site and area are provided in Vol 15 Plate 2.1.2 and Vol 15 Plate 2.1.3.

Vol 15 Plate 2.1.1 Heathwall Pumping Station – aerial photograph

2.1.3 The northern half of the site is located within the River Thames and its foreshore. Within the landward section of the site there is mainly hardstanding, due to its current use as a Thames Water operational site and its former use as a concrete batching works, now cleared (Middle Wharf). The general pattern of existing land uses within and around the site is shown in Vol 15 Figure 2.1.2 (see separate volume of figures).

2.1.4 Existing access to the site is from Nine Elms Lane (A3205). The closest London Underground and mainline railway station is Vauxhall Underground station located approximately 950m walking distance to the northeast of the site. The Thames Path public right of way (PRoW) runs around the eastern (William Henry Walk), southern (Nine Elms Lane) and western boundaries (Tideway Walk) of the site.

Vol 15 Plate 2.1.2 Heathwall Pumping Station – view from River Thames

Vol 15 Plate 2.1.3 Heathwall Pumping Station – eastern section of Nine Elms Pier

2.1.5 There are a number of receptors in close proximity to the site and these include residential, commercial and recreational receptors as follows (approximate closest distant to the proposed site hoarding is given):

a. residential:

i Houseboats at Nine Elms Pier and Tideway Village - 30m west of the cofferdam

b. commercial:

i Battersea Barge restaurant/bar - 6m west of hoarding/cofferdam

c. recreational:

i River Thames - adjacent to north of the site

ii Thames Path National Trail - adjacent to east and south of the site.

2.1.6 Environmental designations for the site and immediate surrounds are shown in Vol 15 Figure 2.1.3 (see separate volume of figures).

2.1.7 The Wandsworth air quality management area (AQMA) encompasses the site and is declared for nitrogen dioxide (NO_2) and particulate matter (PM_{10}).

2.1.8 Part of the site falls within the River Thames and Tidal Tributaries Site of Importance for Nature Conservation (SINC) (Metropolitan level). There are no other nature conservation designations within or adjacent to the site.

2.1.9 There are no listed buildings within or in the immediate vicinity of the site.

2.1.10 The site does not lie within and is not adjacent to a Conservation Area. The nearest conservation areas are located on the opposite side of the River Thames. These are: Dolphin Square, Millbank and Pimlico Conservation Areas. The site also lies within the Wandsworth Archaeological Priority Area.

2.1.11 There are no tree preservation orders (TPOs) in effect on or adjacent to the site. However, there are two mature trees immediately adjacent to the west of the site.

2.1.12 Land quality at the site is influenced by a number of historical on-site activities, including: a lime and whiting works, and as an operational wharf (including use as a concrete batching works). Offsite activities which might have influenced the land quality on-site include the gasworks (Nine Elms) located to the south of the site and the wharves.

2.1.13 The local geology is made up of superficial geology and Made Ground, River Terrace Deposits, London clay, Lambeth group and Thanet sand.

2.1.14 As shown in Vol 15 Plate 2.1.2, the site is located partially within the River Thames foreshore. It is therefore subject to frequent inundation and classified as functional floodplain (Flood Zone 3b, water must flow or be stored in times of flood).

2.1.15 The Thames Tideway Tunnel project Kirtling Street site is approximately 200m to the west of the Heathwall Pumping Station site.

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Volume 15: Heathwall Pumping Station site assessment

Section 3: Proposed development

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3 Proposed development

3.1 Overview

3.1.1 The proposed development at Heathwall Pumping Station would intercept the existing Heathwall Pumping Station and Southwest Storm Relief CSOs. A CSO drop shaft would be constructed, and from the base of the shaft there would be a short underground connection tunnel which would join up with the main tunnel. There would also be an interception chamber, CSO overflow structure, hydraulic structures, chambers with access covers and other structures including culverts, pipes and ducts to modify, connect, control, ventilate and intercept flows from the CSOs.

3.1.2 The geographical extent of the proposals for which the development consent is sought is defined by the limits of land to be acquired or used (LLAU).

3.1.3 This section of the assessment provides a description of the proposed development. The defined development for which consent is sought is described in Section 3.2. In Section 3.3, assumptions are presented on how the development at this site is likely to be constructed and include the assumed programme and typical construction activities. Section 3.4 sets out operational assumptions in terms of operational structures and typical maintenance regime. These construction and operational assumptions underpin the assessment.

3.1.4 Other developments may become operational in advance of or during the Thames Tideway Tunnel project thereby changing the baseline conditions. In order to undertake an accurate assessment it is necessary to compare the predicted situation with the Thames Tideway Tunnel project in place with this future baseline conditions (‘base case’) (rather than comparing it with the current conditions). In addition, other developments may be under construction at the same time as construction or operation of the Thames Tideway Tunnel project and this could lead to cumulative effects. Information regarding schemes included in the base case and in the cumulative assessment is summarised in Section 3.5 with details included in Vol 15 Appendix N. The methodology for identifying these schemes is explained in Volume 2 Section 3.8. Finally, Section 3.6 describes how the development at this site has evolved and any alternatives considered.

3.2 Defined project

3.2.1 This section identifies only those elements of the proposals for which consent is sought and so those which can be regarded, subject to approval, as being ‘certain’ or nearly so (eg, indicative locations).

3.2.2 Vol 15 Table 3.2.1 below sets out those elements of the project for which consent is sought and which have been assessed.

Vol 15 Table 3.2.1 Heathwall Pumping Station – plans and documents defining the proposed development

Document / plan title	Status	Location
Proposed schedule of works	For approval	Schedule 1 of *The Draft Thames Water Utilities Limited (Thames Tideway Tunnel) Development Consent Order 201[ ] (Draft DCO)* (and extracts below)
Site works parameter plan	For approval	Vol 15 Heathwall Pumping Station figures – Section 1
Demolition and site clearance plan	For approval	Vol 15 Heathwall Pumping Station figures – Section 1
Access plan	For approval	Vol 15 Heathwall Pumping Station figures – Section 1
Proposed landscape plan	Indicative (save for the layout of above-ground structures which is Illustrative)	Vol 15 Heathwall Pumping Station figures – Section 1
Typical river wall design intent	Indicative	Vol 15 Heathwall Pumping Station figures – Section 1
Fencing and gate design intent	Indicative	Vol 15 Heathwall Pumping Station figures – Section 1
Design Principles: Generic	For approval	*Design Principles* report Section 3 (see Vol 1 Appendix B)
Design Principles: Site Specific principles (Heathwall Pumping Station)	For approval	*Design Principles* report Section 4.12 (see Vol 1 Appendix B)
Code of Construction Practice (CoCP) Part A: General Requirements	For approval	*CoCP* Part A (see Vol 1 Appendix A)

Document / plan title	Status	Location
Code of Construction Practice (CoCP) Part B: Site-specific requirements (Heathwall Pumping Station)	For approval	*CoCP* Part B Heathwall Pumping Station (see Vol 1 Appendix A)

Description of the proposed works

3.2.3 Schedule 1 of the *Draft DCO* describes the proposed works for which development consent is sought. The schedule describes the main tunnel, connection tunnels and also the works which would be required at each of the proposed sites within the project. This includes the works comprising the nationally significant infrastructure project (NSIP) and associated development (which are described in Part 1 of Schedule1) and ancillary works (which are described in Part 2 of Schedule 1).

3.2.4 The following sections provide a description of the proposed works at this site under three headings: Nationally significant infrastructure project, Associated development and Ancillary works. The description of the proposed works has been taken from Schedule 1 to the *Draft DCO* and the codes given for the works are those given within that schedule.

3.2.5 In accordance with the *Draft DCO*, all distances, directions and lengths referred to are approximate. All distances for scheduled linear works referred to are measured along the centre line of the limit of deviation for that work. Internal diameters for tunnels and shafts are the approximate internal dimensions after the construction of a tunnel lining. Unless otherwise stated, depths are specified to invert level and are measured from the proposed final ground level.

Nationally significant infrastructure project

3.2.6 The proposed structures and works required at this site which comprise the nationally significant infrastructure project are as follows:

a. **Work No. 14a:** Heathwall Pumping Station CSO drop shaft – A shaft with an internal diameter of 16 metres and a depth (to invert level) of 46 metres.

b. **Work No. 14b:** Heathwall / South West Storm Relief connection tunnel - A tunnel between Heathwall Pumping Station CSO drop shaft (Work No. 14a) and the main tunnel (east central) (Work No. 1c)

Associated development

3.2.7 The proposed structures and works required at this site which comprise associated development are as follows:

a. **Work No. 14c:** Heathwall Pumping Station associated development - Works to intercept and divert flow from the Heathwall Pumping Station CSO and South West Storm Relief CSO to the Heathwall Pumping Station CSO drop shaft (Work No. 14a) and into the Heathwall / South

West Storm Relief connection tunnel (Work No. 14b), including the following above and below ground works and structures:

i dredging and construction of a cofferdam including the placement of fill material, connection to the existing river wall and construction of a campshed

ii works to protect existing river wall to the east and west of Work No. 14(c)(i) and works to strengthen the existing Middle Wharf jetty partial demolition of existing river wall and construction of new river wall including connection to and alteration of the existing river wall to reclaim land and to enclose Work No. 14c(iii), (iv) and (vi) and scour protection works, relocation of [existing CSO], and new CSO outfall apron

iii construction of interception chambers, hydraulic structures, chambers with access covers and other structures including culverts, pipes and ducts to modify, connect, control, ventilate, de-aerate, and intercept flow

iv construction of structures for air management plant and equipment including filters and ventilation columns and associated below ground ducts and chambers

v provision of local control pillar

vi construction of pits, chambers, ducts and pipes for cables, hydraulic pipelines, utility connections, utility diversions and drainage, including facilities for drainage attenuation

vii temporary relocation of the Battersea Barge to the west including provision of associated mooring and access

viii alterations to existing accesses on Nine Elms Lane and subsequent reinstatement to original highway layout.

3.2.8 The maximum heights of above-ground structures, which are for approval and shown on the Site works parameter plan (see separate volume of figures – Section 1) are as follows:

a. ventilation column(s) serving the CSO drop shaft = 8m (with minimum 4m)

b. ventilation column(s) serving the SWSR interception chamber = 8m (with minimum 4m)

c. ventilation column(s) serving the Heathwall CSO interception chamber = 6m

d. South West Storm Relief interception and flap valve chamber = 1.5m.

3.2.9 In addition, further works are required at this site that constitute associated development within the meaning of section 115(2) of the Planning Act 2008. These comprise:

a. establishment of temporary construction areas at each works site to include, as necessary, site hoardings/means of enclosure, demolition (including of existing walls, fences, planters, and other buildings and other above and below ground structures), provision of services, including telecommunications, water and power supplies (including substations) including means of enclosure, and ground preparation works including land remediation and groundwater de-watering

b. provision of welfare/office accommodation, workshops and stores, storage and handling areas, facilities for and equipment for processing of excavated materials, treatment enclosures and other temporary facilities, plant, cranes, machinery, temporary bridges and accesses, and any other temporary works required

c. in connection with Work Nos. 5, 6, [8] , 11, 12, 13, 14, 15, 16, 17, 19, [23], 24 [and 26] the provision of temporary moorings (including dolphins) and other equipment and facilities for temporary use by barges, pontoons and other floating structures and apparatus (including as necessary piling for support of such structures) for use in construction of those works, and works for the strengthening of river walls and other flood protection defences

d. temporary removal of coach and car parking bays and creation of temporary replacement coach and car-parking as required and temporary footpath diversions

e. restoration of temporary construction areas, works to restore and make safe temporary work sites and work areas, including (as necessary) removal of hardstanding areas, temporary structures and other temporary works and works to re-establish original ground levels

f. works to trees

g. works to create temporary or permanent landscaping, including drainage and flood compensation, means of enclosure, and reinstatement / replacement of, or construction of, boundary walls and fences including gates

h. formation of construction vehicle accesses and provision of temporary gated or other site accesses and other works to streets

i. diversions (both temporary and permanent) of existing traffic and pedestrian access routes and subsequent reinstatement of existing routes, and works to create permissive rights of way

j. modifications of existing accesses, railings and pedestrian accesses

k. provision of construction traffic signage

l. relocation of existing bus stops and provision of temporary bus lay-bys

m. construction of new permanent moorings and piers, including access brows, bank seats, gangways and means of access

n. permanent and temporary works for the benefit or protection of land or structures affected by the authorised project (including protective works to buildings and other structures, and works for the monitoring of buildings and structures)

o. temporary landing places, moorings or other means of accommodating vessels in the construction and/or maintenance of the authorised project

p. provision of buoys, beacons, fenders and other navigational warning or ship impact protection works

q. such other works as may be necessary or expedient for the purposes of or in connection with the construction of the authorised project which do not give rise to any materially new or materially different environmental effects from those assessed in the Environmental Statement

3.2.10 The works defined by bullets d, k and l (in the list above) are not considered likely to be applicable to the works proposed at this site.

Ancillary works

3.2.11 These works are not 'development' as defined in section 32 of the Act, they do however form part of the Thames Tideway Tunnel project for which development consent will be sought and are included within Schedule 1 to the *Draft DCO*.

3.2.12 The following ancillary works are set out in Schedule 1 to the *Draft DCO*:

a. works within the existing sewers, chambers and culverts and other structures that comprise the existing sewerage network for the purposes of enabling the authorised project, including reconfiguring, modifying, altering, repairing, strengthening or reinstating the existing network

b. works within existing pumping stations including structural alterations to the interior fabric of the pumping station(s), works to reconfigure existing pipework, provision of new pipework, new penstock valves and associated equipment, modification of existing electrical, mechanical and control equipment, and installation or provision of new electrical, mechanical and control equipment

c. installation of electrical, mechanical and control equipment in other buildings and kiosks and modification to existing electrical, mechanical and control equipment in such buildings and kiosks

d. installation of pumps in chambers and buildings

e. works to trees and landscaping works not comprising development

f. works associated with monitoring of buildings and structures

g. provision of construction traffic signage

h. the relocation of boats/vessels

Design principles

3.2.13 The design principles for the project have been developed with stakeholders and set the parameters that must be met in the final detailed design of the above-ground structures and spaces associated with the project. The principles apply only to the operational phase of the project (ie, permanent structures).

3.2.14 The generic principles include principles for the integration of functional components and also principles for heritage, in-river structures, landscape, lighting and site drainage. All of the generic principles, with the exception of the heritage principles, are applicable at this site.

3.2.15 The design principles form an integral part of the project and are assumed to be implemented within the design of the operational development. Where individual principles are relevant to a particular topic, this is indicated within the relevant assessments.

3.2.16 The *Design Principles* report is provided in Vol 1 Appendix B.

Site features and landscaping

3.2.17 Upon completion of the works, the Proposed landscaping plan (see separate volume of figures – Section 1) shows the proposed reinstatement and landscape at this site, taking account of the design principles (see *Design Principles* report Section 4.12). Elements shown in the Proposed landscape plan (save for the layout of above-ground structures) are indicative and therefore have been assessed as part of the EIA for this site. The layout of the above-ground structures is illustrative, and has not been assessed.

3.2.18 Indicative site and landscape features include:

a. a new fence along the existing western wall

b. minor modifications to the landscaping of adjacent Riverlight development to join up with the Thames Path

c. sliding gates to shut off the stretch of Thames Path that would pass across the site when operational access to foreshore structure is required

d. timber benches within foreshore structure

e. secure gates to provide access to foreshore structure from Heathwall Pumping Station

f. vertical timber fenders on the foreshore structure

g. three ventilation column(s), the possible location of these structures is defined by the zone(s) within the site works parameters (see separate volume of figures)

h. two tone (dark and silver grey) granite paving with 10mm steel strip between types would be provided within foreshore structure the realigned Thames Path

i. two local control pillars, the possible location of these structures is defined by the zone(s) within the site works parameters (see separate volumes of figures)

j. passive filter breather unit approximately 1m high

k. boundary marker strip in footpath at edge of safeguarded path

l. existing pedestrian access to jetty to be removed and new pedestrian maintenance access provided

m. existing river wall to be retained, cleaned and made good

n. existing wall and greenery along eastern boundary of Middle Wharf to be cut back to form a new opening for the Thames Path

o. new brick wall along eastern boundary of Thames Water compound

p. raised interception and tidal flap chamber

q. railings around raised chambers

r. main electrical and control equipment would be located in the exiting pumping station building

s. surface within Thames Water compound would be regraded down to road level

t. the perimeter brick wall along Nine Elms Lane would be cleaned and new paving provided on Nine Elms Lane

u. three semi-mature London plane trees would be provided along Nine Elms Lane.

Code of Construction Practice

3.2.19 All works would be undertaken in accordance with the *Code of Construction Practice (CoCP)*. The *CoCP* sets out a series of measures to protect the environment and limit disturbance from construction activities as far as reasonably practicable. These measures would be applied throughout the construction process at this site, and would be the responsibility of the contractor to implement. The *CoCP* is provided in Vol 1 Appendix A and comprises two parts, Part A and Part B. Part A presents measures which are applicable at all sites across the project and Part B defines measures which are only applicable at individual sites.

3.2.20 The *CoCP* forms an integral part of the project and all of the measures contained therein are assumed to be in place during the construction process described in Section 3.3 below. The measures are not described within the Section 3.3 although further details on the measures within the *CoCP* Part B Heathwall Pumping Station are given within the relevant assessments.

3.3 Construction assumptions

3.3.1 This section describes the approach to construction which has been assumed for the purposes of the EIA. The construction programme, layouts and working methods are illustrative and do not form part of the project for which consent is sought.

3.3.2 Although the programme, layouts and working methods described are illustrative, they represent what is considered to be the likely approach, given the existing site constraints, the adjacent land uses and the construction requirements. This section describes the main activities with the focus on those that are relevant for the assessment of environmental effects.

3.3.3 The assumed construction programme is described first, followed by typical construction activities.

3.3.4 It is also assumed that, where the appropriate powers do not form part of the Development Consent Order, further consents may be required before certain construction activities are progressed. These could include various consents issued by the Environment Agency (including flood defence consents, abstraction licenses and discharge consents) and the Port of London Authority (PLA) (including river works licenses) as appropriate.

Assumed construction programme and working hours

3.3.5 Construction at this site would be likely to commence in 2017 (Site Year 1) and be completed by 2020 (Site Year 3). The infrastructure at this site would only become operational in 2023 when the Thames Tideway Tunnel project as a whole becomes operational.

3.3.6 Construction at Heathwall Pumping Station is anticipated to take approximately three years and would involve the following steps (with some overlaps):

a. Site Year 1 – site setup (approximately five months)

b. Site Year 1 – drop shaft construction (approximately eight months)

c. Site Year 1 to 2 - tunnelling (approximately four months)

d. Site Years 2 to 3– construction of other structures (approximately 22 months)

e. Site Year 3 – completion of works and site restoration (approximately six months).

3.3.7 This site would adhere to standard and continuous working hours for various phases and activities as set out in the *CoCP* Part A and Part B (Section 4). Standard working hours would be applied to all of the above phases of construction work apart from elements of tunnelling as described below.

3.3.8 It has been assumed that continuous working hours would be required during the construction of the short connection tunnel, mainly below-ground, for a duration of approximately four months. However, it is noted that there would be periods of activity within this phase where continuous 24 hour working would not be required.

3.3.9 During these periods only those activities directly connected with the task would be permitted within the varied hours.

Typical construction activities

3.3.10 Vol 15 Table 3.3.1 identifies the construction phasing plans used for the assessment of construction effects. These plans have been prepared to illustrate possible site layouts for the principal construction phases and relevant activities.

Vol 15 Table 3.3.1 Heathwall Pumping Station – construction phase plans

Plan title	Activities	Status	Location
Construction phases – phase 1	Site set up, drop shaft construction and tunnelling.	Illustrative	Vol 15 Heathwall Pumping Station figures – Section 1
Construction phases – phase 2	Construction of other structures.	Illustrative	Vol 15 Heathwall Pumping Station figures – Section 1
Construction phases – phase 3	Site demobilisation.	Illustrative	Vol 15 Heathwall Pumping Station figures – Section 1

3.3.11 The methods, order and timing of the construction work outlined herewith are illustrative, but representative of a practical method to construct the works and suitable upon which to base the assessment.

3.3.12 The following construction related activities would be required:

a. site setup
b. shaft construction
c. tunnel construction
d. construction of other structures
e. completion of works and restoration
f. excavated materials and waste
g. access and movement.

Site setup

3.3.13 The boundary wall between the Thames Water compound and Middle Wharf would need to be demolished and the Middle Wharf site cleared.

3.3.14 Prior to any works commencing the site boundary would be established and secured and appropriate hoardings provided. Welfare and office facilities would also be set up.

3.3.15 The extent of demolition and site clearance works are shown on the Demolition and site clearance drawing (see separate volume of figures – Section 1).

3.3.16 Other initial site works would include:

a. traffic management and access
b. utility diversions.

3.3.17 As the site is within the River Thames foreshore a cofferdam would be constructed. The piles used to form the temporary cofferdam would be driven into the impermeable clays from a jack-up barge. The top level of the outer wall of the cofferdam would be set to existing flood defence level to maintain the level of defence during construction.

3.3.18 A concrete campshed would be constructed along the northern and/or eastern face of the temporary cofferdam for barges to sit safely on the river bed. The area of the campshed has been assumed to be approximately $400m^2$. It is assumed that no dredging would be required at this site, although it is likely that there would be some disturbance to the riverbed during construction of the cofferdam and campshed.

3.3.19 For the purpose of this assessment it is assumed that the piles would be driven using vibration piling techniques although the intention would be to seek to maximise the use of pressed piling techniques where reasonably practicable.

3.3.20 The bulk of the granular material to fill the cofferdam would be delivered to site by barges and unloaded utilising a long reach excavator working within the cofferdam.

3.3.21 It is assumed for the assessment that the majority of foreshore material within the temporary cofferdams would remain in situ. For structural reasons, soft material located adjacent to the perimeter of the temporary cofferdams and adjacent to the river wall would be removed. The soft material includes silt, peat and other materials. Removal of this material would ensure that any settlement of the cofferdam fill material does not adversely affect the ties between the walls of the twin walled temporary cofferdam leading to structural difficulties. All soft material within permanent cofferdams would be removed to ensure sound foundations for permanent construction.

3.3.22 The exact extent and depth of the foreshore deposits to be removed would be informed by geotechnical investigations. Areas of removed material would be filled with gravel similar to the existing bed material. Cofferdam fill material would then be placed onto the foreshore on top of a geotextile layer. Suitable sized plant would be utilised to reduce potential load impacts on the foreshore. A drain sump would be maintained within the filled cofferdam to enable any water entering the cofferdam to be pumped back to river.

3.3.23 The existing Heathwall Pumping Station outfall culvert would be abandoned and a new outfall apron constructed prior to reinstatement of the foreshore.

3.3.24 Monitoring of potential scour would be undertaken during the temporary construction works. The need for scour protection to the cofferdam would be identified using the approach set out in the *Scour Monitoring and Mitigation Strategy* (see Vol 3 Appendix L.4).

3.3.25 Internal site roads, plant and material storage areas, offices, welfare and workshops would be established on the cofferdam.

Shaft construction

3.3.26 The CSO drop shaft is assessed as a segmental shaft and shaft construction would utilise caisson and underpinning techniques. The drop shaft would initially be sunk as a caisson and excavation would be by excavator with telescopic grab. A constant pressure would be applied to the rams and the drop shaft evenly excavated. When the rams reach full extension the rams would be retracted and the next ring built. Once the drop shaft enters the London Clay, the water contained within the drop shaft would be pumped out and underpinning techniques would be utilised.

3.3.27 Excavated material would be put into skips within the drop shaft working area and hoisted by crawler crane from the drop shaft and deposited in a suitable storage area. After any required treatment, the material would be loaded onto a barge for transport off site by river.

3.3.28 De-watering wells would be required to provide depressurisation of the Lambeth Group below the drop shaft during construction. Approval would be sought from the EA so that extracted ground water can be discharged directly into the River Thames. Extracted water would be sampled on a regular basis to check water quality.

3.3.29 A steel reinforced concrete base plug would be formed at the base of the shaft.

3.3.30 Prior to tunnelling works commencing a portal would be formed in the drop shaft lining. The drop shaft segments at the tunnel eye would be broken out and the eye concreted to stabilise the face.

Tunnel construction

3.3.31 A short connection tunnel of approximately 4.0m internal diameter would be required to connect the CSO drop shaft to the main tunnel. The connection tunnel would be approximately 56m long.

3.3.1 Sprayed concrete lining (SCL) techniques would be used to construct the connection tunnel. The connection tunnel would be progressively excavated and the SCL tunnel lining built up in even layers until the required profile is achieved. Dewatering and ground treatment techniques would be required for tunnel construction.

3.3.2 The crawler crane used for the drop shaft construction would also be used to service the drop shaft during the connection tunnel construction.

3.3.3 A heavy duty false work system would be assembled in the drop shaft to provide a working platform to construct this connection tunnel.

Secondary lining

3.3.4 Secondary lining is an additional layer of concrete placed against the inside of a tunnel's primary concrete segmental lining for watertightness and to improve the overall structural durability. For the purposes of assessment, it has been assumed that both the short connection tunnel and the shaft would have a reinforced concrete secondary lining.

3.3.5 The secondary lining of the short connection tunnel would be constructed by installing steel reinforcement, erecting a cylindrical shutter within a short length of tunnel and pumping concrete into the gap between the shutter and the primary lining. Once the concrete has hardened sufficiently, the shutters would be removed and erected in the next section of tunnel.

3.3.6 It is assumed that the lining of the CSO drop shaft would be made of reinforced concrete placed inside the shaft's primary support. The steel reinforcement would be assembled in sections and a shutter would be used to cast the concrete against. The shutter would be assembled at the bottom of the shaft and sections of reinforcement installed and lining cast progressively up the drop shaft.

3.3.7 Any reinforced concrete structures internal to the CSO drop shaft and the roof slab would be constructed in a similar manner progressively from the shaft bottom. In some cases precast concrete members may be used.

Construction of other structures

3.3.8 An interception and valve chamber would be built to intercept the existing Heathwall Pumping Station CSO. The existing outfall is a twin box concrete structure within the foreshore. The interception chamber would be constructed over the existing outfall in suitable stages with the flows being maintained whilst sections are blocked off prior to construction and broken out during piling and excavation works.

3.3.9 A 10m internal diameter shaft, which forms part of the Heathwall Pumping Station interception structure, would be constructed adjacent to the outfall within the temporary cofferdam area in a similar manner to the CSO drop shaft.

3.3.10 Secant piles would be driven to construct the valve chamber walls and connect to the shaft within the cofferdam area.

3.3.11 Localised submersible pumps within the chamber would be utilised to manage ground water ingress. The pumps would discharge to the river or existing sewers after being treated through a settlement system.

3.3.12 The connection culvert from the interception chamber to the CSO drop shaft would also be constructed using SCL techniques in a similar manner to the connection tunnel. The tunnel would be fully within the London Clay formation and hence neither ground treatment nor dewatering would be required.

3.3.13 The interception chamber to the Southwest Storm Relief chamber would be constructed in a similar manner.

3.3.14 The cover slab to the existing outfall chamber on the Southwest Storm Relief sewer would be extended to approximately 1.5m above ground level to raise it to flood defence level and would be constructed in reinforced concrete.

3.3.15 Air management structures comprising an underground air treatment chamber and associated ducts and ventilation columns would also be built and commissioned.

3.3.16 Electrical and control equipment for operating the penstocks would be positioned within the existing Heathwall Pumping Station building, with local control pillars installed outside the building.

3.3.17 Mechanical and electrical equipment would be installed, tested and commissioned.

Completion of works and site restoration

3.3.18 On completion of the construction (outlined above) the new river wall would be finished prior to removal of the temporary cofferdam to ensure flood protection.

3.3.19 Once the cofferdam fill is removed, the geotextile layer would be removed and the area of the foreshore where permanent scour protection is required would be excavated by approximately 1.5m by an excavator.

3.3.20 It is assumed for the assessment that permanent scour protection and new outfall apron would consist of loose large stone placed just below foreshore level. The size and type of the stone is to be defined. It is assumed therefore that a 1m depth of stone would be placed up to 0.5m below the existing foreshore level within the zone indicated on the Site works parameter plan (see separate volume of figures – Section 1). This permanent protection would be within the area of the temporary cofferdam.

3.3.21 Once the permanent scour protection is in place, the bed would be reinstated to match the existing river bed conditions as required and the sheet piling forming the temporary cofferdam would then be removed by pulling. Material excavated would be disposed of in accordance with the project's waste management procedure.

3.3.22 Once the main elements of construction are completed, the final landscaping works would be undertaken including final treatments and surfaces, planting and installation of street furniture. Final treatments to the river wall would be completed prior to removal of the temporary cofferdam.

3.3.23 Testing and commissioning would also be undertaken once construction is complete. For the purposes of this assessment, completion of the commissioning stage represents the end of construction and the commencement of the operational phase.

Excavated materials and waste

3.3.24 The construction activities described above and in particular the construction of the CSO drop shaft and the subsequent tunnelling would generate a large volume of excavated material which would require removal. This is estimated at 40,000 tonnes, the main elements of which would comprise approximately 6, 500 tonnes of imported fill (which would require later removal), 22,000 tonnes of London Clay, 5,000 tonnes of Lambeth group and 6,000 tonnes of Made Ground.

3.3.25 In addition, it is estimated that approximately 880 tonnes of construction waste would be generated including 300 tonnes of imported fill and 430 tonnes of concrete.

3.3.26 Excavated materials and construction wastes would be exported from the site in accordance with the *Transport Strategy* which accompanies the application for development consent (the 'application') (see Access and movement section below).

Access and movement

3.3.27 For the purposes of the assessment a single trip to or from the site is referred to as a 'movement', while two trips, one to and one from the site, are referred to as a 'lorry' or a 'barge'.

3.3.28 The *Transport Strategy* which accompanies the application requires that the importation of granular fill for the formation of the temporary working area and the subsequent removal of the fill would be by barge. The removal of all drop shaft excavation material would also be by barge. The assessment assumed that 90% of these materials would be taken by river, with the residual 10% transported by road, to account for periods where river transport is not available or the material is unsuitable for transport by barge.

3.3.29 The highest barge movements would occur during cofferdam construction. Peak daily barge numbers, averaged over a one month period, would be two barges per day, equivalent to four barge movements. It is estimated that total barge numbers for this site would be 137, equivalent to 274 barge movements over the construction period.

3.3.30 Barge numbers are based upon an assessed barge size of 350T.

3.3.31 Barges would sit on campsheds during periods of low tide.

3.3.32 The tug dwell time for this site is assessed as being 20 minutes.

3.3.33 Peak vehicle movements would be associated with specific site activities. The highest lorry movements at the site would occur during cofferdam construction. The peak daily vehicle numbers at this time, averaged over a one month period, would be 18 HGV lorries, equivalent to 36 movements per day. It is estimated that total vehicle numbers for this site would be in the order of 4,200 HGV lorries, equivalent to 8,400 movements over the construction period.

3.3.34 The site would be serviced via two existing accesses off Nine Elms Lane which is a Transport for London Route Network (TLRN). Both require widening and dropped kerbs around the eastern access would also need extending to provide sufficient turning space for larger vehicles. Gates at the western access would be set back to allow HGVs to pull into the site off the road without causing obstructions.

3.3.35 A *Traffic management plan* would be develop for the site, produced, coordinated and implemented by the contractor.

3.3.36 A *Draft Project Framework Travel Plan*, which accompanies the application, has been produced setting out the requirements and guidelines for the site-specific *Travel plans* to be developed for the contractor.

3.4 Operational assumptions

3.4.1 This section provides details of the assumptions which have been made for the operational phase for the purposes of the EIA. Unless otherwise also listed in Section 3.2, the details given are illustrative and do not form part of the project for which consent is sought.

3.4.2 The details given are considered to represent the likely approach, given the site constraints, the adjacent land uses and the operational requirements. This section describes only the main operational structures and activities with the focus on those that are relevant for the assessment of environmental effects.

3.4.3 The operational structures are described first, followed by the assumed maintenance regime.

3.4.4 Once developed the project would divert the majority of current CSO discharges via the new CSO drop shaft and short connection tunnel to the main tunnel for transfer to and treatment at Beckton Sewage Treatment Works. The number of CSO discharges would be reduced from both CSOs. The South West Storm Relief CSO would reduce from13 spill events to approximately one spill event per typical year at an average rate of 3,900m^3 per year. The Heathwall Pumping Station CSO would reduce from 34 spill events to four spill events per typical year at an average rate of 64,000m^3.

Operational structures

3.4.5 For the purposes of the application, each of the main operational structures is shown as being located within a defined zone, in which the structure would be located. The operational structures listed within the proposed schedule of works description in Section 3.2 along with the relevant plans, form part of the proposed development for consent. The defined zones for the structures are shown on the Site works parameter plan (see separate volume of figures – Section 1).

3.4.6 The heights of the main ventilation columns and the South West Storm Relief Sewer interception and flap valve chamber are defined and also form part of the project for consent (see Section 3.2). The following text provides additional clarification on the assumed form, purpose, function and working of these and other structures where this is considered helpful to the reader.

3.4.7 The assessment for each of the environmental topics has been based on the most appropriate dimensions and siting of the structures to ensure the assessment is robust. For example, the lower height for the ventilation column would typically generate higher odour impacts than a higher height and so the lower height limit has been modelled in the assessment. For other topics such as townscape, the upper height may be more important and has been assessed. The approach that has been adopted in this regard is explained within each topic assessment section, where necessary.

3.4.8 The approximate dimensions provided for underground structures are internal dimensions which are determined by the hydraulic requirements at particular sites.

3.4.9 Once constructed and operational the structures listed in the following sections would remain on site.

Shaft

3.4.10 The location, diameter and depth of the CSO drop shaft are described in Section 3.2.

3.4.11 The CSO drop shaft would be off-line from the main tunnel and located on the land within Middle Wharf.

3.4.12 The drop shaft would be finished off at the existing ground level and there would be covers on the top of the shaft to allow access for inspection and maintenance.

Chambers and culverts

3.4.13 There would be two interception and valve chamber structures. One is to intercept the Heathwall Pumping Station CSO and one is to intercept the Southwest Storm Relief CSO.

3.4.14 The Heathwall Pumping Station interception and valve chamber would be built within a new structure within the foreshore, in front of the pumping station and would be enclosed within a new section of river wall, built up to the level of the existing, adjacent river wall. The structures would be finished at the new ground level and there would be covers on top of the chambers to allow access and inspection. A connection culvert would connect the interception chamber to the CSO drop shaft. This would be below-ground level and accessible from the chambers at each end.

3.4.15 The Southwest Storm Relief CSO interception and valve chambers would be built to the east of the existing pumping station building, on and adjacent to existing chambers on the sewer. The top of the chambers would be set at approximately 1.5m above existing ground level and there would be covers on the top of the chamber to allow access for inspection and maintenance.

River wall

3.4.16 The location of the new river wall is defined in Section 3.2. It would be constructed along the front of the new foreshore structure, built to the flood defence level and tied in with existing flood defences at both ends.

Air management structures

3.4.17 The heights and locations of above-ground air management structures, which comprise the ventilation columns, are defined in Section 3.2. One approximately 1.2m internal diameter ventilation column would be located close to the South West Storm Relief interception chamber.

3.4.18 A second approximately 0.6m diameter ventilation column would be located on the interception chamber to vent the existing South West Storm Relief chamber. This would replace the existing ventilation structure.

3.4.19 A third approximately 0.225m diameter ventilation column would be positioned against the transformer building. This would vent the different sections of the Heathwall Pumping Station valve chambers and would be connected to the chambers by an underground duct.

3.4.20 The Heathwall Pumping Station interception chamber would have an approximately 500mm diameter and 1m tall tank breather vent located close to the transformer building within the Thames Water compound. This would treat any small quantities of air which may be released from the Heathwall Pumping Station interception chamber.

3.4.21 Below-ground structures would contain air treatment filters and connect the ventilation columns to the structures that they are ventilating. These would have ground level covers to allow access and inspection.

Electrical and control kiosk

3.4.22 All electrical and hydraulic control equipment would be housed inside the existing Heathwall Pumping Station building. Two local control pillars would be located outside the pumping station to allow an operator to control the below-ground equipment with a line of sight to the relevant chambers. One would be located close to the Heathwall Pumping Station interception structure and the other close to the CSO drop shaft.

Permanent restoration and landscaping

3.4.23 The indicative landscaping at this site is described in Section 3.2 and presented in the Proposed landscape plan (see separate volume of figures – Section 1).

3.4.24 The area around the CSO drop shaft at Middle Wharf would be finished as hardstanding to allow crane access to the covers on top of the drop shaft. Temporary security fencing would be installed when the area is used for shaft access.

3.4.25 An existing chamber on the South West Storm Relief sewer and the adjacent valve chamber would be raised approximately 1.5m above ground level. The remaining area around this structure would be returned to hardstanding to provide operational access.

3.4.26 Access to the operational structures within the pumping station site would be via the existing Thames Water access points off Nine Elms Lane.

3.4.27 Access to the CSO drop shaft at Middle Wharf could either be through a gate in the boundary wall between Heathwall Pumping Station and Middle Wharf or off Nine Elms direct using one of Middle Wharf's two access points.

3.4.28 The Thames Path would be re-routed along the riverside through Middle Wharf and in front of Heathwall Pumping Station. There would be access gates at each end to temporarily close off the path when operational access is required either through Middle Wharf or to the interception structure in front of Heathwall Pumping Station. A diversion via Nine Elms Lane would be clearly signposted when the wharf/foreshore structure is closed.

Typical maintenance regime

3.4.29 A light commercial vehicle would undertake three to six monthly maintenance works. This would be carried out during normal working hours and would take approximately half a day. There would be no aerial lighting. Additionally, once every ten years, more significant maintenance work would be carried out. Vehicular requirements for these visits would include two mobile cranes and associated support vehicles and equipment.

3.5 Base case and cumulative development

3.5.1 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, Greater London Authority and Transport for London 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 15 Appendix N 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.

3.5.2 The development projects which have been included under base case, cumulative or both for the assessment of the proposed development at Heathwall Pumping Station are listed below. A map showing their location is included in Vol 15 Figure 3.5.1 (see separate volume of figures).

a. Riverlight (Tideway Industrial Estate)

b. Embassy Gardens

c. Nine Elms Parkside

d. US Embassy

e. New Covent Garden Market

f. Battersea Power Station

g. 10 Pascal Street

h. Nine Elms Sainsbury's, Wandsworth Road

i. Market Towers

j. St Georges Wharf (Vauxhall Tower)

k. Vauxhall Square Cap Gemini Site

l. Vauxhall Sky Gardens, 143-161 Wandsworth Road

m. Island Site Vauxhall Gyratory

n. Riverwalk House, Millbank

o. 30-60 South Lambeth Road

p. 1-9 Bondway and 4-6 South Lambeth Place

q. Marco Polo House, 346 Queenstown Road

r. Northern Line Extension.

3.6 On site alternatives

3.6.1 Project-wide and site selection alternatives are addressed in Volume 1 Section 3. This section describes on-site alternatives that have been considered and provides the main reasons why these alternatives (to the proposed approach) have not been adopted.

3.6.2 Vol 15 Table 3.6.1 below identifies those items for which alternatives have been considered, the alternatives and provides the main reasons why the alternatives were not taken forward.

Vol 15 Table 3.6.1 Heathwall Pumping Station – on-site alternatives

Item	Alternatives considered	Main reasons that the alternative (give left) was not progressed
Size of new in-river foreshore structure	Smaller area of permanent hardstanding projecting into the river foreshore.	Not providing sufficient area for the construction of below-ground structures to intercept the Heathwall Pumping Station CSO.
Pedestrian access	Thames Path to remain as existing (along Nine Elms Lane) with no provision of permanent pedestrian access through new foreshore structure.	Proposed Thames Path route would improve access to River Thames and comply with local policy aspirations and Design Council CABE recommendations.
Small tank breather	No provision of additional small tank breather.	Without additional infrastructure odour and ventilation requirements would not be met.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 4: Air quality and odour

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 4: Air quality and odour

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4 Air quality and odour

4.1 Introduction

4.1.1 This section presents the findings of the assessment of the likely significant air quality and odour effects of the proposed development at the Heathwall Pumping Station site. The project-wide air quality effects are described in Volume 3 Project-wide effects assessment.

4.1.2 The proposed development has the potential to affect air quality and odour due to:

a. construction traffic on the roads leading to an increase in vehicle emissions (air quality)

b. emissions from tugs pulling river barges (air quality)

c. emissions from construction plant (air quality)

d. construction-generated dust (air quality)

e. operation of the tunnel, resulting in air emissions (odour).

4.1.3 Each of these impacts is considered within the assessment. As a result the construction assessment for Heathwall Pumping Station site comprises four separate components: effects on local air quality from construction road traffic; effects on local air quality from tugs (for river barges); effects on local air quality from construction plant; and effects from construction dust. The effects on local air quality from construction road traffic, tugs (for river barges) and construction plant are assessed together (within the same model) while construction dust is assessed separately. The operational assessment considers the potential for nuisance odour emissions from the operation of the main tunnel. As set out in the *Scoping Report*, local air quality effects are not assessed during operation on the basis that the only relevant operational source of air pollutants would be from the infrequent visits of maintenance vehicles which would not result in a likely significant effect.

4.1.4 The assessment of air quality and odour presented in this section has considered the requirements of the National Policy Statement for Waste Water Sections 4.3 (odour), 4.11 (air quality and emissions) and 4.12 (dust). Further details of these requirements can be found in Volume 2 Environmental assessment methodology Section 4.3.

4.1.5 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station Figures). Appendices supporting this site assessment are contained in Vol 15 Appendix B.

4.2 Proposed development relevant to air quality and odour

4.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to air quality and odour are set out below.

Construction

Construction road traffic

4.2.2 During the proposed construction period there would be construction traffic movements[i] in and out of the site.

4.2.3 The highest number of lorry movements in any one year at the Heathwall Pumping Station site would occur during the cofferdam construction (Site Year 1 of construction). The average daily number of vehicle movements during the peak month would be approximately 36 movements per day.

4.2.4 The construction traffic routes, traffic management and access to the site are detailed in Section 12 of this volume.

4.2.5 Construction traffic is likely to affect local air quality as a result of increasing traffic and therefore emissions on the road network.

Tugs for river barges

4.2.6 River barges may affect local air quality through direct emissions from the tugs pulling them.

4.2.7 The peak number of barge movements would be four barge movements a day averaged over a one month period in Site Year 1 of construction. The emissions associated with the tugs are presented in Vol 15 Appendix B.3.

Construction plant

4.2.8 Construction plant is likely to affect local air quality from direct exhaust emissions associated with the use and movement of the plant around the site.

4.2.9 There are a number of items of plant to be used on site that may produce emissions that could affect local air quality. Examples of such plant are excavators, generators and dumper trucks.

4.2.10 Typical construction plant which would be used at the Heathwall Pumping Station site in the peak construction year and associated emissions data are presented in Vol 15 Appendix B.4.

Construction dust

4.2.11 Activities with the potential to give rise to dust emissions from the proposed development during construction are as follows:

a. site preparation and establishment

b. demolition of existing infrastructure and buildings

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[i] A movement is a construction vehicle moving either to or from the site.

c. materials handling and earthworks

d. construction traffic – from moving over unpaved ground and then tracking out mud and dirt onto the public highway (termed 'trackout' hereafter).

4.2.12 At the Heathwall Pumping Station site there would be approximately $310m^3$ of demolition material generated, while the amount of material moved during the earthworks would be approximately 51,600 tonnes. The volume of building material used during construction would be approximately $13{,}000m^3$.

Code of Construction Practice

4.2.13 Appropriate dust and emission control measures are included in the *Code of Construction Practice (CoCP)*[ii] (Section 7) in accordance with the London Councils *Best Practice Guidance* (GLA and London Councils, 2006)[1]. Measures incorporated into the *CoCP* (Section 7) to reduce air quality impacts include measures in relation to vehicle and plant emissions, measures to reduce dust formation and re-suspension, measures to control dust present and measures to reduce particulate emissions. These would be observed across all construction and demolition activities at the Heathwall Pumping Station site.

4.2.14 The effective implementation of the *CoCP* (Section 7) measures is assumed within the assessment.

Operation

4.2.15 There are two drop shafts at the Heathwall Pumping Station site where tunnel air could be released. The air released from the larger shaft would be treated by passing air through a carbon filter housed in a below ground air treatment chamber. Natural pressure during tunnel filling would allow air to pass passively without the need for fans. The capacity of the passive filter would be $1m^3/s$. The maximum air release rate during a typical year is expected to be $0.6m^3/s$, therefore all air in a typical year would be treated through the passive filter. No nuisance odours are therefore expected.

4.2.16 Air would be released from the ventilation column for about 20 hours in a typical year, all of which would have passed through the passive filter. For the remaining hours, no air would be released although air intake would occur as the tunnel is emptied.

4.2.17 Air released from the smaller shaft would be released through a tank breather carbon filter with a treatment capacity of $0.1m^3/s$.

Environmental design measures

4.2.18 A carbon filter would be included as part of the ventilation structure design and construction. The passive filter would remove odours by adsorption

[ii] *CoCP* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

onto the filter. Full details of the Thames Tideway Tunnel project ventilation system can be found in the *Air Management Plan*.

4.3 Assessment methodology

Engagement

4.3.1 Vol 2 Section 4.2 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of air quality and odour are presented here (Vol 15 Table 4.3.1).

Vol 15 Table 4.3.1 Air quality and odour - stakeholder engagement

Organisation	Comment	Response
London Borough (LB) of Wandsworth, April 2011	Agree monitoring locations with LB of Wandsworth	Locations agreed with LB of Wandsworth Environmental Health Officer.
LB of Wandsworth, March 2011	Odour complaints in the area should be considered	No odour complaints - confirmed by LB of Wandsworth Environmental Team Leader (Environmental Initiatives).

Baseline

4.3.2 The baseline methodology follows the methodology described in Vol 2 Section 4. There are no site specific variations for identifying baseline conditions for this site.

Construction

4.3.3 The assessment methodology for the construction phase follows that described in Vol 2 Section 4. There are no site specific variations for undertaking the construction assessment of this site.

4.3.4 Section 4.5 details the likely significant effects arising from the construction at the Heathwall Pumping Station site. The neighbouring Thames Tideway Tunnel project site at Kirtling Street could elevate construction dust nuisance effects within the assessment area (see para. 4.3.5 below) and is therefore considered in the dust assessment. With regard to local air quality, the effect of all relevant traffic associated with Thames Tideway Tunnel project sites using the highway network in the vicinity of the site is taken into account in the assessment traffic data used for the assessment includes traffic associated with all Thames Tideway Tunnel project sites.

Construction assessment area

4.3.5 The assessment area for the local air quality assessment during construction covers a square area of 600m by 600m centred on the Heathwall Pumping Station site (which therefore includes the Kirtling Street site). This assessment area has been used for the assessment of road transport, tugs for river barges, construction plant and construction dust and has been selected on the basis of professional judgement to ensure that the effects of the Heathwall Pumping Station site are fully assessed. A distance of 200m is generally considered sufficient (Highways Agency, 2007)[2] to ensure that any significant effects are considered. The selected assessment area exceeds this considerably.

Construction assessment year

4.3.6 The peak construction year in terms of construction traffic movements (Site Year 1 of construction) has been used as the year of assessment for construction effects (construction road and river transport, construction plant and construction dust) in which the development case (with the Thames Tideway Tunnel project) has been assessed against the base case (without the Thames Tideway Tunnel project) to identify likely significant effects of the Thames Tideway Tunnel project.

4.3.7 The assessment of construction effects also considers the extent to which the effects on local air quality would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Other developments

4.3.8 As indicated in the site development schedule (see Vol 15 Appendix N), there are four other new developments (Riverlight, Nine Elms Parkside, Embassy Gardens and US Embassy) identified within 300m of the Heathwall Pumping Station site (construction assessment area), all of which are relevant to the air quality assessment being sensitive properties in close proximity to the site. Three of these (Riverlight, Embassy Gardens and US Embassy) would be partially or fully complete and operational in Site Year 1 of construction and are therefore considered as receptors in the air quality assessment. Trips associated with all the developments detailed in the development schedule are taken into account in the traffic data used for the air quality assessment.

4.3.9 Of the four developments within 300m of the Heathwall Pumping Station site, three (Riverlight, Nine Elms Parkside and Embassy Gardens) would be under construction at the same time as construction works at the Heathwall Pumping Station (in the peak construction year). These are therefore considered in the cumulative construction assessment.

Operation

4.3.10 The odour assessment methodology for the operational phase follows that described in Vol 2 Section 4. There are no site specific variations for undertaking the operational assessment of this site.

4.3.11 Section 4.6 details the likely significant effects arising from the operation at the Heathwall Pumping Station site. The neighbouring Thames Tideway Tunnel project site at Kirtling Street could give rise to additional effects on odour within the assessment area for this site and is therefore considered in the odour assessment.

Operational assessment area

4.3.12 Odour dispersion modelling has been carried out over an area of 850m by 650m centred on the Heathwall Pumping Station site. The assessment area has been selected on professional judgement on the basis of it being considered the potential maximum extent of the impact area.

Operational assessment year

4.3.13 The assessment undertaken for a typical use year (as described in Vol 2 Section 4) applies equally to all operational years. Therefore no specific year of operation has been assessed.

Other developments

4.3.14 Four other developments (Riverlight, Nine Elms Parkside, Embassy Gardens and US Embassy) have been identified for inclusion in the odour assessment and are included as receptors. The proposed buildings at Riverlight, Nine Elms Parkside and US Embassy have also been included in the modelling as these buildings may affect dispersion. Due to the nature of the developments, there are however no cumulative operational odour effects to assess.

Assumptions and limitations

Assumptions

4.3.15 The general assumptions associated with this assessment are presented in Vol 2 Section 4.

Construction

4.3.16 The site specific assumptions in terms of model inputs for the local air quality dispersion modelling are set out in Vol 15 Appendix B.1.

Operation

4.3.17 The site specific assumptions in terms of the assumed capacity of the carbon filter and air release rate used for the odour dispersion modelling are described in paras. 4.2.15-4.2.18.

4.3.18 Odour dispersion modelling only includes emissions from the ventilation structure and does not take account of background concentrations due to other sources. Background odour concentrations in the area are assumed to be low as there has been only one complaint in the surrounding area over recent years (see para. 4.4.14) and seasonal spot measurements of hydrogen sulphide (H_2S) carried out in 2011/12 indicate that concentrations are typical of urban areas (Michigan Environmental Science Board, 2000)[3].

4.3.19 Following dispersion modelling, the maximum concentration predicted at any location beyond the site boundary has been reported whether this is at a building where people could be exposed or on open land. As a reasonable worst case assumption, it has been assumed that this is a relevant receptor. This means that should the ventilation structure be moved within the identified parameter plan (see Site parameter plan, separate volume of figures – Section 1), the impact would not be worse than that reported in Section 4.6.

Limitations

4.3.20 The general limitations associated with this assessment are presented in Vol 2 Section 4.

Construction

4.3.21 As there are no PM_{10} monitoring sites located within the vicinity of the Heathwall Pumping Station site, it has not been possible to verify PM_{10} modelling results[iii]. The adjustment factor derived for NO_x (from a comparison of monitored and monitored NO_x data) has therefore been applied to the PM_{10} modelling results. The PM_{10} monitoring data from Bondway Interchange have not been used for the verification, because of insufficient traffic data and the proximity of the bus interchange to this site.

4.3.22 It is noted that the 2011 PM_{10} monitoring data from the closest monitoring station (unsuitable for verification purposes) reported in the baseline (Section 4.4) are not yet fully ratified[iv]. The lack of full ratification does mean that the characterisation of the existing baseline PM_{10} concentration is less certain. However, there are no direct implications for the assessment, as this concentration is not used in the assessment for verification purposes or as the background concentration used in the modelling.

Operation

4.3.23 There are no limitations specific to the odour assessment of this site.

4.4 Baseline conditions

4.4.1 The following section sets out the baseline conditions for air quality and odour within and around the site. Future baseline conditions (base case) are also described.

Current baseline

Local air quality

4.4.2 The current conditions with regard to local air quality are best established through long-term air quality monitoring.

4.4.3 As part of their duties under Part IV of the Environment Act 1995 (UK Government, 1995)[4], local authorities, especially in urban areas where air quality is a significant issue, undertake long-term air quality monitoring within their administrative areas.

[iii] Model verification refers to checks that are carried out on model performance at a local level. This basically involves the comparison of predicted (modelled) versus measured concentrations. Where there is a disparity between the predicted and the measured concentrations, the first step should always be to check the input data and model parameters in order to minimise the errors. If required, the second step would be to determine an appropriate adjustment factor that can be applied to the modelled traffic contribution

[iv] The process of data ratification generally involves a first level screening of the data (by manual and/or automatic methods), to remove obvious erroneous values. These data will have been suitably calibrated against reference standards. Within the national monitoring networks, these validated data are labelled “provisional”. The secondary process in data ratification involves a more thorough checking of the data, for example, data rescaling to allow for drift in the calibration standards, or data adjustments following site audits, which have identified problems that could not have been identified remotely.

4.4.4 There is one continuous monitoring station and one diffusion tube site which collect data pertinent to the Heathwall Pumping Station site and associated construction traffic routes, which are operated by the LB of Lambeth and the LB of Wandsworth respectively. The location of these is shown in Vol 15 Figure 4.4.1 (see separate volume of figures). Monitoring data for these sites for the period 2007-2011 are contained in Vol 15 Table 4.4.1 (NO_2 concentrations) and Vol 15 Table 4.4.2 (PM_{10} concentrations).

Vol 15 Table 4.4.1 Air quality - measured NO_2 concentrations

Monitoring site	Site type	Annual mean (µg/m^3)					Number of exceedances of hourly standard				
		2011	2010	2009	2008	2007	2011	2010	2009	2008	2007
Continuous monitoring site											
Bondway Interchange (LB5)	Roadside	**77***	**77**	**77****	**83**	NM	4 (178)*	17	12 (194)**	**38**	NM
Diffusion tube monitoring site											
Newton Prep School (W3)	Roadside	**63**	**53**	**59**	**67**	**64**	NM				

Note: NM indicates not measured. Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m^3 for the annual mean and 200µg/m for the hourly mean which can be exceeded 18 times per year. Codes in brackets represent monitoring site identifiers used in Vol 15 Figure 4.4.1 (see separate volume of figures).
**Data capture was 81%, the figure in brackets for the hourly exceedances is the 99.8 percentile. ** Data capture was 88%, the figure in brackets for the hourly exceedances is the 99.8 percentile.*

Vol 15 Table 4.4.2 Air quality - measured PM_{10} concentrations

Monitoring site	Site type	Annual mean (µg/m^3)					Number of exceedances of daily standard				
		2011	2010	2009	2008	2007	2011	2010	2009	2008	2007
Bondway Interchange (LB5)	Roadside	**43***	**43****	**42*****	**52**	**67******	**92***	**76****	**71*****	**160**	**211******

** Data capture was 78%. ** Data capture was 79%. *** Data capture was 85%. **** Data capture was 85%.*
Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m^3 for the annual mean and 50µg/m^3 for the daily mean which can be exceeded 35 times per year.

4.4.5 The monitoring data at these sites show that the annual mean NO_2 objective / limit value was exceeded at both roadside sites in each of the five years. The hourly mean NO_2 objective / limit value was exceeded in one of the four measured years at the Bondway interchange (LB5) roadside site.

4.4.6 The annual and daily mean PM_{10} objectives / limit values were exceeded in all five years at the monitoring site.

4.4.7 As a result of previous exceedances of air quality objectives, LB of Wandsworth has declared the whole borough an AQMA for both NO_2 and PM_{10}.

4.4.8 In addition to the local authority monitoring, diffusion tube monitoring has been undertaken as part of the environmental impact assessment (EIA) to monitor NO_2 concentrations in the vicinity of the Heathwall Pumping Station site. This monitoring comprises seven diffusion tubes based at the locations identified in Vol 15 Table 4.4.3 The table shows a 2010 annual mean concentration (baseline year), which has been calculated from the measurements made between April 2011 and April 2012 at each of the sites. To calculate the 2010 annual mean NO_2 concentrations, the 2011/12 measurements are adjusted for bias using the co-located diffusion tubes and are then seasonally adjusted. Annual mean NO_2 concentrations, for the period covered by the diffusion tubes, and for the year 2010 have been collated from four nearby background continuous monitoring sites measuring NO_2 and with data capture rates greater than 90%. The average of the ratios between the period and annual means has been used to calculate the seasonal adjustment factor. To enable any bias to be corrected a triplicate site (comprising three diffusion tubes) was established at a continuous monitoring site in Putney (site PEFM4 – see Vol 7); for additional precision, a triplicate site was established at one of the monitoring sites (HEAM1) near the Heathwall Pumping Station site; otherwise all the monitoring locations have single tubes.

Vol 15 Table 4.4.3 Air quality - additional monitoring locations

Monitoring site	Grid reference	Site type	2010 NO_2 annual mean ($\mu g/m^3$)
Nine Elms Lane / Riverside Court (HEAM1)	529838, 177749	Roadside	**78.7**
Nine Elms Lane / Post Office Depot (HEAM2)	529448, 177499	Kerbside	**90.9**
Cringle Street / Kirtling Street (KSTM1)	529325, 177446	Kerbside	**66.0**
Kirtling Street (KSTM2)	529333, 177371	Kerbside	**50.8**
Nine Elms Lane / New Covent Garden Market (KSTM3)	529242, 177391	Roadside	**74.2**

Monitoring site	Grid reference	Site type	2010 NO_2 annual mean ($\mu g/m^3$)
Thessaly Road / Battersea Park Road, (KSTM4)	529138, 177243	Kerbside	**58.8**
Battersea Park Road / Battersea Dog and Cat Home (KSTM5)	528971, 177144	Roadside	**84.7**

Note: Emboldened figures indicate an exceedance of the objective / limit value which is 40µg/m³ for the annual mean.

4.4.9 All seven sites recorded concentrations above the NO_2 annual mean standard of 40µg/m³. The concentrations recorded during the monitoring are similar to those recorded during local authority monitoring at roadside sites and are typical of the high levels in London.

4.4.10 This monitoring has been used in conjunction with existing LB of Wandsworth monitoring to define the baseline situation and also to provide input to model verification.

4.4.11 In addition to monitoring data, an indication of baseline pollutant concentrations in the vicinity of the site has been obtained from the background data on the air quality section of the Defra website (Defra, 2010)[5]. Mapped background pollutant concentrations are available for each 1km by 1km grid square within every local authority's administrative area for the years 2008 to 2020. The background data relating to the Heathwall Pumping Station site are given in Vol 15 Table 4.4.4 for 2010 (baseline year).

Vol 15 Table 4.4.4 Air quality - 2010 background pollutant concentrations

Pollutant*	2010
NO_2 ($\mu g/m^3$)	43.9
PM_{10} ($\mu g/m^3$)	22.9

* *Annual mean for 1km grid square centred on 529500, 177500.*

Odour

4.4.12 LB of Wandsworth has not received any odour complaints for the local area over recent years (LB of Wandsworth, 2011)[6]. The Thames Water complaints database was reviewed for an area within a 500m radius of the zones identified for the proposed ventilation column. Over the last five years, the only identified complaint was in 2010, which related to odour from the general sewerage system.

4.4.13 Data gathering for the EIA included spot measurements of H_2S made near the site, the results of which are summarised in Vol 15 Table 4.4.5 and the monitoring locations shown in Vol 15 Figure 4.4.2 (see separate volume of figures). The highest concentrations, up to 34.9µg/m³, were measured on 21 May 2012 during northerly wind conditions. These levels are typical of urban areas (Michigan Environmental Science Board, 2000)3 when a faint odour may be detectable on occasions (WHO, 2000)[7] [v].

Vol 15 Table 4.4.5 Odour - measured H_2S concentrations

Location	Grid reference	Date	Time	H_2S concentration ($\mu g/m^3$)
Houseboats (Nine Elms) (HEAS1)	529474, 177622	28/08/11	10:44:40	0.0
		28/08/11	10:45:12	0.0
		11/10/11	16:33:57	7.4
		11/10/11	16:35:02	4.6
		30/10/11	10:36:46	0.0
		30/10/11	10:37:13	0.0
		04/01/12	13:11:50	9.4
		04/01/12	13:12:29	8.6
		20/02/12	16:16:50	5.9
		20/02/12	16:17:43	5.3
		29/02/12	12:30:43	7.4
		29/02/12	12:31:44	7.9
		21/05/12	11:10:39	7.6
		21/05/12	11:11:44	7.9
West corner of Pumping Station (HEAS2)	529502, 177633	28/08/11	10:42:32	0.0
		28/08/11	10:43:01	0.0
		11/10/11	16:31:11	6.4
		11/10/11	16:32:26	4.7
		30/10/11	10:35:33	5.1
		30/10/11	10:36:01	4.3
		04/01/12	13:09:28	31.3
		04/01/12	13:10:31	9.7
		20/02/12	16:14:20	34.0
		20/02/12	16:15:36	6.9
		29/02/12	12:27:59	29.9
		29/02/12	12:29:45	8.9

[v] The H_2S odour detection threshold is $7ug/m^3$ which is the level at which 50% of the people on an odour panel who have been proven to have a good sense of smell can just detect the gas in laboratory controlled conditions.

Location	Grid reference	Date	Time	H_2S concentration (µg/m^3)
		21/05/12	11:08:02	31.0
		21/05/12	11:08:37	10.0
		21/05/12	11:09:37	8.8
East corner of Pumping Station (HEAS3)	529588, 177652	28/08/11	10:36:31	0.0
		28/08/11	10:37:10	0.0
		11/10/11	16:11:01	5.2
		11/10/11	16:12:09	0.0
		30/10/11	10:21:36	6.3
		30/10/11	10:22:06	4.7
		04/01/12	12:54:46	8.2
		04/01/12	12:56:16	7.4
		20/02/12	16:00:14	8.5
		20/02/12	16:01:44	6.5
		29/02/12	12:12:51	8.5
		29/02/12	12:13:57	9.4
		21/05/12	10:48:34	34.9
		21/05/12	10:49:14	8.8
		21/05/12	10:50:17	7.9
Elm Quay (HEAS4)	529636, 177673	28/08/11	10:38:26	0.0
		28/08/11	10:38:57	0.0
		11/10/11	16:14:24	5.0
		11/10/11	16:15:31	5.1
		30/10/11	10:23:06	0.0
		30/10/11	10:23:35	0.0
		04/01/12	12:57:58	6.7
		04/01/12	12:59:56	10.3
		20/02/12	16:03:06	6.1
		20/02/12	16:04:17	5.6
		29/02/12	12:15:06	7.6
		29/02/12	12:16:15	7.7
		21/05/12	10:51:43	8.1
		21/05/12	10:53:18	7.7

Location	Grid reference	Date	Time	H_2S concentration ($\mu g/m^3$)
Meteorological conditions: 28/08/11 SW wind up to 2m/s, partially cloudy, rain on previous day. 11/10/11 W wind up to 6.6m/s, overcast, windy, dry. 30/10/11 SW wind at 0.5m/s, cloudy, last rain on 27/10/11 04/01/12 W wind up to 2.3m/s, cloudy. 20/02/12 SW wind up to 3.1m/s, overcast, dry. 21/05/12 N wind, average speed 2.3m/s.				

Receptors

4.4.14 As set out in Section 4.1 and Vol 2 Section 4, the air quality assessment involves the selection of appropriate receptors, which are shown in Vol 15 Figure 4.4.3 (see separate volume of figures) and the table below (Vol 15 Table 4.4.6) for the Heathwall Pumping Station site. All of these receptors are relevant, albeit with different levels of sensitivity to each of the elements of the air quality assessment. The sensitivity of identified receptors has been determined using the criteria detailed in Vol 2 Section 4.

4.4.15 It is noted that Vol 15 Table 4.5.1 includes receptors associated with the proposed developments at Riverlight, Nine Elms Parkside, Embassy Gardens and US Embassy for consideration in the air quality and odour assessments.

Vol 15 Table 4.4.6 Air quality and odour - receptors

Receptors (relating to all identified emissions sources)	Approximate distance of modelled receptor from site boundary and direction from site	Receptor sensitivity		
		Air quality (construction traffic, river tugs for barges and construction plant)	Construction dust (on-site demolition and construction processes)	Odour (ventilation column)
Residential properties - Riverlight (HEAR3)*	Adjacent	High (exposure relevant for annual mean, daily mean and hourly mean standards).	Medium	High
Residential properties - Embassy Gardens (HEAR6)*	15m south	High (exposure relevant for annual mean, daily mean and hourly mean standards).	Medium	High
Residential properties - houseboats (HEAR1)	30m west	High (exposure relevant for annual mean, daily mean and hourly mean standards).	Medium	High
Residential properties - Nine Elms Parkside (HEAR5)*	45m south	Not included as a receptor as the development is still under construction in Site Year 1.		High
Residential properties - Elm Quay Court (HEAR9)	55m east	High (exposure relevant for annual mean, daily mean and hourly mean standards).	Medium	High
US Embassy (HEAR8)*	130m southeast	High (exposure relevant for annual mean, daily mean and hourly mean standards).	Medium	High
Restaurant/bar vessel - Battersea Barge (HEAR2)	6m west	Medium (exposure is relevant for the hourly mean standard only).	Medium	High
Industrial - Fedex, Nine Elms Lane (HEAR4)	Adjacent	Low (exposure is relevant for the hourly mean standard only).	Medium	Medium
Offices - Nine Elms Lane (HEAR7)	26m southeast	Low (exposure is relevant for the hourly mean standard only).	Medium	Medium
Recreational - Thames Path	Adjacent	Low (exposure is relevant for the hourly	Low	Low

Receptors (relating to all identified emissions sources)	Approximate distance of modelled receptor from site boundary and direction from site	Receptor sensitivity		
		Air quality (construction traffic, river tugs for barges and construction plant)	Construction dust (on-site demolition and construction processes)	Odour (ventilation column)
(HEAR10)		mean standard only)		
Recreational - River Thames (HEAR11)	Adjacent	Low (exposure is relevant for the hourly mean standard only)	Low	Low

** Denotes receptor that is altered or constructed after the baseline year.*

Construction base case

4.4.16 The base case conditions for the construction assessment year would be expected to change from the baseline conditions due to modifications to the sources of the air pollution in the intervening period.

4.4.17 For road vehicles, there would be an increase in the penetration of new Euro emissions standards (Defra, 2012)[8] to the London vehicle fleet between the current situation and Site Year 1 of construction. Euro standards define the acceptable exhaust emission limits for new vehicles sold in the EU. These standards are defined through a series of European Union directives staging the progressive introduction of increasingly stringent standards over time. The uptake of newer vehicles with improved emission controls should lead to a reduction in NO_2 and PM_{10} concentrations over time. These changes in fleet composition and the emissions are covered in this assessment.

4.4.18 Other emissions sources should also reduce due to local and national policies. Therefore, the non-road sources of the background concentrations used in the modelling have been reduced in line with Defra guidance LAQM.TG(09) (Defra, 2009)[9]. Background pollutant concentrations for Site Year 1 of construction (peak construction year) used in the modelling are shown in Vol 15 Table 4.4.7.

4.4.19 The background NO_2 and PM_{10} concentrations have been taken from the Defra mapped background data5.

Vol 15 Table 4.4.7 Air quality – annual mean background pollutant concentrations

Pollutant	Baseline (2010)	Peak construction year (Site Year 1 of construction)
NO_2 ($\mu g/m^3$)*	39.9	32.2
PM_{10} ($\mu g/m^3$)*	22.6	20.8

** Taken from Defra mapped 1km grid square centred on 529500, 177500. Adjusted to ensure local A roads are not double counted.*

4.4.20 As indicated in para. 4.4.15 , the base case in Site Year 1 of construction takes into account the proposed developments (Riverlight, Embassy Gardens and US Embassy), including them as receptor locations in the air quality assessment. These are included in the receptor list provided in Vol 15 Table 4.4.6.

Operational base case

4.4.21 Base case conditions have been assumed to be the same as baseline conditions with respect to background odour concentrations as no change in background odour concentrations is anticipated.

4.4.22 As indicated in para. 4.4.15, the base case for the odour assessment takes into account the proposed developments (Riverlight, Nine Elms Parkside, Embassy Gardens and US Embassy), including them as receptor locations in the odour assessment. These are included in the receptor list provided in Vol 15 Table 4.4.6. Three new developments have been included in the odour modelling as the structures may affect dispersion, these buildings are listed in para. 4.3.14.

4.5 Construction effects assessment

Local air quality assessment

4.5.1 Construction effects on local air quality (comprising emissions from construction road traffic, tugs for river barges and construction plant) have been assessed following the modelling methodology set out in Vol 2 Section 4. This involves predicting NO_2 and PM_{10} concentrations in the baseline year (2010), and in the peak construction year (Site Year 1 of construction) without the proposed development (base case) and with the proposed development (development case). Predicted pollutant concentrations for the base case and development case can then be compared to determine the air quality impacts associated with the project and considering these in the context of statutory air quality objectives/limit values to determine the significance of effects at specified receptors (listed in Vol 15 Table 4.4.6).

4.5.2 The assessment has focussed on NO_2 and PM_{10} concentrations as these are the only pollutants whose air quality standards may be exceeded. From professional experience, emissions of other pollutants (eg, volatile organic compounds (VOCs)) are very unlikely to be significant and therefore do not need to be assessed.

4.5.3 A model verification exercise has been undertaken at the Heathwall Pumping Station site in line with the Defra guidance LAQM.TG(09)9. This checks the model performance against measured concentrations, using the seven monitoring sites established for this assessment and one local authority monitoring site (KSTM1–KSTM5 and HEAM1-HEAM2– see Vol 15 Table 4.4.3 and W3). Further details regarding the verification process are included in Vol 15 Appendix B.1. The model adjustment factor derived from the verification process was applied to all model results for both NO_2 and PM_{10}.

4.5.4 The model inputs for the local air quality assessment for the Heathwall Pumping Station site are also detailed in Vol 15 Appendix B (B.2, B.3 and B.4). This includes road traffic data (comprising annual average daily traffic flows, heavy goods vehicle proportions and speeds for each road link) and data pertaining to the tugs for river barges and construction plant.

NO_2 concentrations

4.5.5 Predicted annual mean NO_2 concentrations for the modelled scenarios are shown in Vol 15 Table 4.5.1. This table details the forecast NO_2 concentrations at specific sensitive receptors. Annual mean results are shown for all of the sensitive receptors but the receptors are divided into two groups depending on whether the annual mean objective/limit value applies or not. The annual mean criteria only apply at those receptors which could be occupied continually for a year (eg, residential properties).

Exceedances of the hourly criteria are inferred from the annual mean concentration. Additionally, contour plots are provided (Vol 15 Figure 4.5.1 to Vol 15 Figure 4.5.3, see separate volume of figures) showing modelled concentrations for the baseline, base case and development case scenarios over the construction assessment area. A plot showing the change in NO_2 annual mean concentrations between the base and development cases (in the peak construction year) is also presented at Vol 15 Figure 4.5.4 (see separate volume of figures).

4.5.6 The modelled concentrations in Vol 15 Table 4.5.1 show that annual mean NO_2 levels are predicted to decrease between 2010 and the peak construction year with or without the Thames Tideway Tunnel project. This decrease is due to predicted reductions in background concentrations and improved vehicle engine technology. The results for the development case show small increases over the base case at all modelled receptors due to the construction works at the Heathwall Pumping Station site.

4.5.7 Exceedances of the annual mean criterion (40µg/m^3) are predicted at all receptors in the baseline case, at six receptors in the base case and at eight receptors in the development case. In line with LAQM.TG(09)9, at the receptors with modelled concentrations above 60µg/m^3, exceedances of the hourly NO_2 air quality objective / limit value are considered likely. Exceedances of this criterion are likely to occur at five receptors in the baseline case and none of the receptors in the base and development cases.

Vol 15 Table 4.5.1 Air quality - predicted annual mean NO_2 concentrations

Receptor	Predicted annual mean NO_2 concentration (µg/m^3)			Change between base and dev cases (µg/m^3)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
Receptors where the annual mean objective / limit value applies					
Houseboats (HEAR1)	**45.5**	35.0	35.2	0.3	Negligible
Riverlight residential (HEAR3)*	**54.2**	39.3	**40.7**	1.4	Small
Embassy Gardens residential (HEAR6)*	**87.4**	**58.6**	**59.3**	0.7	Small

Receptor	Predicted annual mean NO_2 concentration ($\mu g/m^3$)			Change between base and dev cases ($\mu g/m^3$)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
Elm Quay Court, Nine Elms Lane residential (HEAR9)	**65.5**	**45.4**	**46.0**	0.5	Small
US Embassy (HEAR8)*	**60.4**	**42.7**	**42.9**	0.2	Negligible
Receptors where the annual mean objective / limit value does not apply					
Battersea Barge (HEAR2)	**46.7**	35.6	37.1	1.6	Small
Industrial, Nine Elms Lane (HEAR4)	**71.0**	**48.8**	**50.1**	1.3	Small
Offices, Nine Elms Lane (HEAR7)	**78.8**	**53.5**	**54.0**	0.5	Small
Thames Path (HEAR10)	**53.9**	39.0	**41.5**	2.5	Medium
River Thames (HEAR11)	**45.5**	35.1	36.3	1.2	Small

** Note: Emboldened figures indicate an exceedance of the criteria which is 40µg/m^3 for the annual mean.*
** Denotes receptor that is altered or constructed after the baseline year. Changes in concentration at each receptor have been rounded to one decimal place.*

4.5.8 The highest predicted increase in annual mean concentration as a result of the construction works at the Heathwall Pumping Station site is 2.5µg/m^3 which is predicted at receptor HEAR10 on the Thames Path. However the annual mean objective / limit value (40µg/m^3) does not apply here. The largest increase at a receptor of relevant exposure to the annual mean concentration is 1.4µg/m^3 at the proposed residential development at Riverlight (HEAR3). This increase is described as small magnitude according to the criteria detailed in Vol 2 Section 4.

4.5.9 The significance of the effect at the residential properties at Riverlight (HEAR3), Embassy Gardens (HEAR6) and Elm Quay Court (HEAR9), which have a high sensitivity to local air quality, is **minor adverse** (according to the criteria detailed in Vol 2 Section 4). The significance of the effect at the residential properties at Tideway Village and Nine Elms Pier (houseboats) (HEAR1) and at the US Embassy (HEAR8), which also have a high sensitivity to local air quality, is **negligible**. At the Battersea

Barge (HEAR2) which has a medium sensitivity to local air quality and at which the hourly objective / limit value applies, the significance of the effect would also be **negligible**. The significance of effects would be **minor adverse** at the offices (HEAR7) on Nine Elms Lane, which has a low sensitivity to local air quality. The significance of effects would be **negligible** at the River Thames receptor (HEAR11), the Thames Path receptor (HEAR10) and the industrial locations on Nine Elms Lane (HEAR4), which have a low sensitivity to local air quality and at which the hourly objective / limit value applies.

PM_{10} concentrations

4.5.10 Predicted annual mean PM_{10} concentrations for the modelled scenarios, taking account of emissions from construction road traffic, tugs for river barges and construction plant, are shown in Vol 15 Table 4.5.2. This table details the forecast PM_{10} concentrations at specific sensitive receptors. Additionally, contour plots are provided (Vol 15 Figure 4.5.5 to Vol 15 Figure 4.5.7, see separate volume of figures) showing modelled concentrations for the baseline, base case and development case scenarios over the construction assessment area. A plot showing the change in annual mean PM_{10} concentrations between the base and development cases (in the peak construction year) is also presented at Vol 15 Figure 4.5.8 (see separate volume of figures).

4.5.11 The modelled concentrations in Vol 15 Table 4.5.2 show that annual mean concentrations of PM_{10} are predicted to achieve the annual mean standard (40µg/m^3) and decrease between 2010 and the peak construction year with or without the Thames Tideway Tunnel project. This decrease is due to predicted reductions in background concentrations and improved vehicle engine technology. The predicted results for the development case show small increases over the base case at eight out of the eleven modelled receptors due to construction activities at the Heathwall Pumping Station site.

Vol 15 Table 4.5.2 Air quality - predicted annual mean PM_{10} concentrations

Receptor	Predicted annual mean PM_{10} concentration (µg/m^3)			Change between base and dev cases (µg/m^3)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
Receptors where the annual mean objective / limit value applies					
Houseboats (HEAR1)	23.4	21.4	21.5	0.0	Negligible
Riverlight residential (HEAR3)*	24.6	22.4	22.6	0.2	Negligible

Receptor	Predicted annual mean PM_{10} concentration ($\mu g/m^3$)			Change between base and dev cases ($\mu g/m^3$)	Magnitude of impact
	2010 baseline	Peak construction year base case	Peak construction year dev case		
Embassy Gardens residential (HEAR6)*	31.0	27.4	27.5	0.2	Negligible
Elm Quay Court, Nine Elms Lane residential (HEAR9)	26.5	23.8	23.9	0.1	Negligible
US Embassy (HEAR8)*	25.6	23.1	23.2	0.0	Negligible
Receptors where the annual mean objective / limit value does not apply					
Battersea Barge (HEAR2)	23.5	21.6	21.8	0.2	Negligible
Industrial, Nine Elms Lane (HEAR4)	27.5	24.7	24.9	0.2	Negligible
Offices, Nine Elms Lane (HEAR7)	29.1	25.9	26.0	0.1	Negligible
Thames Path (HEAR10)	24.5	22.3	22.8	0.4	Small
River Thames (HEAR11)	23.4	21.4	21.6	0.2	Negligible

** Denotes receptor that is altered or constructed after the baseline year. Changes in concentration at each receptor have been rounded to one decimal place.*

4.5.12 The largest predicted increase in the annual mean concentration as a result of construction at the Heathwall Pumping Station site is 0.4$\mu g/m^3$, which is predicted at the Thames Path receptor (HEAR10). The largest increase at a receptor of relevant exposure to the annual mean objective is 0.2$\mu g/m^3$ at the proposed residential properties at the Riverlight development (HEAR3) and Embassy Gardens development (HEAR6). This change is described as negligible according to the criteria detailed in Vol 2 Section 4.

4.5.13 With no exceedances of the annual mean PM_{10} standard (40$\mu g/m^3$), the significance of the effects is **negligible** at all receptors.

4.5.14 With regard to the daily mean PM_{10} concentrations, Vol 15 Table 4.5.3 shows the predicted number exceedances of the daily PM_{10} standard (50µg/m^3) for each modelled scenario. The objective / limit value allows no more than 35 exceedances in a year.

4.5.15 The results in Vol 15 Table 4.5.3 show that the number of daily exceedances of PM_{10} is predicted to decrease between 2010 and the peak construction year with or without the Thames Tideway Tunnel project. This decrease is due to predicted reductions in background concentrations and improved vehicle engine technology. The predicted results for the development case show a maximum increase of one day per year with concentrations above 50µg/m^3 compared with the base case at the modelled receptors due to construction works at the Heathwall Pumping Station site.

4.5.16 With no exceedances of the of the daily PM_{10} objective in the development case, the significance of the effects would be **negligible** at all sensitive receptors.

Vol 15 Table 4.5.3 Air quality - predicted exceedances of the daily PM_{10} standard

Receptor	Predicted number of exceedances of the daily PM_{10} standard			Change between base and dev cases (days)	Magnitude of impact
	2010 base-line	Peak construction year base case	Peak construction year dev case		
Receptors where the objective / limit value does apply					
Houseboats (HEAR1)	9	5	5	0	Negligible
Riverlight residential (HEAR3)*	11	7	7	0	Negligible
Embassy Gardens residential (HEAR6)*	31	19	19	0	Negligible
Elm Quay Court, Nine Elms Lane residential (HEAR9)	16	10	10	0	Negligible
US Embassy (HEAR8)*	14	8	8	0	Negligible
Receptors where the objective / limit value does not apply					
Battersea Barge (HEAR2)	9	6	6	0	Negligible

Receptor	Predicted number of exceedances of the daily PM_{10} standard			Change between base and dev cases (days)	Magnitude of impact
	2010 base-line	Peak construction year base case	Peak construction year dev case		
Industrial, Nine Elms Lane (HEAR4)	19	12	12	0	Negligible
Offices, Nine Elms Lane (HEAR7)	24	15	15	0	Negligible
Thames Path (HEAR10)	11	7	8	1	Small
River Thames (HEAR11)	9	5	6	0	Neglgible

** Denotes receptor that is altered or constructed after the baseline year. Changes at each receptor have been rounded to the nearest whole number.*

Sensitivity test for programme delay

4.5.17 For the assessment of local air quality effects during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors. Based on the development schedule (Vol 15 Appendix N), it is possible that as a result of the one year delay, more of the Riverlight and Embassy Gardens developments and some of the Nine Elms Parkside development may be complete and occupied. However, it is not expected that any new receptors would experience different effects to those receptors assessed above, rather it would be a case of the potential for some additional receptors to experience the same as those that have already been identified.

Construction dust

4.5.18 Construction dust would be generated from both on-site activities and from road vehicles accessing and servicing the site.

4.5.19 Dust sensitive receptors have been identified in the vicinity of the Heathwall Pumping Station site in accordance with the criteria in Vol 2 Section 4, as described in Vol 15 Table 4.4.6. A summary of the approximate numbers of receptors in distance bands from the Heathwall Pumping Station site is detailed in Vol 15 Table 4.5.4.

Vol 15 Table 4.5.4 Air quality - numbers of dust sensitive receptors

Buffer distance (m)	Number of receptors*	Receptor type
<20	10-100	Residential properties, open space, industrial
20-50	10-100	Residential properties, open space, industrial

Buffer distance (m)	Number of receptors*	Receptor type
50-100	100-500	Residential properties, open space, industrial
100-350	More than 500	Residential properties; open space; industrial

** Buildings or locations that could be affected by nuisance dust.*

4.5.20 In line with the IAQM guidance (IAQM, 2012)[10], the site has been categorised using the criteria given in Vol 2 Section 4 to assess the likely impacts from demolition, earthworks, construction and trackout activities during construction and the likely effects of these activities on sensitive receptors close to the development.

4.5.21 The demolition for the Heathwall Pumping Station site is classified as a 'small' dust emission class. This classification is based on the small size of the demolition volume, which is less than 20,000m^3. As the nearest receptor is less than 20m from the construction site, this makes the risk category for demolition activities medium risk.

4.5.22 The earthworks have been assessed to be a 'medium' dust emission class as the size of the construction site is greater than 10,000m^2 but the total material to be moved is less than 100,000 tonnes. With the nearest receptor less than 20m away, the site is assessed to be high risk for earthworks.

4.5.23 The construction proposed for the Heathwall Pumping Station site has a 'medium' dust emission class. This classification is based on the medium size of the building volumes, the use of piling for the cofferdam and the use of on-site concrete batching. As the nearest receptor is within 20m, the risk category for construction activities is therefore assessed to be high risk.

4.5.24 There would be 50-100m of unpaved haul roads on site and the number of construction lorry movements per day would be between 25-100, so the trackout dust emission class is classified as 'medium'. The closest receptor is within 20m of the affected roads. The risk category from trackout is therefore assessed to be medium risk.

4.5.25 The risk categories for the four activities are summarised in Vol 15 Table 4.5.5. This summary of these risks does not take into account the measures outlined in the *CoCP* (Section 7).

Vol 15 Table 4.5.5 Air quality – summary of construction dust risks

Source	Dust soiling / PM_{10} effects
Demolition	Medium risk site
Earthworks	High risk site
Construction	High risk site
Trackout	Medium risk site

Note: without CoCP (Section 7) measures

4.5.26 On this basis, the development at the Heathwall Pumping Station site is classified as a high risk site overall.

4.5.27 Although the receptor sensitivity (with respect to construction dust nuisance) is identified as medium for all receptors apart from footpaths (as identified in Vol 15 Table 4.4.6), due to the duration of the works, the other developments being constructed in the locality, the proximity to the Kirtling Street site and the number of sensitive receptors in the locality, the sensitivity of the area has been defined as 'very high'.

4.5.28 With regard to the significance of effects, a high risk site with a very high sensitivity of the area would result in an overall major adverse effect without control measures. When the measures outlined in the *CoCP* (Section 7) are applied, the significance of the effect would be reduced to **minor adverse** for receptors within 50m of the site boundary (in accordance with IAQM guidance). The significance of construction dust effects at receptors greater than 50m from the site boundary would be minor adverse without the *CoCP* (Section 7) measures and therefore **negligible** with the measures. The significance of the effect for each receptor is summarised in Vol 15 Table 4.5.6.

Vol 15 Table 4.5.6 Air quality - significance of construction dust effects

Receptor	Significance of effect
Houseboats (HEAR1)	Minor adverse
Riverlight residential (HEAR3)*	Minor adverse
Embassy Gardens residential (HEAR6)*	Minor adverse
Elm Quay Court, Nine Elms Lane residential (HEAR9)	Negligible
US Embassy (HEAR8)*	Negligible
Battersea Barge (HEAR2)	Minor adverse
Industrial, Nine Elms Lane (HEAR4)	Minor adverse
Offices, Nine Elms Lane (HEAR7)	Minor adverse
Thames Path (HEAR10)	Minor adverse
River Thames (HEAR11)	Minor adverse

** Denotes receptor that is altered or constructed after the baseline year.*

4.6 Operational effects assessment

4.6.1 The operational assessment has been undertaken in accordance with the modelling methodology set out in Vol 2 Section 4. Vol 15 Table 4.6.1 shows the predicted maximum ground level odour concentrations at the Heathwall Pumping Station site. These are the highest concentrations that could occur at the worst affected ground level receptor at or near the site in a typical year. In accordance with the odour benchmark set by the Environment Agency, results are presented for the 98th percentile of hourly average concentrations in the year (or the 176th highest hourly concentration in the year) and the number of hours in a year with concentrations above $1.5ou_E/m^3$. Achieving the 98th percentile is considered to prevent nuisance and protect amenity. The number of hours with concentrations above $1.5ou_E/m^3$ gives an indication of the number of hours in a year that an odour might be detectable at the worst affected receptor. The Environment Agency benchmark permits 175 hours above $1.5ou_E/m^3$. The table also identifies the magnitude of the identified impacts in accordance with the criteria detailed in Vol 2 Section 4.

Vol 15 Table 4.6.1 Odour - impacts and magnitude – operation

Year	Maximum at ground level locations		Impact magnitude and justification
Typical	98th percentile (ou_E/m^3)	0	Negligible 98th percentile concentration is less than $1ou_E/m^3$
	No. of hours > $1.5ou_E/m^3$	4	

4.6.2 In Vol 15 Table 4.6.1 above, the 98th percentile is shown as zero as air would be released from the ventilation column for less than 2% (176 hours) of the year. This means that the odour benchmark would be achieved at all locations. This represents an impact of negligible magnitude.

4.6.3 The most frequent occurrence of odours in the typical year would occur to the west of the ventilation columns with concentrations above $1.5ou_E/m^3$ for four hours at 15-30m from the South West Storm Relief combined sewer overflow (CSO) interception chamber ventilation column, which depending upon the location of this column, could occur within the site. Odour concentrations could be above $1.5ou_E/m^3$ for at least one hour for up to 200m from the column which in the typical year modelled, extends over the river to include the Battersea Barge with one hour of odour in a year. With a frequent use year (ie, a more rainy year than average), the impact is likely to be of similar magnitude.

4.6.4 With regard to the significance of effects given that the predicted odour concentrations at all locations would not exceed the 98th percentile criterion of $1.5ou_E/m^3$, it is considered that overall significance would be **negligible**. No significant effects are therefore predicted in relation to odour.

4.7 Cumulative effects assessment

Construction effects

4.7.1 Three developments were identified in Section 4.3 (Riverlight development, Embassy Gardens and Nine Elms Parkside) that could potentially give rise to cumulative effects as they would be under construction as the same time as the proposed development at the Heathwall Pumping Station site. This cumulative effect has been taken into account by increasing the sensitivity of the area to construction dust. The traffic effects from these developments have already been accounted for in the traffic data used for the air quality assessment. Therefore the effects on local air quality would remain as described in Section 4.5 above.

4.7.2 In the event that the programme for the Thames Tideway Tunnel is delayed by approximately one year, more of the above developments may be built and occupied which would lead to a corresponding reduced level of cumulative activity. Cumulative effects would therefore be no greater than described above.

Operational effects

4.7.3 As described in para. 4.3.14, there would not be any cumulative operational effects. Therefore the effects on odour would remain as described in Section 4.6 above.

4.8 Mitigation

Construction

4.8.1 Control measures of relevance to air quality are embedded in the *CoCP* (Section 7) as summarised in Section 4.2. No mitigation is required because effects are not significant.

Operation

4.8.2 Based on the assessment results (which includes the environmental design measures detailed in para. 4.2.18) indicating that all effects would be negligible, no mitigation is required.

Monitoring

4.8.3 It is envisaged that an appropriate particulate monitoring regime would be agreed with the LB of Wandsworth prior to commencement of construction at the Heathwall Pumping Station site.

4.9 Residual effects assessment

Construction effects

4.9.1 As no mitigation measures are required, the residual construction effects remain as described in Section 4.5. All residual effects are presented in Section 4.10.

Operational effects

4.9.2 As no mitigation measures are required, the residual operational effects remain as described in Section 4.6. All residual effects are presented in Section 4.10.

4.10 Assessment summary

Vol 15 Table 4.10.1 Air quality - summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential - houseboats (HEAR1)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Residential - Riverlight (HEAR3)*	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Minor adverse	None	Minor adverse
	Effects from construction dust	Minor adverse	None	Minor adverse
Residential - Embassy Gardens (HEAR6)*	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Minor adverse	None	Minor adverse
	Effects from construction dust	Minor adverse	None	Minor adverse
Residential - Elm Quay Court (HEAR9)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Minor adverse	None	Minor adverse
	Effects from construction dust	Negligible	None	Negligible
US Embassy (HEAR8)*	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Negligible	None	Negligible
Restaurant/bar - Battersea Barge (HEAR2)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Industrial - Fedex, Nine Elms Lane (HEAR4)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
	Effects from construction dust	Minor adverse	None	Minor adverse
Offices - Nine Elms Lane (HEAR7)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Minor adverse	None	Minor adverse
	Effects from construction dust	Minor adverse	None	Minor adverse
Recreational - Thames Path (HEAR10)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse
Recreational - River Thames (HEAR11)	Local air quality – effects from construction road traffic, tugs for river barges and plant emissions	Negligible	None	Negligible
	Effects from construction dust	Minor adverse	None	Minor adverse

** Denotes receptor that is altered or constructed after the baseline year.*

Vol 15 Table 4.10.2 Odour - summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential - Houseboats (HEAR1)	Odour	Negligible	None	Negligible
Residential - Riverlight (HEAR3)*		Negligible	None	Negligible
Residential - Embassy Gardens (HEAR6)*		Negligible	None	Negligible
Residential - Nine Elms Parkside (HEAR5)*		Negligible	None	Negligible
Residential - Elm Quay Court (HEAR9)		Negligible	None	Negligible
US Embassy (HEAR8)*		Negligible	None	Negligible
Restaurant/bar - Battersea Barge (HEAR2)		Negligible	None	Negligible
Industrial - Fedex, Nine Elms Lane (HEAR4)		Negligible	None	Negligible
Offices - Nine Elms Lane (HEAR7)		Negligible	None	Negligible
Recreational - Thames Path (HEAR10)		Negligible	None	Negligible
Recreational - River Thames (HEAR11)		Negligible	None	Negligible

** Denotes receptor that is altered or constructed after the baseline year.*

References

[1] Greater London Authority and London Councils. *Best Practice Guidance: The Control of Dust and Emissions from Construction and Demolition* (November 2006).

[2] Highways Agency. *Design Manual for Roads and Bridges*, Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 1 pg D-1 HA207/07 Air Quality, May 2007.

[3] Michigan Environmental Science Board. *Health Effects of Low-Level Hydrogen Sulfide in Ambient Air* (2000).

[4] UK Government. *Environment Act 1995*. Available at: http://www.legislation.gov.uk/ukpga/1995/25/contents. Accessed June 2012.

[5] Defra. *2010 Based Background Maps for NOx, NO2, PM10 and PM2.5.* Available at: http://laqm.defra.gov.uk/maps/maps2010.html. Accessed June 2012.

[6] London Borough of Wandsworth, *Personal Communication,* July 2012.

[7] World Health Organization. *Air Quality Guidelines for Europe Second Edition* (2000), Chapter 6.6.

[8] Defra. *Emissions.* Available at: http://laqm.defra.gov.uk/review-and-assessment/tools/emissions.html#eft. Accessed June 2012.

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

[10] Institute of Air Quality Management. *Guidance on the Assessment of the Impacts of Construction on Air Quality and the Determination of their Significance* (January 2012).

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 5: Ecology - aquatic

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 5: Ecology – aquatic

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5 Ecology – aquatic

5.1 Introduction

5.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on aquatic ecology at the Heathwall Pumping Station site.

5.1.2 The proposed development may lead to effects on aquatic ecology due to both the physical works in-river during construction and operation of the Thames Tideway Tunnel. During operation the interception of the combined sewer overflow (CSO) would result in substantially reduced discharges of untreated sewage into the tidal Thames at this location. There would also be permanent in-river structures at this site. Significant construction and operational effects are therefore considered likely, and an assessment of effects on aquatic ecology for both phases is presented.

5.1.3 The presence of sewage in the aquatic environment has adverse effects on aquatic ecology receptors (habitats, mammals, fish, invertebrates and algae). In particular, discharges of untreated sewage effluent can result in low levels of dissolved oxygen (DO), which can cause mass fish mortalities known as hypoxia events. There are CSOs discharging at locations throughout the tidal Thames, including the reach upstream and downstream of the South West Storm Relief and Heathwall Pumping Station CSOs.

5.1.4 The tidal Thames comprises a dynamic environment, in which tidal action leads to dispersal of discharges. Therefore the effects of the operational Thames Tideway Tunnel which is designed to intercept the most problematic CSOs would be most evident at a project-wide level. These effects are therefore reported in Volume 3 Project-wide assessment. This section assesses the localised effects at a site-specific level for Heathwall Pumping Station.

5.1.5 The assessment of the likely significant effects of the project on aquatic ecology has considered the requirements of the National Policy Statement (NPS) for Waste Water (Defra, 2012)[1]. In line with these requirements, designations, species and habitats relevant to aquatic ecology are identified and measures incorporated into the proposed development described. Based on assessment findings, measures to address likely significant adverse effects are identified. Vol 2 Section 5 provides further details on the methodology.

5.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station Figures).

5.2 Proposed development relevant to aquatic ecology

5.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to aquatic ecology are set out below.

Construction

5.2.2 The construction maximum extent of working at Heathwall Pumping Station would be located predominantly on the foreshore. Construction activities would occur over three years, with structures in place for approximately two and a half to three years. The elements of the construction of the proposed development of relevance to aquatic ecology would be as follows:

a. The installation of temporary sheet piling to create cofferdams on the foreshore for the CSO interception works as shown in the Construction Phases – Phase 1 Site Setup, Shaft Construction and Tunnelling drawing, and subsequent removal of the temporary cofferdam. The installation of cofferdams would be accomplished using a jack-up barge, or similar equipment.

b. It is assumed for the assessment that the majority of foreshore material within the temporary cofferdam would remain in situ. For structural reasons, soft material located adjacent to the perimeter of the temporary cofferdams and adjacent to the river wall would be removed. The soft material includes silt, peat and other materials. Removal of this material would ensure that any settlement of the cofferdam fill material does not adversely affect the ties between the walls of the twin walled temporary cofferdam leading to structural difficulties. All soft material within permanent cofferdams would be removed to ensure sound foundations for permanent construction.

c. The exact extent and depth of the foreshore deposits to be removed would be informed by geotechnical investigations. Areas of removed material would be filled with gravel similar to the existing bed material. Cofferdam fill material would then be placed onto the foreshore on top of a geotextile layer. Suitable sized plant would be utilised to reduce potential load impacts on the foreshore. Upon removal of the temporary cofferdam, the fill and geotextile layer would be removed and the bed would be reinstated to match the existing river bed conditions. Material excavated would be disposed of in accordance with the project's Waste Management procedure.

d. The placement and removal of a temporary campshed on the foreshore outside the cofferdam for the CSO works, suitable for up to a 350 tonne barge.

e. Regular barge movements and resting on the campshed (with a peak monthly average of four movements per day).

f. Temporary relocation of the Battersea Barge upstream from its current location during the construction phase of the project.

5.2.3 The construction of in-river structures, and in particular the temporary works cofferdam would affect the river regime. There is potential for localised increases in flow velocity to cause scour of the river bed and foreshore, or deposition of sediments. The scour could occur around the face of the cofferdam or at the adjacent foreshore structures (abutment scour) or across the channel width (contraction scour). Any potential scour development during construction would be monitored and if relevant trigger levels are reached, appropriate protection measures would be provided. Further details are provided in Scour and Accretion Monitoring and Mitigation Plan for Temporary Works in the Foreshore (Vol 3 Appendix L.4).

Code of Construction Practice

5.2.4 The *Code of Construction Practice (CoCP*) context sets out the standards, procedures and measures for managing and reducing construction effects. These measures would be implemented through a Construction Environment Management Plan (CEMP) prepared by the contractor to control site operations and works.

5.2.5 The *CoCP* is provided in Vol 1 Appendix A. It contains general requirements (*Part A*), and site-specific requirements for this site (*Part B*). The *CoCP Part A* includes the following measures, which are an integral part of the project and relevant for the purposes of this assessment:

a. The location of barges resting on the foreshore and river bed shall be controlled to reduce extent of potential environmental impacts. The design of facilities such as campsheds would consider the need to minimise environmental impacts and should consider the use of lattice structure barge grids where appropriate. In-river structures, including campsheds, would be removed on completion of the works unless otherwise agreed. Where concrete is used, such as campsheds, a membrane is required to protect the underlying riverbed. The method for reinstatement of the temporary works area would be subject to a method statement that would consider requirements for impact on aquatic ecology (*CoCP Part A* Section 11).

b. Avoiding piling at night to ensure free windows of opportunity to allow fish to migrate past the site within each 24-hour period (*CoCP Part A* Section 6).

c. Undertaking noise measurements at prescribed points and intervals to ensure compliance with the *CoCP* (*CoCP Part A* Section 6).

d. Limiting allowable noise and vibration levels to leave part of the river cross-section passable at all times (*CoCP Part A* Section 6).

e. Where technically feasible utilising low noise/vibration cofferdam or pile/pier installation techniques such as pressing or vibro-piling rather than impact/percussive piling. In the event that in-river percussive piling is needed, prior approval from the EA would be required (*CoCP Part A* Section 6).

f. Where vibro-piling is undertaken, slowly increasing the power of the driving to enable fish to swim away before the full power of the pile driver is felt through the river (*CoCP Part A* Section 6).

g. The contractor shall make every reasonable effort to remove all piles completely from the bed of the river. With the prior written agreement of the PLA the contractor would ensure any piles which prove impossible to fully extract on application of the confirmed minimum crane pull of 40 tonnes, are driven down, cut off or removed to a depth of a least 1 metre below the adjacent riverbed level unless advised otherwise (*CoCP Part A* Section 4).

h. Dewatering operations for cofferdams and in river structures need to consider fish rescue arrangements. To the extent that it is not dealt with in the application for development consent, prior written consent from the EA is required under the Salmon and Freshwater Fisheries Act, 1975, to net or trap fish, or introduce fish into a water course (*CoCP Part A* Section 8).

i. Avoidance of pollution of the river through measures that accord with the principles set out in industry guidelines, including the Environment Agency (EA) note PPG05 *Works in, near or liable to affect water courses* (Environment Agency, undated)[2] and Construction Industry Research and Information Association (CIRIA) report C532: *Control of water pollution from construction sites* (CIRIA, 2001)[3] (*CoCP Part A* Section 8).

j. Appropriate measures would be taken with regard to ‘in river’ works to minimise the release of suspended sediment and solids into the water column (*CoCP Part A* Section 8).

k. For works where materials are being loaded and unloaded on the river, the Contractor is required to establish suitable management arrangements and mitigation measures so as to prevent spillage of transferred materials. This includes design of conveyor systems, enclosures, conveyor belt scrapper locations and selection of other loading equipment. Monitoring methods and contingencies arrangements are to be included in the River Transport Management Plan and Emergency Preparedness Plan (*CoCP Part A* Section 8).

l. In constructing temporary cofferdams the contractor would avoid any mixing of fill material with the underlying substrate. This would be achieved by installing a membrane between the existing river bed and the back fill material (*CoCP Part A* Section 11).

m. The lighting, to be specified in a *Lighting management plan*, would be designed to comply with relevant standards. This would consider the aquatic environment and avoid direct lighting of watercourses, where reasonably practical, to avoid inhibiting movements of photophobic species such as eel (*CoCP Part A* Section 4) (see para. 5.2.6 for *CoCP Part B* measures for site working hours relevant to lighting at Heathwall Pumping Station).

5.2.6 The *CoCP Part B* at Heathwall Pumping Station commits to the following measures that are of relevance to aquatic ecology:

a. Lighting would address the impact on terrestrial and aquatic ecology and include the use of low level directional lighting where possible whilst meeting safe work requirements (*CoCP Part B* Section 4).

b. Membrane to be installed between existing river bed and temporary back fill material to prevent contamination of juvenile fish habitat. Areas of foreshore used for temporary works would be restored to similar condition and material prior to the works (*CoCP Part B* Section 11).

Operation

5.2.7 The elements of the operation of the proposed development of relevance to aquatic ecology are set out below. Further information is provided in Section 3 of this volume:

5.2.8 Discharges from the Southwest Storm Relief CSO and Heathwall Pumping Station CSO would be intercepted at the Heathwall Pumping Station site. Based on the base case (which includes permitted tidal Thames sewage treatment works upgrades, and the Lee Tunnel scheme, as well as projected population increases) discharges (which have been modelled for 2010) during the Typical Year[i] from the Southwest Storm Relief CSO are anticipated to be 239,000m^3 per annum over a total of 13 discharge events (or spills) by 2021. The discharge is predicted to reduce to 3,900m^3 per annum over one discharge event once the Thames Tideway Tunnel project is operational. Discharges from the Heathwall CSO during the Typical Year are anticipated to be 748,000m^3 per annum over a total of 39 discharge events by 2021. The discharge is predicted to reduce to 63,000m^3 per annum over four discharge events once the Thames Tideway Tunnel project is operational. The total residual discharge at this site would thus be 66,900m^3 over 5 spills. This represents an approximately 93% decrease as a result of the Thames Tideway Tunnel project.

5.2.9 A permanent foreshore structure housing the CSO interception would be in place in the river and would give rise to effects from the construction phase of the project onwards. However, as it is a permanent structure, its effects would be ongoing for its full existence, and are therefore considered under the operational assessment.

5.2.10 Scour protection for the permanent foreshore CSO interception structure and discharge apron would consist of buried rip-rap which would be overlaid with an appropriate substrate material.

Environmental design measures

5.2.11 Generic design principles of relevance to aquatic ecology at Heathwall Pumping Station are as follows:

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[i] The 'Typical Year' represents the most 'typical' 12 month period of rainfall observed between 1970 and 2011 and is represented by the period from October 1979 to September 1980

a. Where appropriate to context and practicable, fendering (horizontal or vertical) shall be included on the foreshore structure, preferably in timber, in order to promote aquatic ecology.

b. Scour protection shall be provided beneath any new outfall extending to below the low water line and along the line of the new river wall (to protect its foundation). The detailed design and extent of this shall seek to avoid or minimise adverse effects on aquatic ecology.

c. Where practicable, at the base of the foreshore structure, measures such as low level habitat features shall be provided to encourage retention of sediment to promote aquatic ecology.

d. Light pollution shall be minimised within the sites by using capped, directional and cowled lighting units.

e. Lighting shall balance the need to provide a safe environment with one that also responds to the need to reduce light pollution and promote biodiversity (terrestrial and aquatic)

f. No lighting shall be proposed in the River Thames or, directed riverward unless required for navigational purposes.

g. There shall be no lighting on the outside of the foreshore structures unless required for navigational purposes

h. New lighting to the foreshore structure shall be provided in accordance with the lighting principles

5.2.12 Specific design principles of relevance to aquatic ecology at Heathwall Pumping Station are as follows:

a. New lighting to the riverside walkway and foreshore structures shall be provided in accordance with the generic lighting principles.

5.3 Assessment methodology

Engagement

5.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of aquatic ecology are presented in Vol 15 Table 5.3.1.

Vol 15 Table 5.3.1 Aquatic ecology – stakeholder engagement for Heathwall Pumping Station

Organisation	Comment	Response
Environment Agency (Phase two response – February 2012)	It is difficult to understand why the footprint of the permanent land take needs to be so large on this site. The width of the interception and valve chamber could be reduced to minimise the amount of land take into the river Thames.	The footprint of the structure has been minimised within the engineering constraints presented by the structures at this site.

Organisation	Comment	Response
Environment Agency (Section 48 response – 2012)	How has the footprint of the encroachment been minimised and the design evolved to minimise scour.	The footprint of the structure has been minimised within the engineering constraints presented by the structures at this site.

Baseline

5.3.2 The baseline methodology follows the methodology described in Vol 2. There are no site specific variations for identifying the baseline conditions for this site.

5.3.3 The assessment is based on survey and desk study data. For habitats, mammals, fish, invertebrates and algae, desk study data has been obtained for the whole of the tidal Thames. The data sets for fish, invertebrates and algae are based on fixed sampling locations at intervals through the tidal Thames. Sites as close to Heathwall Pumping Station as possible have been selected. Details of the background or desk study data sets are provided in Vol 2.

5.3.4 Surveys for fish and invertebrates were undertaken during October 2010 at Tideway Walk, immediately upstream of Heathwall Pumping Station, and at Heathwall Pumping Station during May 2011. Surveys were within the proposed development site and within 100m radius of the site boundary. During these surveys, the intertidal habitats present were recorded. Surveys for juvenile fish were also undertaken at five sampling locations along the tidal Thames six times between May and September 2011. The nearest sampling location to the site was Chelsea Embankment Foreshore, approximately 1km upstream. Surveys for algae were undertaken at eight sampling locations in May 2012, comprising each of the foreshore sites, including Heathwall Pumping Station. The survey comprised sampling of algae along a vertical transect of the river wall located within or as close to the proposed development site as possible.

Construction

5.3.5 The assessment methodology for the construction phase follows that described in Vol 2. The assessment area is the zone which lies within a 100m radius of the boundary of the proposed development site. The assessment year for construction effects is Site Year 1, ie when construction would commence. There are no site specific variations for undertaking the construction assessment of this site.

5.3.6 Section 5.5 details the likely significant effects arising from the construction of the proposed development at the Heathwall Pumping Station site. Kirtling Street (Vol 14) is located west of the Heathwall Pumping Station site. The combined impacts of construction at both of these sites is considered for aquatic ecology in this volume and Vol 14 (Kirtling Street).

5.3.7 In terms of the base case, the site development schedule (Vol 15 Appendix N) identifies the Riverlight (Tideway Industrial Estate) mixed use development, located adjacent to the Kirtling Street site, and the development on land at St George's Wharf, located approximately 550m downstream, which both include riverside walkways. However, it is not considered that either of these schemes would alter the baseline conditions. The same is considered to be true for Riverwalk House, Millbank, some 720m to the north-east, where a stairway linking the river walk with Vauxhall Bridge would be constructed. Therefore no other developments are considered within the base case. At Battersea Power Station, 360m upstream of the Heathwall Pumping Station site there will be development from 2016. Although parts of the residential development would already be operational during Thames Tideway Tunnel construction (thus forming part of the base case), it is possible that works including modifications to the existing jetty and adjustment to the existing river wall would be ongoing during Thames Tideway Tunnel construction works at the Heathwall Pumping Station site; therefore this part of the scheme is considered within the cumulative effects section of this assessment.

5.3.8 All other developments listed in the site development schedule (Volume 15 Appendix N) are in-land, do not comprise in-river development, development adjacent to the river or development discharging into the river and therefore would not affect the aquatic ecology baseline. Similarly, there are no other schemes under construction which would be in-river, adjacent to the river or discharging to the river, and therefore no further schemes are included in the cumulative assessment.

5.3.9 The assessment of construction effects also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Operation

5.3.10 The assessment methodology for the operation phase follows that described in Vol 2. The assessment area is as stated in para. 5.3.5. There are two assessment years for operational effects; Year 1 and Year 6. Year 1 is the year that the Thames Tideway Tunnel project would be brought into operation. Year 6 provides sufficient time after operation commences to allow the longer term effects on aquatic ecology to be assessed. There are no site specific variations for undertaking the operational assessment of this site.

5.3.11 Section 5.6 details the likely significant effects arising from the operation of the proposed development at the Heathwall Pumping Station site. The effects of the interception of all of the CSOs within the Thames Tideway Tunnel project on aquatic ecology receptors at a river wide level are considered in Vol 3 Project-wide assessment.

5.3.12 The site development schedule (Vol 15 Appendix N) identifies that the development scheme at Battersea Power Station would be operational at the same time as the scheme at Heathwall Pumping Station. Therefore this development is considered as part of the operational base case for aquatic ecology.

5.3.13 No schemes from the site development schedule (Vol 15 Appendix N) are considered relevant to a cumulative impact assessment with regard to aquatic ecology. Therefore no cumulative impact assessment has been undertaken.

5.3.14 As with construction (see para. 5.3.9) the assessment of operational effects also considers the extent to which the assessment findings would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Assumptions and limitations

5.3.15 The assumptions and limitations associated with this assessment are presented in Vol 2. Assumptions and limitations specific to this site are outlined below.

Assumptions

5.3.16 It has been assumed that:

a. The campshed would be concrete structure.

b. It would be necessary to remove all alluvial and other deposits above the natural gravel within the temporary cofferdam and campsheds in order to establish a stable construction platform, as detailed in Section 5.2.

c. The campshed would be constructed using the method similar to that described for the temporary cofferdams (para. 5.2.2). Sheet piles would be used to create the outer edge of the campshed. Soft material would be removed from within the sheet piled area and replaced with a more coarse material similar to the existing river bed in order to provide stability. Concrete would be placed into the sheet piled area on top of a geotextile membrane.

d. The area between the outer edge of the temporary cofferdam and the maximum extent of working area would be subject to disturbance and consolidation during construction from jack up barges and similar equipment, particularly during cofferdam installation.

e. No dredging would be required while the campshed is in use.

f. There would be illumination at this facility due to the need for continuous working for the duration of the connection tunnel construction.

g. Reinforcement of the foreshore beneath Heathwall Pumping Station CSO and Southwest Storm Relief CSO for scour protection would be required.

h. The trigger level for implementing scour protection measures (para. 5.2.3) would be set to ensure that scour would not penetrate below the depth of the existing substrate (i.e. there would be no change in broad habitat type as a result of scour).

Limitations

5.3.17 There are no site-specific limitations.

5.4 Baseline conditions

5.4.1 The following section sets out the baseline conditions for aquatic ecology within and around the site. Future baseline conditions (base case) are also described.

Current baseline

5.4.2 The section begins with a discussion of any statutory (i.e. with a basis in law) or non-statutory (i.e. designated only through policy) sites designated for their nature conservation value. It then addresses habitats, followed by the species receptors associated with those habitats, namely mammals, fish, invertebrates and algae. This order is followed throughout the assessment sections.

Designations and habitats

5.4.3 This section sets out the effects on designations and habitats applicable at the site specific level. Designations and habitats applicable at the project wide scale are assessed in Vol 3.

5.4.4 The tidal Thames is part of the Thames Estuary South East Marine Conservation Zone (MCZ no. 5) the details of which were submitted to Government in early 2012. If adopted, it will be designated as a national statutory site under the Marine and Coastal Access Act 2009. The purpose of MCZs is to protect the full range of nationally important biodiversity, as well as certain rare and threatened species and habitats. Species include smelt (*Osmerus eperlanus*), European eel (*Anguilla anguilla*) and tentacled lagoon worm (*Alkmaria romijnii*) (Balanced Seas, 2011)[4]. The tidal Thames offers important spawning and migratory habitat for smelt, and migratory habitat for European eel.

5.4.5 There are no other international or national statutory sites (ie Sites of Special Scientific Interest or Local Nature Reserves) designated for aquatic ecology within the assessment area.

5.4.6 Heathwall Pumping Station falls within the non-statutory River Thames and Tidal Tributaries Site of Importance for Nature Conservation (SINC Grade III of Metropolitan importance)[ii]. The SINC is designated by the Greater London Authority and adopted by all boroughs which border the Thames. It recognises the range and quality of estuarine habitats including mudflat, shingle beach, reedbeds and the river channel itself. The SINC citation notes that over 120 species of fish have been recorded in the Tideway, though many of these are only occasional visitors. The more common species include dace (*Leuciscus leuciscus*), bream (*Abramis brama*) and roach (*Rutilus rutilus*) in the freshwater reaches

[ii] SINC (Grade M) = Site of Importance for Nature Conservation (Grade III of Metropolitan importance)

(described in para. 5.4.8), and sand-smelt (*Atherina presbyter*), flounder (*Platichtyhys flesus*) and Dover sole (*Solea solea*) in the estuarine reaches. Important migratory species include Twaite shad (*Alosa fallax*), European eel, smelt, salmon (*Salmo salar*) and sea trout (*Salmo trutta*). A number of nationally rare snails occur, including the swollen spire snail *Mercuria confusa*, as well as an important assemblage of wetland and wading birds.

5.4.7 The tidal Thames is the subject of a Habitat Action Plan(HAP) within the London Biodiversity Action Plan (BAP) (Thames Estuary Partnership Biodiversity Action Group, undated)[5]. There is no BAP at the borough level for Wandsworth, therefore the borough follows the London BAP. The tidal Thames HAP identifies a number of habitats and species which characterise the estuary, such as gravel foreshore, mudflat and saltmarsh. A number of these habitats and species, including mudflat, are also the subject of action plans under the UK BAP.

5.4.8 The river is divided into three zones within the tidal Thames HAP; freshwater, brackish and marine (Vol 3 Figure 5.4.1, see separate volume of figures). The brackish zone is equivalent to the category known as 'transitional water' or estuaries under the Water Framework Directive (WFD). Further details of the WFD river zone classifications can be found in Vol 3.

5.4.9 Heathwall Pumping Station lies within the freshwater zone of the river, which means that the fish and invertebrate communities which occur within the river at this location consist of freshwater species and more freshwater tolerant marine species. Invertebrate diversity is generally higher than in the brackish zone but species must be able to withstand some variations in salinity and a stressful environment. Stress is caused by the fluctuating tidal conditions, which means that flora and fauna have to be able to tolerate wide variations in their physical environment.

5.4.10 During the survey of habitats within and immediately adjacent to the CSO construction site the intertidal habitat at Heathwall Pumping Station was recorded as consisting of a gravel foreshore.

5.4.11 An assessment of the habitats undertaken during spring 2011 indicated that the substrate was found to be a mixture of gravel (10-20mm) and pebbles (40-100mm) overlying a compacted silt under-layer. UK BAP target habitats present included sublittoral sands and gravels. The site is recognized as being located within an area of UK BAP priority habitat mudflats (Natural England, undated)[6].

5.4.12 The river in this location is confined by a vertical river wall. There is no marginal or high tide vegetation, although the vertical river wall supports communities of macro and micro algae.

5.4.13 A summary of habitat types present, and other features of interest recorded during October 2010 and May 2011 surveys are presented in Vol 15 Table 5.4.1. The survey area is presented in Vol 15 Figure 5.4.1 (see separate volume of figures).

Vol 15 Table 5.4.1 Aquatic ecology – principal habitat, substrate and other features of interest at Heathwall Pumping Station

UK BAP target habitats present and features of interest	Substrate present in intertidal zone (approximate cover)	Substrate present in subtidal samples
Gravel foreshore Sublittoral sand and gravels River wall Mudflats	Pebbles (70%) Silt (15%) Sand, cobbles (15%)	Sand Silt Gravel

Evaluation of habitats for Heathwall Pumping Station

5.4.14 The value of the habitats for individual aquatic ecology receptors is described in the relevant baseline sections. For the purpose of this assessment the habitats are considered to be of medium-high (metropolitan) value as part of the River Thames and Tidal Tributaries SINC (Grade M).

Marine mammals

5.4.15 Records compiled by the Zoological Society of London for 2003 - 2011 indicate that common seal (*Phoca vitulina*) have been observed in this area of the Thames.

Evaluation of marine mammals for Heathwall Pumping Station

5.4.16 The site is considered to be of low-medium (local) value for marine mammals given the small number of records of seal, and the limited extent of intertidal habitat for species of seal to use as a haul out site.

Fish

5.4.17 In general, tidal Thames fish populations are mobile and wide ranging. Although the abundance and diversity of fish at any one site may provide some indication of the habitat quality offered at that site it is important to consider the data within the context of sites throughout the tidal Thames, since the factors influencing distribution are likely to be acting at this wider scale. To this end, the findings of the Thames Tideway Tunnel project site specific survey, relevant juvenile fish surveys and EA background data are presented in this section and are used to inform the evaluation of the site. Effects at the project wide scale are assessed in Vol 3.

Baseline surveys

5.4.18 Two days survey were undertaken in the vicinity of this site, one in October 2010 at Tideway Walk, approximately 350m to 60m upstream, and the second at Heathwall Pumping Station, in May 2011. Full details of the methodology and rationale for the timing of surveys are presented in Vol 2. The area covered by the survey is illustrated in Vol 15 Figure 5.4.1 (see separate volume of figures).

5.4.19 Fish are routinely categorised into 'guilds' according to their tolerance to salinity and habitat preference (Elliott, M and Taylor, CJL, 1989[7], Elliott, M, and Hemingway, KL, 2002[8]). The species which occur in the tidal Thames can be divided into the following four guilds:

a. Freshwater – species which spend their complete lifecycle primarily in freshwater.

b. Estuarine resident – species which remain in the estuary for their complete lifecycle.

c. Diadromous – species which migrate through the estuary to spawn having spent most of their life at sea.

d. Marine juvenile – species which spawn at sea but spend part of their lifecycle in the estuary.

5.4.20 The survey recorded moderate fish abundance in the area of Heathwall Pumping Station, with 86 individuals captured in October 2010 and 13 in May 2011. The range of species recorded and the number of individuals is presented in Vol 15 Table 5.4.2.

Vol 15 Table 5.4.2 Aquatic ecology – results of fish surveys at Tideway Walk/ Heathwall Pumping Station

Common name	Scientific name	Number of individuals		Guild
		Oct 2010	May 2011	
Common bream	*Abramis brama*	34	3	Freshwater
Roach	*Rutilus rutilus*	22	7	Freshwater
Smelt	*Osmerus eperlanus*	15	2	Diadromous
Flounder	*Platichthys flesus*	7	0	Estuarine resident
Dace	*Leuciscus leuciscus*	4	0	Freshwater
Sea bass	*Dicentrarchus labrax*	2	0	Estuarine resident
Eel	*Anguilla anguilla*	2	1	Diadromous

5.4.21 Including the results from the immediately adjacent Kirtling Street sample (Vol 14 Table 5.4.2), six smelt were recorded in the May 2011 survey. All of these were in the 80-110mm size range and are likely to be fish from the previous year's spawning which failed to escape into the estuary during winter, or have come into the river on the flood of the tide to feed. One elver was also captured at Heathwall Pumping Station. This eel was likely to be in the first years of its freshwater stage, having arrived in the estuary the previous spring. These survey sites (including Kirtling Street) are the furthest downstream that large aggregations of coarse fish were found.

5.4.22 Smelt is a species listed under Section 41 of the Natural Environment and Rural Communities Act 2006 and is a priority UK BAP species. (Colclough, SR, *et al,* 2002*)*[9] have identified smelt spawning sites on gravel shores in the tidal Thames, upstream of Battersea. The spawning period is March-April and thereafter smelt drift progressively downstream from spawning sites towards Greenwich. Catches may be expected along the tidal Thames.

5.4.23 The distribution of salinity-sensitive species may shift seasonally and from year-to-year, depending on fluvial inputs, so that community composition can vary. There is relatively high salinity at this mid-tidal Thames location, which is towards the downstream end of the freshwater zone, where salinity is relatively close to the tolerance threshold of freshwater species. However, freshwater dace, common bream and roach are known to be present in the tidal Thames from Teddington to Thamesmead, extending furthest downstream in wetter years. Although only four dace (a freshwater species) were recorded at Tideway Walk in October 2010, EA WFD) data (paras. 5.4.29 to 5.4.30) indicate that adult dace are known to utilise this stretch of river.

5.4.24 The site is upstream of favoured areas for marine fish species, which explains the small number of such species other than smelt. Post-larval and juvenile fish of these species are known to move upstream during summer (Colclough, SR, *et al*., 2002)[10]. Individuals may be present year-round.

5.4.25 At Heathwall Pumping Station, as with other sampling locations, fish numbers were altogether lower in the May samples than in October. Early spring represents the seasonally low period for fish biomass in the tidal Thames. By early May many species have either already completed spawning migrations into the tidal Thames and have returned to the estuary, or are undergoing some form of localised migration into stable freshwater habitats in preparation for spawning. Surveys in autumn generally show highest fish biomass due largely to the first season's growth amongst young of the year.

Juvenile fish surveys

5.4.26 The shallow river margins, which shift across the intertidal foreshore with the ebb and flood of the tides, provide an important migration route for juvenile fish along the estuarine corridor. The young of species such as eel (known as glass eels or elvers), flounder, dace and smelt rely upon access to these areas of lower water velocity to avoid being washed out by tides and to avoid predation by the larger fish that occur in deeper water. Young fish also feed predominantly amongst the intertidal habitat. Adult migrants of larger fish tend to use faster mid-channel routes.

5.4.27 Surveys for juvenile fish were undertaken at Chelsea Embankment Foreshore, approximately 1km upstream of Heathwall Pumping Station, as part of a suite of five sites sampled six times between May and September 2011 as part of the project-wide assessment. The site locations are presented in Vol 2 Figure 5.4.4 (see separate volume of figures). The findings are relevant to this site because it gives context to the assemblage of fish that may be expected to be found in this reach of the river. The aim of the surveys was to record juvenile fish migrations through the tidal Thames to inform a study of the hydraulic effects of the temporary and permanent structures on fish migration. The extent of the surveys and details of the methodology are presented in Vol 2. The data from the juvenile fish surveys at Chelsea Embankment Foreshore are shown in Vol 15 Table 5.4.3.

Vol 15 Table 5.4.3 Aquatic ecology – results of 2011 juvenile fish surveys at Chelsea Embankment Foreshore

Common name	Scientific name	Number of individuals					
		Survey 1 May	2 late May	3 June	4 July	5 Aug	6 Sept
Flounder	*Platichthys flesus*	10	375	98	3	1	2
Smelt	*Osmerus eperlanus*	0	0	0	0	0	2
Eel	*Anguilla anguilla*	3	2	5	1	1	2
Common bream	*Abramis brama*	0	0	0	3	0	4
Dace	*Leuciscus leuciscus*	2	2	1	0	0	0
Roach	*Rutilus rutilus*	0	0	30	0	0	1
Perch	*Perca fluviatilis*	0	25	3	0	0	0
Goby	*Pomatoschistus* spp.	0	0	38	472	369	470
Sea bass	*Dicentrarchus labrax*	0	0	6	162	149	23
3-spined stickleback	*Gasterosteus aculeatus*	0	0	5	1	0	2
Sand smelt	*Atherina presbyter*	0	0	0	0	2	0

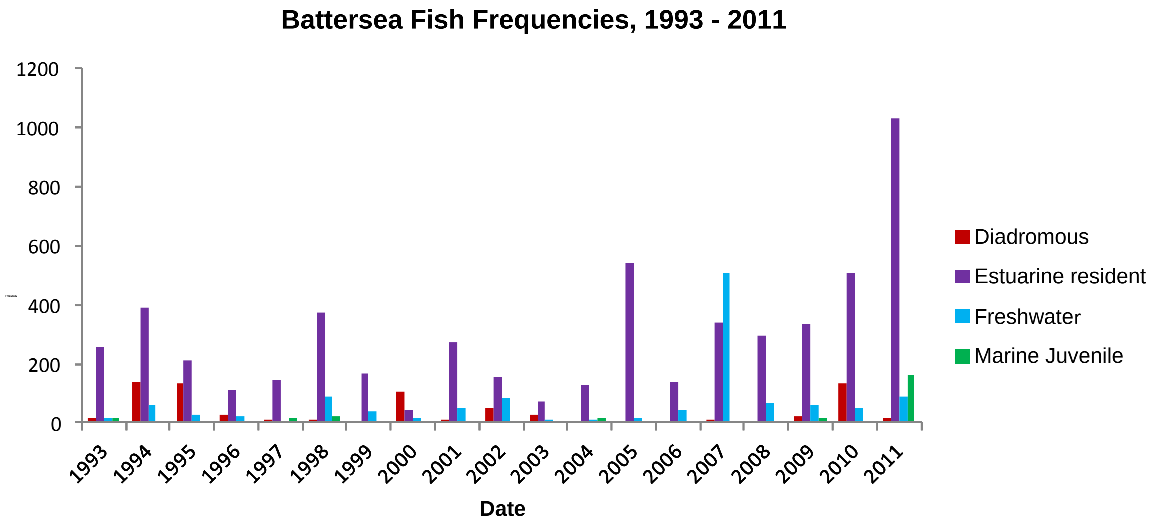
5.4.28 Post-larval flounders dominated the catch from surveys two and three confirming a widespread upper estuary colonisation. Goby (*Pomatoschistus* sp.) numbers increased considerably from survey four onwards, peaking at 472 individuals in survey four. Sea bass numbers also increased in surveys four and five. The survey area results indicate that the area is of importance for juvenile fish as a nursery area, which is an area spatially segregated from adult habitats, providing refuges and a ready food supply for juveniles. The intertidal and subtidal gravel habitat may offer a spawning substrate for smelt, although it lies downstream of the spawning zone for this species.

Environment Agency background data

5.4.29 The surveys described in paras. 5.4.26 to 5.4.28 provide up-to-date baseline information directly relevant to fish community composition at Heathwall Pumping Station. EA records have also been used to provide a wider context for the fish community in the tidal Thames. The EA carry out annual surveys of fish within the tidal Thames, with data available from 1992-2011. Methodologies for the survey are provided in Vol 2. The closest EA sampling site to Heathwall Pumping Station is at Vauxhall, however records here are limited to 1992 and 1993 records of juvenile dace and bass.

5.4.30 A more comprehensive survey dataset exists for Battersea, located approximately 4km upstream, where EA surveys have been carried out every year from 1993 to 2011. Fifteen fish species have been recorded for Battersea. These show fairly steady catches in trawls but some indication of increasing seine-net catches in recent years (Vol 15 Plate 5.4.1). Catches are dominated by estuarine resident fish such as common goby, flounder and sand smelt, freshwater species including dace, common bream, perch (*Perca fluviatilis*) and roach, and migratory species including eel and smelt. Other migratory species such as salmon and sea trout must pass through the area but are too infrequently present to be detected by only one or two surveys per year. This concurs well with the more limited Tideway Walk and Vauxhall data and probably gives a better view of the overall status of fish populations in the vicinity of the Heathwall Pumping Station site. The high frequency of freshwater species recorded in 2007 may be as a result of very high rainfall during that year. High flows may have led to a greater number of freshwater fish being washed in to the tidal Thames and lower salinity conditions which allowed them to survive.

Vol 15 Plate 5.4.1 Aquatic ecology – long-term EA total fish catches from Battersea site



Water quality and current fish baseline

5.4.31 Prior to the 1960s, water quality in the tidal Thames was heavily degraded by raw sewage inputs caused by under-capacity of sewage treatment works (STWs). With the construction of new works the progressive improvement of fish populations from the 1960s onwards was recorded (Wheeler, AC, 1979)[11]. The ecology of the tidal Thames has undergone further improvement in recent decades, with some 125 fish species now recorded by the EA.

5.4.32 However, hypoxia events (see Vol 3 Appendix C.1) arising from CSO spills and occasional discharges of untreated waste from STWs still occur. Discharges have the effect of depleting DO (measured in mg/l) by the biological breakdown of organic matter in the discharge. This is referred to as biochemical oxygen demand (BOD). Substantial fish mortalities begin to occur when DO levels drop beneath 4mg/l. An example of the effects of a hypoxia event occurred in June 2011, in which approximately 26,000 fish were killed across the tidal Thames assessment area following a release of around 450,000 tonnes of untreated sewage. This incident is discussed in further detail in the project wide assessment (Vol 2 Section 5)

5.4.33 The Tideway Fish Risk Model (TFRM) was developed to evaluate DO standards for the tidal Thames (Turnpenny, AWH, *et al.*, 2004)[12] as part of the *Thames Tideway Strategic Study (TTSS)*. The DO standards for the tidal Thames comprise four threshold levels expressed as concentrations of DO in mg/l over specified tidal durations. Frequencies are set on the number of times per year each of these thresholds can be exceeded. Further details of the standards are presented in Vol 2 Section 14. Details of the TFRM are presented in Vol 2 and Vol 2 Appendix C.3). The TFRM considers fish distribution and the effects of low DO conditions within defined 3km zones within the tidal Thames. The zones are based on those used by the EA's automated water quality monitoring system (AQMS), for which DO data are collected continuously.

5.4.34 The model uses known hypoxia tolerance thresholds for seven species which are considered to represent the range of species which occur in the tidal Thames. The model is based on the assumption that most species of fish populations would be sustainable provided hypoxia related mortality does not exceed 10% of the total population. The model considers both adult and juvenile fish (known as 'lifestage cases'), since juveniles generally have a lower tolerance to hypoxia.

5.4.35 It is not possible to isolate the contribution of individual CSO discharges to hypoxia related fish mortalities in the tidal Thames. This is because the TFRM provides outputs only at a population level. For example, DO conditions may be below a lethal threshold in one zone known to be used by a particular species of fish. However, provided conditions are above the threshold in other zones such that 90% of the population are unharmed then conditions are considered to be sustainable. The outputs are discussed in further detail in the project wide assessment (Vol 3 Section 5.5). However, TFRM results for the existing baseline suggest that a total of five of the seven species/lifestage cases are expected to suffer unsustainable hypoxia related mortality in the tidal Thames each year. Given that the indicator species used in the model act as surrogates for a wider range of ecosystem components, other sensitive taxa are also likely to be unsustainable under this water quality regime.

Evaluation of fish community for Heathwall Pumping Station

5.4.36 The fish community at Heathwall Pumping Station is considered to be of medium-high (metropolitan) importance due to its moderate species diversity and abundance of individuals. The site also forms part of a length of shoreline where relatively high numbers of particularly coarse fish were recorded. This may be due to the numerous permanent moorings and structures in this area creating slack-waters and refuge areas.

Invertebrates

5.4.37 Benthic invertebrates are used in the freshwater, estuarine and marine environments as biological indicators of water and sediment quality since their diversity, abundance and distribution reflects natural or man-made fluctuations in environmental conditions. Species diversity is influenced by factors such as substrate and salinity. However high species diversity (or numbers of species) at any given site generally indicates good water and/or sediment quality, whilst low diversity may indicate poor quality.

5.4.38 Invertebrate populations and particularly those which occur in the water column (pelagic) are influenced by conditions throughout the estuary. The strongest influences on invertebrate distribution and density tend to be physical factors such as salinity, and substrate type followed by water quality and local habitat conditions.

Baseline surveys

5.4.39 Two days survey were undertaken for invertebrates; one at nearby Tideway Walk during October 2010 and the second in May 2011 at Heathwall Pumping Station. The areas covered by the survey are the same as that described for the fish survey above (paras. 5.4.18 to 5.4.21) and illustrated in Vol 15 Figure 5.4.1 (see separate volume of figures). Details of the sampling methods used can be found in Vol 2. Three intertidal and two subtidal samples were taken on each occasion.

5.4.40 The invertebrates collected during the October 2010 field surveys are presented in Vol 15 Table 5.4.4 below. The invertebrates collected during May 2011 field surveys are presented in Vol 15 Table 5.4.5. The Community Conservation Index (CCI) score (Chadd, R, and Extence, C, 2004)[13] has been used to identify species of nature conservation importance. CCI classifies many groups of invertebrates of inland waters according to their scarcity and conservation value in Great Britain and relates closely to the Red Data Book (RDB) (Bratton, JH, 1991[14], Shirt, DB, 1987[15]) by attributing a score between 1 and 10. The higher the CCI score the more scarce the species and/or greater its conservation value.

Vol 15 Table 5.4.4 Aquatic ecology – invertebrate fauna sampled at Tideway Walk in October 2010

Taxa	CCI Score	No. of individuals - subtidal samples		No. of individuals - Intertidal samples		
Sample numbers		**Air Lift1**	**Air Lift 2**	**Kick sample**	**Sweep Net 1**	**Sweep Net 2**
Theodoxus fluviatilis	3	2	0	2	2	5
Potamopyrgus antipodarum	1	24	750	0	22	42
Radix balthica	1	1	8	1	15	34
Corbicula fluminea	-	5	1	0	1	0

Taxa	CCI Score	No. of individuals - subtidal samples		No. of individuals - Intertidal samples		
Sample numbers		Air Lift1	Air Lift 2	Kick sample	Sweep Net 1	Sweep Net 2
Oligochaeta	-	59	85	8	650	1000
Erpobdella sp.	-	0	0	0	0	2
Erpobdella damaged	-	1	0	0	0	0
Erpobdella testacea	5	0	1	0	1	5
Crangon crangon	-	0	17	0	2	0
Eriocheir sinensis	-	0	2	0	0	0
Apocorophium lacustre	8	2	300	0	60	280
Gammarus zaddachi	1	1	97	5	300	350
Number of taxa	**-**	**8**	**9**	**4**	**8**	**8**

Vol 15 Table 5.4.5 Aquatic ecology – invertebrate fauna sampled at Heathwall Pumping Station in May 2011

Taxa	CCI Score	No. of individuals - subtidal samples		No. of individuals - Intertidal samples		
Sample numbers		Air Lift1	Air Lift 2	Kick sample	Sweep Net 1	Sweep Net 2
Theodoxus fluviatilis	3	2	2	5	0	3
Potamopyrgus antipodarum	1	165	30	2	80	31
Radix balthica	1	13	1	1	10	0
Cochlipodidae	-	0	0	0	2	0
Ancylus fluviatilis	1	0	0	0	1	0
Pisidium spp.	-	0	0	0	0	1
Corbicula fluminea	-	0	0	5	0	0
Polychaeta	-	0	0	1	0	0
Oligochaeta	-	10	150	0	200	58
Helobdella stagnalis	1	1	0	0	0	0
Erpobdella sp.	-	0	0	0	1	0
Erpobdella testacea	5	0	3	1	0	0
Erpobdella octoculata	1	9	0	0	0	0
Palaemon longirostris	5	0	2	0	0	0

Taxa	CCI Score	No. of individuals - subtidal samples		No. of individuals - Intertidal samples		
Sample numbers		**Air Lift1**	**Air Lift 2**	**Kick sample**	**Sweep Net 1**	**Sweep Net 2**
Apocorophium lacustre	8	1	0	0	0	0
Gammarus zaddachi	1	1700	2000	30	1300	948
Chironomidae	-	0	1	0	0	1
Number of taxa	**-**	**8**	**8**	**7**	**7**	**6**

5.4.41 Heathwall Pumping Station samples were characterised by moderate invertebrate diversity for the subtidal and intertidal samples for this area of the Thames. In addition to the typical pollution tolerant groups (*Radix balthica,* Oligochaeta, Erpobdella and Potamopyrgus), moderately pollution tolerant groups were abundant in both the subtidal and intertidal zones (*Theodoxus fluviatilis*, *Gammarus* and *Apocorophium*). The species generally considered most sensitive to organic pollution is the river neritid, *T. fluviatilis* (Neritidae) was present in low abundances in both intertidal and subtidal samples, and it was less abundant than at other similar sites. The diversity may be partly explained by the fact that the CSO outfalls present near to this sample site are submerged and discharge towards the central (subtidal) area of the channel.

5.4.42 As with other sites, all of the taxa present are brackish species or animals that have a varying tolerance to different levels of salinity from estuarine to near freshwater. No obligate freshwater or marine animals were present. The brackish nature of the water is demonstrated by species such as *Gammarus zaddachi* (a brackish species of shrimp, rather than its more commonly occurring freshwater homologue *Gammarus pulex*) and *Crangon crangon* (shrimps, typical of estuarine and brackish conditions).

5.4.43 The only species of high nature conservation importance was the mudshrimp *Apocorophium lacustre* (CCI 8), an RDB species, which was present in subtidal samples at the site. EA data have however shown *A. lacustre* to be common in the tidal Thames (paras. 5.4.46 to 5.4.49), and therefore the relative value of the invertebrate community is not considered to be of higher value in this instance.

5.4.44 Chinese mitten crab (*Eriocheir sinensis*), an invasive and non-indigenous species, was sampled at Tideway Walk. Individual mitten crabs were captured at a number of sampling locations along the tidal Thames. Mitten crabs can cause bank destabilisation and erosion, and also compete for food resources with other species. The former issue is less of a concern at this location, as much of the river bank comprises hard defences, but competition with other species could occur.

5.4.45 The non-native species white prawn (*Palaemon longirostris*) was recorded in one of the sub tidal samples, but was not recorded at any of the other Thames Tideway Tunnel project sites. The invasive Asiatic clam

(*Corbicula fluminea*) was present. This species can only tolerate high salinity levels for a limited period (Aguirre, P, and Poss, SG, 1999)[16].

Environment Agency background data

5.4.46 Heathwall Pumping Station is located approximately 4km downstream of the EA monitoring site at Battersea, which is the nearest sampling location with recent data (2005 to 2011). The EA samples are taken using a number of techniques, including cores and kick sampling in the intertidal and day grab and core samples in the subtidal.

5.4.47 A total of 50 taxa were recorded at Battersea over the seven year period in which samples were collected. The taxa Oligochaeta (worms), which thrives in organically polluted conditions, was relatively abundant, together with other pollution tolerant species such as the snail *Potamopyrgus antipodarum*. However, *G. zaddachi*, a moderately pollution-sensitive species was also highly abundant and *T. fluviatilis* (pollution sensitive river neritid) was present most years.

5.4.48 The basic invertebrate community structure surveyed in 2010 and 2011 at Tideway Walk and Heathwall Pumping Station was similar to EA samples from Battersea. Higher species richness recorded in some sample years at Battersea is likely to reflect the greater sampling frequency. For example, in 2005, 26 animal species were recorded at Battersea, but this was from a total of 14 samples across the year. Other differences, notably the lower abundance of Chironomidae and *P. antipodarum* at Heathwall Pumping Station are likely to reflect subtle differences in habitat, seasonal and sampling variation.

5.4.49 *A. lacustre*, the rare species of mud shrimp sampled at Heathwall Pumping Station, appears to be similarly abundant at Battersea.

Water quality and current invertebrate baseline

5.4.50 The influence of water quality, and specifically CSO discharges was investigated through statistical analysis of the EA invertebrate background data, Thames Tideway Tunnel project baseline data, and EA water quality data. The analysis is presented in Vol 3 Appendix C.5. Although it was not possible to isolate trends over time at a site specific level, a number of observations were made that helps to identify the factors influencing invertebrate abundance and diversity. For example, certain species of Oligochaete worm, present at Heathwall Pumping Station, are indicative of polluted conditions because they are able to tolerate the low DO conditions and multiply rapidly in the enriched sediments.

5.4.51 The analysis is described in further detail in Vol 3 Section 5.4. The following summary is relevant to the freshwater zone of the tidal Thames in which the Heathwall Pumping Station site is located.

5.4.52 The varying level of salinity and saline fluctuations appear to be a dominant factor determining the diversity and structure of benthic invertebrate assemblages. The analysis showed that, in general, samples in the brackish zone were less diverse compared with samples taken in the freshwater zone. This concurs with previous research into the invertebrate community of the tidal Thames and other estuaries, which show diversity decreasing downstream as the saline influence increases (Bailey-Brock' JH, *et al.*, 2002)[17]. This is generally attributed to the fact that relatively few invertebrates are adapted to significant fluctuations in salinity. Other factors such as poor water quality and lack of habitat diversity, particularly in central London, are also likely to contribute.

5.4.53 Redundancy analysis[iii] (RDA) was used to compare the invertebrate dataset with water quality data for the period between 1992 and 2011. The analysis demonstrated the importance of environmental variables in determining the invertebrate communities in the tidal Thames. It appears that dominance of either Gammaridae (sensitive to hypoxia) or Oligochaeta (more tolerant to hypoxia) is influenced by the DO concentrations and DO sags in the tidal Thames, although other factors such as habitat are also highly important. Other invertebrate taxa also appeared to be affected by poor water quality (low DO) and/or saline intrusion, notably the insect group (mayflies), while other groups (essentially Polychaete and Oligochaete worms) were shown to be tolerant of these conditions.

Evaluation of invertebrate community for Heathwall Pumping Station

5.4.54 The Heathwall Pumping Station site is considered to be of medium (borough) importance due to the dominance of the invertebrate community by pollution tolerant species. Only a single species of conservation importance (*A. lacustre*) was recorded, and it is ubiquitous within the tidal Thames.

Algae

5.4.55 Algae occurs in the tidal Thames both in the water column and growing on the river wall and associated structures. The range of species which occur in the tidal Thames reflect both salinity, habitat and environmental conditions. As well as their intrinsic value algal communities provide valuable habitat for invertebrates and juvenile fish. Algae are often used as an indicator of water quality, since nutrients associated with sewage promote the growth of certain species of algae. This assessment focuses on the algal communities which grow on the river wall and associated structures.

Baseline surveys

5.4.56 A single day survey was undertaken in May 2012 at Heathwall Pumping Station foreshore. All records are shown in Vol 15 Table 5.4.6.

Vol 15 Table 5.4.6 Aquatic ecology – marine algae sampled at Heathwall Pumping Station foreshore

Species	2012 Survey observations	Species presence within the Thames Estuary

[iii] Redundancy analysis is a form of regression analysis which provides information on the influence of environmental variables on the composition/ abundances of the invertebrates assemblages.

Species	2012 Survey observations	Species presence within the Thames Estuary
Blidingia minima	Dominant in the upper zone of the river wall.	Abundant in tidal Thames.
Cladophora glomerata	Frequently present on the lower zone of the river wall.	Widespread and abundant.
Rhizoclonium riparium	Frequently present on the lower zone of the river wall.	Common in the estuary.
Ulva prolifera	Occasionally present on the river wall.	Widespread in the estuary.
Vaucheria sp.	Occasionally present on the river wall.	The *Vaucheria sp* recorded is most probably *Vaucheria compacta*, which occurs on the upper littoral levels on sea walls. Widespread in the tidal Thames.
Bangia atropurpurea	Occasionally present near the foot of the wall.	Recorded sporadically on river walls since 1975.

Natural History Museum background data

5.4.57 Data was obtained from the Natural History Museum, London (NHM) that identifies records of marine algae received for the period from the early 1970s to 1999. Algae were recorded from a sampling location at Chelsea Bridge, located approximately 850m upstream of Heathwall Pumping Station, with the records all shown in Vol 15 Table 5.4.7.

Vol 15 Table 5.4.7 Aquatic ecology – marine algae sampled at Chelsea Bridge between early 1970s and 1999

Species	Observations
Blidingia marginata	Upper littoral and supra-littoral, and floating structure just above the water-line. Widespread and abundant.
Blidingia minima	Upper littoral and supra-littoral, wood breakwaters and halophyte stems. Abundant in tidal Thames.
Ulva intestinalis	Upper littoral on sea walls. Common in tidal Thames.
Ulva prolifera	Upper mid-littoral on sea walls and on floating structures above the water line. Widespread in the estuary.
Rhizoclonium riparium	Upper mid-littoral levels on sea walls and occasionally on floating structures above the water-line. Common in the estuary.

Species	Observations
Vaucheria compacta	Upper littoral levels on sea walls. Common in the estuary.

Water quality and algal communities

5.4.58 Algae depend on the nutrients nitrate and phosphate for growth. Although these nutrients occur naturally in water bodies, they are also present in sewage. Discharges of untreated sewage can result in elevated levels of nutrients which can lead to excessive growth of algae. As these algae die and decompose they use up oxygen in the water resulting in hypoxia (para. 5.1.3). This process is known as eutrophication. Excessive levels of algae can disrupt other elements of the ecosystem by smothering them.

5.4.59 Studies of the pelagic algae (para. 5.4.55) of the tidal Thames to inform its classification for the WFD have concluded that the estuary is not eutrophic due to strong tidal flows (English Nature, 2001)[18]. However, historically poor water quality has had a considerable negative influence on the algal communities of the tidal Thames and the loss of pollution sensitive species. Improvements in sewage treatment since the 1960s have lead to a gradual process of recovery (Tittley, 2009)[19], although pollution tolerant species such as the green algal species still dominate the community.

Evaluation of algal community for Heathwall Pumping Station

5.4.60 None of the species recorded in Vol 15 Table 5.4.6 and Vol 15 Table 5.4.7 have protected or notable status (e.g. RDB species or UK or local BAP species). The algal populations are therefore given low-medium (local) value as only limited records of widespread species occur from this location.

Aquatic ecology receptor values and sensitivities

5.4.61 Using the baseline set out in paras. 5.4.1 to 5.4.60 the value accorded to each receptor considered in this assessment is set out in Vol 15 Table 5.4.8 below. The definitions of the receptor values and sensitivities used in this evaluation are set out in Vol 2 Section 2.4.

Vol 15 Table 5.4.8 Aquatic ecology – summary of receptors and their values/sensitivities during construction at Heathwall Pumping Station

Receptor	Value/sensitivity
Foreshore habitat (intertidal and subtidal)	Medium-high (metropolitan)
Marine mammals	Low-medium (local)
Fish	Medium-high (metropolitan)
Invertebrates	Medium (borough)
Algae	Low-medium (local)

Construction base case

5.4.62 The base case in Site Year 1 of construction would include the improvements at the five main sewage treatment works that discharge into the tidal Thames (Mogden, Beckton, Crossness, Long Reach and Riverside), and the Lee Tunnel project. TFRM modelling (Vol 3 Appendix C.3) has shown that at a river-wide level there would be a significant reduction in the occurrence of mass or population level fish mortalities (i.e. events which result in more than 10% mortality of fish populations). However, predictions for the base case show that, even with these schemes, unsustainable mortalities of salmon, the most sensitive species can be expected. Salmon is considered as acting as a surrogate for the more sensitive aspects of ecology, and thus taxa other than salmon may also be harmed under this condition.

5.4.63 Given that CSOs within the tidal Thames would continue to spill, including the Heathwall CSO and Southwest Storm Relief CSO, and no significant changes in habitat quality are anticipated the fish baseline for the Heathwall Pumping Station site may therefore be expected to support a similar assemblage of species to the current baseline, with potentially a greater number of pollution sensitive species and life stages. Recovery due to water quality improvements will, however, be at an early stage.

5.4.64 The invertebrate analysis demonstrates that more pollution sensitive groups such as shrimps (Gammaridae) are subject to significant fluctuations in abundances during low DO periods. With the improvements associated with the Lee Tunnel scheme and sewage treatment works upgrades at Mogden, these fluctuations are likely to be reduced. Whilst there may be minor changes in abundance and diversity this will be limited by the fact that even with the Lee Tunnel and STW improvements in place there are still predicted to be numerous failures of DO standards. Colonisation by DO sensitive taxa such as Corophiidae, Crangonidae and Gammaridae which would otherwise occur within the freshwater zone, including Heathwall Pumping Station would continue to be suppressed. As for fish, recovery of the invertebrate communities would be at an early stage. The recovery in algal communities that has taken place since the 1960s is expected to continue under the base case, however the baseline conditions are not anticipated to significantly change from that described in Section 5.4. No changes in marine mammals are anticipated as they are relatively insensitive to point source sewage discharges.

5.4.65 As noted in para. 5.3.7 no other developments have been identified that would change the base case. Furthermore it is considered unlikely that there would be encroachment onto the tidal Thames foreshore for non-river dependent uses as this is restricted through *London Plan* (Greater London Authority, 2012)[20] Policy 7.28 Restoration of the Blue Ribbon Network which states that development should 'protect the value of the foreshore of the Thames and tidal rivers'. The EA's *National Encroachment Policy for Tidal Rivers and Estuaries* (Environment Agency, 2005)[21] also presumes against developments riverward of the existing flood defences where these would, individually or cumulatively, change flows so that fisheries were affected or cause loss or damage to habitat. Therefore no change to the current baseline from other developments is considered likely.

Operational base case

5.4.66 The river wide recovery in fish and invertebrate communities that will occur as a result of the Lee Tunnel and sewage treatment works upgrades will have advanced by Year 1 and Year 6 of operation due to the reduced number of hypoxia events. However, as noted in para. 5.4.62 there will still be unsustainable mortalities of salmon, and possibly other sensitive taxa. Further, catchment modelling shows that the frequency, duration and volume of spills from the Heathwall and Southwest Storm Relief CSOs will continue to rise due to population growth, which will limit improvements for aquatic ecology receptors (spill frequency and volume as stated in para. 5.2.8: further details of projected spills are provided in Section 14 Water resources – surface water of this volume). Therefore recovery due to water quality improvements will be suppressed at Heathwall Pumping Station. As a result there are unlikely to be significant changes in habitat quality at the site level and pollution sensitive fish species, such as salmon will continue to be suppressed. Indeed, conditions in the immediate vicinity of the CSO may be less favourable for fish than the current baseline given the increase in frequency, volume and duration of CSO spills.

5.4.67 At a river wide scale invertebrate communities will be likely to include more pollution sensitive components as noted in para. 5.4.63, which will also be reflected to some degree at a site level. However, increased CSO spill frequency, durations and volumes will suppress recovery and may also be less favourable than current baseline conditions given the increase in frequency, volume and duration of CSO spills.

5.4.68 The recovery in algal communities that has taken place since the 1960s is expected to continue under the base case however the baseline conditions are not anticipated to significantly change from that described in Section 5.4. No changes in marine mammals are anticipated as they are relatively insensitive to point source sewage discharges.

5.4.69 The Battersea Power Station scheme (para. 5.3.7) would also be operational at this stage. The works would involve an altered jetty structure, and therefore there is potential for slightly altered patterns of river flow past the site.

5.5 Construction effects assessment

5.5.1 This section presents the findings of the construction phase assessment. It outlines the construction impacts arising from the proposed development and the likely significant effects on aquatic ecology receptors.

Construction impacts

Temporary landtake

5.5.2 There would be a total of approximately 650m^2 of temporary landtake from habitats associated with the temporary cofferdam (of which all but 35m^2 would be intertidal), temporary relocation of the Battersea barge and a campshed. This represents 0.003% of the River Thames and Tidal Tributaries SINC (Grade M). Material from within the temporary cofferdam would be removed and a geotextile membrane used to separate the underlying substrate from the imported granular fill material. The structures would be in place for a total of two and half to three years, which is therefore the duration of the temporary landtake.

5.5.3 In those areas where scour protection is not required around the permanent structure (see para. 5.2.10), reinstatement would involve the removal of imported granular fill and the geotextile membrane. Where soft material had been removed in order provide stable conditions within the cofferdam (see para. 5.2.2b) this would be replaced with an appropriate substrate material. The approach to reinstatement at each of the foreshore sites is presented in Vol 3 Appendix C.4. The objective would be to restore the area to a profile similar to the surrounding foreshore.

5.5.4 Given the uncertainty over the re-establishment of the habitat, the impact of temporary landtake is considered to be negative, however due to the small area involved in the context of the wider SINC designation it is accorded low magnitude. The probability of the impact occurring is considered to be certain.

Sediment disturbance and consolidation

5.5.5 It has been assumed that the area between the outer edge of the cofferdams and the maximum extent of working area would be subject to disturbance and consolidation. At Heathwall Pumping Station this represents a total area of approximately 7295m^2 outside the cofferdam which would be affected by construction activities during the site establishment phase. There is also likely to be consolidation and disturbance due to barge movements. The Battersea Barge would temporarily be relocated upstream, thus would cause disturbance and consolidation to the intertidal habitat on which it would rest. At Heathwall Pumping Station there would be approximately a peak monthly average of four barge movements per day.

5.5.6 Impacts on the intertidal and subtidal habitats and associated flora and fauna are considered to be low negative, probable and temporary due to the small area likely to be subject to regular consolidation and disturbance within the maximum working area boundary.

Change to scour and accretion patterns

5.5.7 The approach to addressing scour associated with the temporary structures is summarised in para. 5.2.3. It consists of monitoring the structures and implementing mitigation only if trigger levels of scour are reached. Further details are provided in the Scour and Accretion Monitoring and Mitigation Plan for Temporary Works in the Foreshore (Vol

3 Appendix L.4). There is currently some accumulation of sediment within the river immediately upstream and downstream of the Heathwall Pumping Station site. With the temporary structures the areas of accretion would increase slightly, in the immediate vicinity, with some occasional additional deposits, especially upstream. These predicted areas of sediment and accumulation are illustrated in Vol 15 Section 14 (Water resources – surface water).

5.5.8 Based on the assumption that scour associated with the temporary structures would not be permitted to penetrate beyond the existing substrate layer (para. 5.3.16h) impacts associated with temporary scour and accretion are considered to be are considered to be low negative, probable and temporary.

Change to flow velocity

5.5.9 The presence of the temporary cofferdam would result in alterations to the hydraulic regime. The presence of a temporary cofferdam would partially block channel flow along the intertidal foreshore for two and a half to three years resulting in a maximum reduction in the width of the intertidal foreshore of 27m. Hydraulic modelling shows that there would be an increase in maximum velocity of 9% on mean spring tides with normal fluvial flow. There would be areas of low velocity water created in the lee of the structure and faster flowing water around the riverward faces. The impact on flow velocity is considered to be negligible, probable and temporary.

5.5.10 Given the close proximity between Heathwall Pumping Station and the jetty piers at Kirtling Street (Volume 14) there is potential for combined impact on hydrodynamic flow to be experienced. However, since the Kirtling Street site only involves jetty pile installation, the combined impact is considered negligible, probable and temporary.

Waterborne noise and vibration

5.5.11 There would be approximately 100m of sheet piling installed for the temporary cofferdam and approximately 70m of bored pile foundations for the permanent river wall. Piles would be driven using vibro piling techniques, thus limiting the principal source of waterborne noise and vibration impacts. Further measures to limit noise and vibration impacts during the construction stage of the project have been incorporated into the *CoCP*. These are described in Section 5.2.

5.5.12 There would be additional sources of noise and vibration, including activities associated with construction of the shaft and vehicle and barge movements. Although background levels of noise and vibration within the tidal Thames are likely to be moderately high due to existing boat movements, and ground-propagated noise from transport systems, the proximity of the works to the river and their scale means that underwater noise and vibration levels are likely to be elevated locally during construction. Noise and vibration have the potential to cause physical damage to fish, and disrupt behaviour and movement. However, in this case, given the piling techniques proposed and the extent of the works relative to the width of the channel this is considered to be a low negative impact, probable and temporary.

5.5.13 Given the close proximity between Heathwall Pumping Station and the jetty pile installation at Kirtling Street (Volume 15) there is potential for combined impact of noise and vibration to be experienced. However, since the Kirtling Street site only involves jetty pile installation, the combined impact is considered negligible, probable and temporary.

Spillage of light from construction compound into surrounding riverine habitats

5.5.14 Light spillage into the water column has the potential to cause disturbance to fish. During construction the site would be operated 24hrs for the short connection tunnel works. As stated in the *CoCP* (para. 5.2.4) lighting of the construction site would be managed via a *Lighting management plan*. It has been assumed that flood lighting or similar would be designed such that it would be directed into the site or shielded to minimise illumination of the water. The extent of light spillage is therefore anticipated to be very limited, and it would be of short duration, especially during the summer months. The impact is therefore considered to be negligible, probable and temporary.

Increase in suspended sediment loads

5.5.15 Construction of the campshed, piling operations, and barge movements are likely to lead to localised increases in suspended sediment with the possibility for effects on local and downstream habitats. It is predicted that the cofferdams would impact on scour patterns while in place, which could cause the mobilisation of increased levels of suspended solids and potentially contaminants into the river.

5.5.16 During chemical analysis of sediment, lead was recorded above the Probable Effects Level (in two of the four samples – 2,200 mg/kg and 210 mg/kg compared to a PEL of 112 mg/kg). The majority of poly-aromatic hydrocarbons were recorded above the PEL in each sample. These levels are all very typical of levels in the tidal Thames. Excavation on the foreshore would be confined within a cofferdam which would effectively prevent release of contamination during sediment removal.

5.5.17 There would be small quantities of sediment liberated during cofferdam installation; however these would be negligible compared to the 40,000 tonnes (or 20,000m^3 assuming an in-situ density of 2t per m^3) of sediment that are carried on the spring tide (HR Wallingford, 2006)[22]. In this context, the volumes produced by the construction works from piling or scour would not be detectable against natural fluctuations in sediments and would not have an impact on surface water resources (HR Wallingford, 2012)[23]. Impacts are considered to be low negative, probable and temporary.

5.5.18 Measures and safeguards to minimise the risk of accidental releases of silty or contaminated discharges to the tidal Thames are included in the *CoCP Part A*. These are described in Section 5.2. No impacts from polluted discharges are anticipated with these control measures and safeguards in place.

Construction effects

5.5.19 This section (5.5.19 to 5.5.51) describes the effects of these impacts on aquatic ecology receptors based on the significance criteria set out in Vol 2 Section 2.3. Only those impacts which are considered relevant to each receptor are assessed, in accordance with the methodology presented in Vol 2.

Designations and habitats

Loss of intertidal and subtidal habitat due to temporary landtake

5.5.20 There would be a temporary loss of approximately 650m^2 of mainly intertidal habitat through the construction of the temporary cofferdam, the relocated Battersea Barge, and a campshed, coupled with localized losses due to scour. The habitats affected by temporary landtake are presented in Vol 15 Table 5.4.1 and include gravel foreshore, sublittoral sand and gravels, mudflats and a river wall. These habitats which are considered to be of medium-high (metropolitan) importance are represented elsewhere across the tidal Thames. The impact of temporary landtake is considered to be of low negative magnitude since the extent of the areas affected in the context of the overall size of the SINC is small.

5.5.21 Subsequent excavation and removal of the granular fill material followed by reinstatement of substrate of comparable particulate material to the original substrate would facilitate recovery. This is expected to lead to establishment in the medium (one-five years) or long term (+5 years). The overall effect is considered to be **minor adverse**.

Change in intertidal and subtidal habitat due to scour and accretion

5.5.22 The intertidal habitats at Heathwall Pumping Station are dominated by pebbles with smaller volume of silt, sand and cobbles (Vol 15 Table 5.4.1). There may be some removal of the finer material in the areas subject to abutment and contraction scour, although scour would not be permitted to develop beyond the depth of the existing broad substrate type, which is river gravel deposits. Changes are thus anticipated to be limited to minor and localised changes in the relative composition of the substrate types.

5.5.23 There would be an increase in the proportion of fine sediments in the vicinity of the site due to accretion. This may result in localised changes in the composition of the habitat as sediments accumulate on top of the coarser material. There is a risk that anoxic (i.e. low DO) conditions could develop within accreted sediment with potentially adverse effects on sediment dwelling organisms.

5.5.24 Overall, the effect of scour and accretion is considered to be **minor adverse** given the medium-high (metropolitan) importance of the receptor and the low negative impact.

Disturbance and consolidation of intertidal and subtidal habitat

5.5.25 There would be disturbance and consolidation of approximately 7000m^2 outside the cofferdam during the site establishment phase due to the presence of a jack up barge to install the temporary cofferdam. The jack-up barge may also be used to remove the piles once construction is complete. Habitats within this zone are expected to recover within the short term (less than 12 months) following site establishment. Coupled with the medium-high (metropolitan) value of the habitats the effect is considered to be **minor adverse** due to the low negative magnitude of the impact.

Marine mammals

Interference with the migrations of marine mammals within the Tideway

5.5.26 Noise, vibration and other construction activity has the potential to disturb marine mammals and deter them from passing the site. However, given the low-medium (local) value of the receptor and the low negative impact magnitude, the vibro piling methods proposed, the duration of the period when piling would be taking place, and the controls on underwater noise-generating activities described in the *CoCP*, (see Section 5.2) this is considered to be a **negligible** effect.

Fish

Loss of feeding, resting and nursery habitat for fish due to temporary landtake

5.5.27 The site is not considered to offer suitable spawning habitat for smelt, or any other fish species, but was found to provide a nursery area for juvenile fish during surveys undertaken in 2011. Only a small proportion of the intertidal foreshore in this location would be affected by construction works. Loss of foreshore habitat is considered to be a low negative impact. Given the medium-high (metropolitan) value of the receptor the effect is considered to be **minor adverse**.

Loss of feeding, resting and nursery habitat for fish due to sediment disturbance and consolidation

5.5.28 The area which would be subject to disturbance and consolidation outside the cofferdam lies in both the intertidal and subtidal zones. The foreshore was found to provide a nursery area for juvenile fish during surveys undertaken in 2011. Given that recovery is likely to occur within the short term (less than 12 months) the effect is considered to be **minor adverse**, given the medium-high (metropolitan) value of the receptor and the low negative impact magnitude.

Change in feeding, resting and nursery habitat for fish due to scour and accretion

5.5.29 The limited depths of scour predicted at this site are not predicted to result in a change in the extent or nature of feeding, resting and nursery habitats. Increase levels of accretion may cause minor localised changes in the invertebrate community. However, this is not anticipated to limit the feeding opportunities for fish. The site lies downstream of the zone in which smelt and dace are known to spawn and therefore there is a risk of smothering of spawning habitats due to sediment accretion. Effects are considered to be **minor adverse** due to the medium-high (metropolitan) importance of the receptor and the low negative magnitude of the impact.

Potential disturbance due to illumination of the river

5.5.30 Although fish behaviour can be altered through lighting, the illumination associated with the 24 hour construction would be primarily land-side and directed away from the river. Illumination of the river is likely to be highly localised in extent. Since it is considered an impact of negligible magnitude on a receptor of medium-high (metropolitan) value would result in a **negligible** effect.

Interference with the migratory movements of fish

5.5.31 Ideally the river channel should provide an uninterrupted route for juvenile fish migrations for species such as eel as glass eels or elvers, dace, goby and flounder as they move through the estuary.

5.5.32 In general, encroachment of structures such as cofferdams into the river channel may affect the river hydraulics, particularly at high discharges associated with heavy fluvial inputs or spring tides. Changes in water velocity caused by constriction of the hydraulic channel may hinder movements of fish against the tide, including their ability to withstand, or hold station in the flow. Constriction of the hydraulic channel, reduction of the intertidal zone and increased water velocities might cause some fish to be lost, for example by forcing them into deeper water with increased predation risk. Formation of eddy currents in the wake of structures may temporarily entrap fish and delay progress of migrations. Persistently delaying the successful migrations of fish past individual sites may also interfere with key life stage events such as spawning through preventing fish from reaching spawning sites at appropriate times.

5.5.33 The river is less constricted by the existing river defences in the vicinity of Heathwall Pumping Station than in other locations and a large area of intertidal foreshore would remain even during construction (an approximately 20m width). The Individual Based Modelling (IBM) used to simulate the effects of the temporary and permanent structures on juvenile fish migration demonstrates that the temporary works should benefit upstream migration by presenting more opportunities for fish to shelter from adverse currents. Although the structure would cause juvenile fish to move into deeper water where predation risk is higher, the period of time in which they are exposed to this risk is sufficiently short that the study found it would have no effect on overall mortality rates when compared to the base case. Detail of the study, including the modelling methods, are presented in Vol 3.

5.5.34 Given the temporary nature of the works, and the fact that the minor adverse effects of fish being forced into deeper water would be offset by the minor beneficial effect anticipated through increased opportunities for shelter, the effects of the temporary structures on juvenile fish migrations are considered to be **negligible**.

Effects of waterborne noise and vibration on fish

5.5.35 The effects of waterborne noise and vibration on fish vary according to the proximity of the receptor to the source. Effects depend on distance from source, ranging from potential death at very close proximities, through injury, and behavioural disturbance with increasing distance from the source. The driving of sheet piles for the cofferdams would be undertaken using techniques that minimise the level of noise and vibration where practicable. However the period of piling would be sufficiently brief (assumed for the purposes of this assessment to be approximately six weeks). Removal of the piles would take a similar length of time at the end of the construction period. Furthermore, a series of control measures relating to the timing and duration of piling operations have been included in the *CoCP* (see Section 5.2).

5.5.36 The site is not considered to support sensitive spawning habitat, but, during surveys undertaken during 2011, was found to have value for juvenile fish as a nursery area. Waterborne noise and vibration is considered to be a low negative impact, and given that the value of the receptor is medium-high (metropolitan), the overall effect is assessed as being **minor adverse**.

Reduction in water quality due to suspended sediment

5.5.37 Although the tidal Thames is a sedimentary environment with high levels of suspended solids, construction activities such as piling and barge movements may generate high levels of suspended sediment which may cause disorientation of fish.

5.5.38 Given the length and extent of cofferdam actually in contact with the tidal flow (approximately 100m of temporary cofferdam), there is the potential for re-suspended sediments from piling and barge movements to affect juvenile fish migrations, particularly when considered along with the hydraulic effects described in paras. 5.5.31 to 5.5.34. The small area of temporary landtake at Heathwall Pumping Station would ensure this remains small. Adult fish are considered to be less likely to be affected as they are able to move away from the turbid water. Effects on juvenile fish, with regards to the medium-high (metropolitan) value of the receptor and the low negative impact magnitude, are considered to be **minor adverse,** with natural recovery of sediments anticipated.

Invertebrates

Direct mortality of invertebrates due to temporary landtake, sediment disturbance and consolidation

5.5.39 There would be direct mortality of invertebrates within sediments removed or covered by the cofferdams and the temporary relocation of the Battersea Barge, and due to consolidation and disturbance of sediment due the site establishment phase. The effect is considered to be **negligible** due to the low negative scale of impact and medium (borough) value of the receptor.

Loss of burrowing and feeding habitat for invertebrates due to temporary landtake

5.5.40 The area beneath the temporary cofferdam would also be lost as burrowing and feeding habitat for invertebrates during the entire construction period. Subsequent excavation and removal of the granular fill material followed by reinstatement of substrate of comparable particulate material to the original substrate would facilitate recovery.

5.5.41 Given the medium (borough) value of the receptor and the low negative impact of habitat loss, the overall effect is considered to be **negligible**, particularly given the relatively limited loss of a burrowing and feeding resource.

Loss of feeding and burrowing habitat for invertebrates due to sediment disturbance and consolidation

5.5.42 The area beneath the temporary cofferdam would be subject to heavy consolidation, and hence would be unavailable to burrowing invertebrates in the medium term (one to five years) following removal of the cofferdam. The temporary consolidation and disturbance to the habitat for burrowing invertebrates is considered to be a **negligible** effect. This is because the receptor is of medium (borough) value, the impact of sediment disturbance and consolidation is considered to be low, and the effects are considered likely to be reversed upon recovery of the habitat, which would occur in the short term (less than 12 months).

Change to burrowing and feeding habitat due to scour and accretion

5.5.43 Whilst there may be some losses of fine material in the localised areas where scour is predicted, this is not anticipated to result in a change in the invertebrate community. The increase in the proportion of fine material associated with accretion may favour certain benthic invertebrates including the sediment dwelling Oligochaeta and Polychaeta. Oligochaeta are already the dominant benthic invertebrate group at the site and the change in the proportion of fine sediments is unlikely to change the overall community composition.

5.5.44 Overall, the effects are considered to be **negligible** due to the low negative magnitude of the impact and the medium (borough) importance of the receptor.

Potential disturbance due to illumination of the river

5.5.45 The illumination associated with the 24 hour construction would be primarily land-side directed away from the river. Although pelagic invertebrates can be affected by lighting much of the invertebrate interest of the area is benthic and unlikely to be affected by illumination. Since it is considered an impact of negligible magnitude on a receptor of medium (borough) value, this would have a **negligible** effect.

Reduction in water quality due to suspended sediment

5.5.46 The predicted increases in suspended sediment due to general construction activity such as barging are not expected to affect invertebrate communities given the existing background levels within the tidal Thames. However, high levels of suspended sediment which may occur as a result of a sudden scour event could give rise to localised reductions in DO and potentially, increases in the concentrations of contaminants.

5.5.47 The majority of the invertebrates present are not considered to be particularly sensitive to accretion or low DO conditions. These organisms are adapted to withstand tidal flows that bring about movements of degradable and non degradable solids. The feeding mechanisms of animals that filter water might be affected (e.g. larger bivalves), but these are sparsely recorded in the tidal Thames. Tube living animals such as Corophiidae might be more susceptible, but they are quite mobile and able to move away from sources of impact.

5.5.48 Effects are thus considered to be **negligible**, given the medium (borough) value of the receptor and low negative impact magnitude.

Algae

Loss of habitat due to temporary landtake

5.5.49 The construction of the temporary cofferdam would mean that any algae would be lost from the area of wall within the structures, as the algae require regular inundation with water in order to survive. However, given the low-medium (local) value of the receptor, the low negative impact magnitude and the fact that algae are likely to re-colonise rapidly following removal of the cofferdams, the effect is considered **negligible**.

Reduction in water quality due to suspended sediment

5.5.50 As stated in para. 5.5.37, the tidal Thames is already a sedimentary environment with high levels of suspended solids. The generation of increased levels of suspended sediment from construction activities may cause smothering of marine algae.

5.5.51 Given the length and extent of cofferdam in contact with the tidal flow as described in para. 5.5.38, there is the possibility that re-suspended sediments may affect marine algae located on river walls immediately downstream. The value of the receptor is low-medium (local) and the impact considered low negative magnitude and therefore the effect is considered to be **negligible**.

Sensitivity test for programme delay

5.5.52 For the assessment of effects on aquatic ecology during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above (paras. 5.5.1 to 5.5.51). This is because there are no developments in the site development schedule that would fall into the base case as a result of this delay and therefore the base case would remain as described in paras. 5.4.62 to 5.4.65.

5.6 Operational effects assessment

5.6.1 This section presents the findings of the operational phase assessment. It outlines the operational impacts arising from the proposed development and the likely significant effects on aquatic ecology receptors.

Operational impacts

Permanent landtake

5.6.2 There would be approximately 625m^2 of landtake from intertidal habitats. A further approximately 480m^2 would be would be modified as a result of the scour protection measures and permanent apron. This would consist of buried rip rap overlaid with an appropriate substrate material. The permanent foreshore structure would extend approximately 18m into the channel, and would be entirely contained within the intertidal area. Permanent landtake is certain and is considered to be a low negative impact.

Modification of habitat as a result of scour protection measures

5.6.3 As noted above, the outfall at Heathwall Pumping Station would include a CSO outfall apron to prevent residual discharges scouring the surrounding bed. Scour protection would also be provided around the perimeter of the permanent foreshore structure. Scour protection (including aprons) would comprise buried rip rap. A total area of up to 490m^2 (of which approximately 480m^2 would be from intertidal habitat and 10m^2 from subtidal habitat) is likely to be affected by scour protection at the Heathwall Pumping Station site.

5.6.4 This is regarded as a low negative impact as habitat modification, rather than habitat loss, would result.

Change to scour and accretion patterns

5.6.5 The permanent foreshore structure would extend approximately 18m into the channel. Hydraulic modelling has shown that the structure would impact on scour patterns. Scour protection would be provided beneath the new outfall where it extends below the mean low water line, in the form of an outfall apron, and along the line of the new river wall (to protect its foundation). The detailed design and extent of this shall seek to avoid or minimise adverse effects on aquatic ecology.

5.6.6 With the permanent structure in place, almost no new sediment accumulation is predicted to occur, though some occasional deposition is predicted for a short distance downstream and upstream of the permanent foreshore structure within the intertidal zone. These predicted areas of sediment and accumulation are illustrated in Vol 15 Section 14 (Water resources – surface water).

5.6.7 Impacts on the intertidal and subtidal habitats and associated flora and fauna are considered to be low negative, probable and permanent, due to the reduced area likely to be subject to scour following incorporation of scour protection. Impacts are considered to be negligible, probable and permanent for accretion.

Change to flow velocity

5.6.8 The presence of a permanent foreshore structure would result in alterations to the hydraulic regime. On a mean spring tide, maximum velocities are predicted to increase by 2% on normal fluvial flows. There would be a zone of reduced velocities adjacent to the structure and in their wake along the opposite foreshore. The impact is considered to negligible.

Increases in dissolved oxygen concentrations in the vicinity of the CSO

5.6.9 The projected Typical Year 93% decrease in the volume discharges compared against the base case (see para. 5.2.8) would result in improvements in DO concentrations at a local level, and throughout the tidal Thames, and would contribute to a river wide improvement arising from the project. The improvements would ensure compliance with the DO standards described in para. 5.4.33. These improvements are assessed at a river wide level in Vol 3. The impact is considered to be medium positive due to the relative large magnitude of the Heathwall Pumping Station and Southwest Storm Relief CSOs, and impacts would be near certain and permanent.

Reduction in sediment nutrient levels

5.6.10 Elevated concentrations of nutrients (phosphate and nitrate) are likely to have accumulated in the sediments in proximity to the discharge point as a result of the faecal material and sewage derived litter discharged from the CSO. In addition to the directly toxic effects of elevated ammonia (particularly in low oxygen situations) increased nutrients in the sediment can reduce the natural limits on algal growth and enable more nitrogen/phosphate responsive species to outcompete other species reducing diversity. Interception of the CSOs would lead to a gradual reduction in sediment nutrient levels. The impact is considered to be low positive, probable and permanent.

Reduced levels of sewage derived litter

5.6.11 Sewage derived litter from the CSO can be expected to reduce by approximately 93%, from approximately 252t to 18t, in the Typical Year with beneficial effects on aquatic ecology receptors.

5.6.12 This is considered to be a low positive impact and would be near certain and permanent.

Operational effects

5.6.13 The following section describes the effects of these impacts on aquatic ecology receptors based on the significance criteria set out in Vol 2 Section 2.3. Only those impacts which are considered relevant to each receptor are assessed, in accordance with the methodology presented in Vol 2.

5.6.14 Unless stated the effects described below apply to both Year 1 of operation and Year 6 of operation.

Designated sites and habitats

Permanent loss of intertidal habitats

5.6.15 There would be a permanent loss of approximately 625m^2 due to the permanent structure. A further 490m^2 (480m^2 from intertidal habitat and 10m^2 from subtidal habitat) would be modified as a result of the scour protection measures and permanent apron. This would consist of buried rip-rap which would be overlaid with an appropriate substrate material. The effect is considered to be **moderate adverse** due to the magnitude of the impact (medium negative) and the value of the receptor (medium).

Change in intertidal and subtidal habitat due to accretion

5.6.16 The modelling results have predicted minimal changes in sediment accumulation and occasional deposition as a result of the permanent foreshore structure. Therefore overall the effect of accretion is considered to be **negligible**, given the medium-high (metropolitan) value of the receptor and negligible impact

Improvements in habitat quality through changes in water quality

5.6.17 The predicted increases in DO concentrations and reductions in BOD, ammonia and nutrients within the sediment would result in localised improvements in habitat quality. This may be characterised by increased levels of photosynthesis by microscopic algae within the sediments, termed primary production. These algae form the basis of the estuarine food chain, providing a food source for fish and invertebrates. The gradual breakdown of sewage derived litter associated with the sewage discharge would contribute to the recovery. However, habitats per se are relatively insensitive to alterations in DO concentrations, with reductions in sediment nutrient levels and sewage derived litter more important factors with regards to habitat quality improvements. Therefore the impact in this instance is considered to be of low positive magnitude, rather than medium positive. Combining the magnitude of change (low positive) with the medium-high (metropolitan) value of the resource, the effects are considered to **negligible** at Year 1 increasing to **minor beneficial** by Year 6.

Marine mammals

Increase in the number and/or change in the distribution of marine mammals

5.6.18 No changes are anticipated on marine mammals as a result of the water quality improvements associated with interception of the two CSO discharges. This is because they are relatively insensitive to point source sewage discharges. Improvements in habitat quality due to the reduction in sewage derived litter may make the habitat more favourable, although the factor determining its use by seals relates predominantly to the lack of disturbance rather than water quality. Effects are considered to be **negligible**, given the low-medium (local) value of the receptor and the negligible impact magnitude.

Fish

Permanent loss of intertidal feeding and resting habitat for fish due to landtake

5.6.19 The site is not considered to offer suitable spawning habitat for fish species, but during surveys undertaken in 2011, it was found to provide nursery habitat for juvenile fish. Loss of intertidal foreshore habitat is considered to be a low negative impact magnitude. Given that the value of the receptor is medium, the effect on fish is considered to be **minor adverse**.

Modification of intertidal feeding and subtidal habitat for fish

5.6.20 At Heathwall Pumping Station, scour protection would occupy an area of 490m^2. The rip rap scour protection areas, which would consist of rip- rap overlain with an appropriate substrate material, may offer some benefits to juvenile fish by providing refuges from the current and from predators. In this respect it is analogous to artificial reef structures created in the marine environment to provide shelter for fish and increase the heterogeneity of otherwise uniform habitats (Grove, RS, *et al*., 1991)[24].

5.6.21 Similarly, the rip rap scour protection may offer shelter for pelagic invertebrates such as *Gammarus* which represent a food source for some fish species. It is unlikely to have potential as feeding habitat for benthic feeding fish except where accretion allows colonisation by invertebrates.

5.6.22 The effects on fish are considered to be **negligible**. This is because although the overall impact is low negative, the balance of positive and negative effects for fish gives rise to a negligible effect.

Change in feeding, resting and nursery habitat for fish due to accretion

5.6.23 The modelling results have predicted minimal changes in sediment accumulation and occasional deposition as a result of the permanent foreshore structure. Increase levels of accretion may cause minor localised changes in the invertebrate community. However, this is not anticipated to limit the feeding opportunities for fish. The site lies downstream of the zone in which smelt and dace are known to spawn, and furthermore the accretion changes are predominantly predicted within the intertidal zone, whilst it is the subtidal zone that provides the key spawning habitat. Therefore overall the effect of accretion is considered to be **negligible**, given the medium-high (metropolitan) value of the receptor and negligible magnitude of impact.

Interference with migratory movements of fish

5.6.24 The Individual Based Modelling study shows that none of the three species (bass, eel and flounder) used to represent the range of species found in the Tideway flounder were significantly affected when comparing the base case and the proposed development. This is likely to be influenced by the permanent foreshore structure offering refuges for juvenile fish against adverse currents, and thus offsetting the slightly increased velocities resulting from the presence of permanent foreshore structure. The effect is therefore considered to be **negligible**, given the medium-high (metropolitan) value of the receptor and the negligible impact magnitude.

Reduction in the occurrence of dissolved oxygen related fish mortalities

5.6.25 Interception of the CSOs throughout the tidal Thames would result in far fewer hypoxia events. The TFRM has been used to predict the change in the number of hypoxia events, and the results are reported in Vol 3. In summary, all tidal Thames fish populations would become sustainable (ie, less than 10% mortality as a result of hypoxia (Turnpenny, AWH, *et al*.,

2004) [25], compared with the current baseline in which there is a greater than 10% mortality due to hypoxia for four key species (smelt, dace, flounder and common goby).

5.6.26 Interception of the Southwest Storm Relief and Heathwall Pumping Station CSOs would contribute to tidal Thames-wide improvement, but would also result in improvements in the local area. Given that the impact is considered to be medium positive, and the value of the receptors is medium-high (metropolitan), the effect is thus considered to be **moderate beneficial**.

Increase in the distribution of pollution sensitive fish species

5.6.27 The tidal Thames currently supports a small number of rare fish species such as salmon, sea trout, twaite shad and river lamprey (*Lampetra fluviatilis*). A number of factors limit the colonisation of habitats by these species, including salinity, substrate type and current, but pollution is known to be a significant factor in determining colonisation (Maitland, PS, and Hatton-Ellis, TW, 2003)[26]. Improving water and sediment quality would facilitate the spread of those pollution sensitive species which are currently being impeded by poor water and sediment quality.

5.6.28 EA data and bespoke project surveys have indicated no records of rare fish species in the vicinity of Heathwall Pumping Station and habitat quality at this site is limited by confinement of the river channel between vertical river walls, which limits the extent of intertidal habitat. Given that the impact is considered to be medium positive, and the value of the receptors is medium-high (metropolitan), the effect is thus considered to be **negligible** in the short term (Year 1), and **moderate beneficial** in the medium term (Year 6), since it would take time for fish species to colonise.

Improvement in the quality of foraging habitat

5.6.29 Intertidal habitat in the upper and middle tidal Thames is used by juvenile fish for foraging. For example, juvenile flounder, bass and smelt migrate to the tidal limit in spring and early summer and then migrate downstream in search of suitable foraging habitat. As habitat quality improves as described in para. 5.6.17, and the invertebrate community becomes more diverse (paras. 5.6.35 to 5.6.40) foraging opportunities for fish may increase. Given that the impact is considered to be medium positive, and the value of the receptors is medium-high (metropolitan), the effect is considered to be **negligible** in the short term (Year 1), increasing to **moderate beneficial** in Year 6 of operation as it would take time for communities to develop.

Invertebrates

Permanent loss of intertidal feeding and burrowing habitat for invertebrates due to landtake

5.6.30 The area beneath the permanent works would be lost as burrowing and feeding habitat for invertebrates. Given that the impact is considered to be low negative, and the value of the receptors is medium (borough), the overall effect is considered to be **negligible**.

Modification of intertidal and subtidal habitats for invertebrates by scour protection

5.6.31 As for fish the degree to which the scour protection would change conditions for invertebrates depends on the nature of the existing substrate. Fine substrates are unlikely to accumulate extensively within the rip rap scour protection given the high flow velocities which are likely to occur in the vicinity of them. Benthic invertebrates may thus be excluded from these areas, except in sheltered pockets where accretion can occur.

5.6.32 Pelagic invertebrates such as *G. zaddachi* may be attracted to these areas in order to shelter from the current.

5.6.33 The overall effect on invertebrates is considered to be **negligible**, given the medium (borough) value of the receptor and the low negative impact magnitude.

Change to burrowing and feeding habitat due to accretion

5.6.34 The modelling results have predicted minimal changes in sediment accumulation as a result of the permanent foreshore structure. The increase in the proportion of fine material associated with accretion may favour certain benthic invertebrates including the sediment dwelling Oligochaeta and Polychaeta. Oligochaeta are already the dominant benthic invertebrate group at the site and the change in the proportion of fine sediments is unlikely to change the overall community composition. Therefore overall the effect of accretion is considered to be **negligible**, given the medium (borough) value of the receptor and negligible impact magnitude.

Localised improvements in invertebrate diversity and abundance

5.6.35 Improvements in DO concentrations are likely to lead to an increase in the distribution of a range of species that are currently being suppressed by poor water quality conditions. Some of these improvements will occur under the base case due to the Lee Tunnel and STW upgrades. However, even with these improvements in place there are still predicted to be a number of occasions during an average year when DO standards would be breached. Colonisation by DO sensitive taxa such as Corophiidae, Crangonidae and Gammaridae which would otherwise occur within the freshwater zone would continue to be suppressed.

5.6.36 Full compliance with the standards as a result of the Thames Tideway Tunnel is expected to enable colonisation by these DO sensitive taxa. In the localised areas around CSO discharges gradual reductions in organic material associated with sewage would also allow for a transition from invertebrate communities dominated by small numbers of species to a more diverse and balanced community. For example, pollution sensitive estuarine taxa such as Corophiidae, Crangonidae, Gammaridae, Sphaeromatidae, Nuculidae, Anthuridae, and Palaemonidae may be expected to increase in abundance.

5.6.37 Improvements in water quality could theoretically selectively enhance colonisation by invasive, non-native species. However, studies on mitten crabs, for example, have determined that the species is able to tolerate poor water quality, but that improvement of water quality does not necessarily lead to an increased distribution (Veilleux, E, and de Lafontaine, Y, 2007)[27].

5.6.38 Given that the impact is considered to be medium positive, and the value of the receptors is medium (borough), the effect is considered to be at **negligible** at Year 1 and **minor beneficial** Year 6 of operation since it would take time for new species to colonise.

Increase in the distribution of pollution sensitive invertebrate species

5.6.39 The tidal Thames currently supports a small number of rare invertebrate species, such as swollen spire snail and tentacled lagoon worm. A number of factors limit the colonisation of habitats by these species, including salinity, substrate type and current, but pollution is known to be a significant factor in determining colonisation. Improving water and sediment quality would facilitate the spread of those pollution sensitive species which are currently being impeded by poor water and sediment quality.

5.6.40 EA data and bespoke project surveys have indicated no records of rare invertebrate species in the vicinity (other than *A.lacustre* which as discussed although uncommon nationally is common in the tidal Thames). Given that the impact is considered to be medium positive, and the value of the receptors is medium (borough), the effect is thus considered to be **negligible** in Year 1, and **minor beneficial** in Year 6 as it would take time for species to colonise.

Algae

Permanent loss of original river wall

5.6.41 The algae that have previously been found on the river wall at the Heathwall Pumping Station site can be expected to recolonise the new river wall (i.e. the outer wall of the permanent structure) relatively quickly following the completion of construction (within 5 years). As none of these species are uncommon the effect is considered to be **negligible**, given the low-medium (local) value of the receptor and the low negative impact magnitude.

Changes in algal communities

5.6.42 The reduction in nutrient levels, both in the water column and the sediments in the vicinity of the discharge may cause local changes to the algal communities of the river wall. Whilst it is not possible to predict these changes precisely it is likely that the reduction in nutrients would contribute to the recovery of algal flora, with pollution sensitive species becoming a more common component of the community at the expense of more pollution tolerant species.

5.6.43 However, habitat availability would remain a key factor determining the diversity and abundance of algal communities and so the effects associated with the Thames Tideway Tunnel project are considered to be **negligible**, given the low-medium (local) value of the receptor and the low positive impact magnitude.

Sensitivity test for programme delay

5.6.44 For the assessment of effects on aquatic ecology during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above (paras. 5.6.1 to 5.6.43). This is because there are no developments in the site development schedule that would fall into the base case as a result of this delay and therefore the base case would remain as described in paras. 5.4.66 to 5.4.69.

5.7 Cumulative effects assessment

5.7.1 As described in Section 5.3, during the construction phase the only scheme within the site development schedule (Vol 15 Appendix N) that would have an impact on aquatic ecology receptors would be the Battersea Power Station scheme. During construction of this scheme, there would be works on the jetty that would require both capital and maintenance dredging, and construction of a floating pontoon with steel mono piles. Therefore there could be impacts on aquatic ecology receptors through increased waterborne noise and vibration, and increased sediment loads. The construction phase at Heathwall Pumping Station has been concluded as leading to low negative impacts (paras. 5.5.12 and 5.5.15). The extent and duration of piling at Battersea Power Station would be limited, and given that the site is 360m distant from Heathwall Pumping Station, cumulative impacts are considered to remain of low impact, and to be probable and temporary.

5.7.2 Therefore the effects on aquatic ecology would remain as described in Section 5.5 and 5.6 above.

Sensitivity test for programme delay

5.7.3 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, the cumulative effects assessment would remain unchanged. As described above in paras. 5.7.1 to 5.7.2, there are no schemes anticipated to generate cumulative effects on aquatic ecology and this would remain the case with a programme delay of approximately one year.

5.8 Mitigation and compensation

Mitigation

5.8.1 The approach to mitigation has been informed by the ‘Mitigation and Compensation Hierarchy’ consulted on with the Thames Tideway Tunnel Biodiversity Working Group and EA Technical Working Group as a systematic and transparent decision-making process. The hierarchy is appended to Vol 2.

5.8.2 The hierarchy is sequential and seeks to avoid adverse environmental effects. The hierarchy of ‘avoid effect’, ‘minimise’, ‘control’ ‘compensate’, and ‘enhance’ has been strictly applied in this sequence.

5.8.3 All *CoCP* and embedded design measures of relevance to aquatic ecology are summarised in Section 5.2. No significant effects requiring mitigation are predicted during the construction stage

5.8.4 During operation the permanent loss of intertidal foreshore is considered to be a moderate adverse effect. The footprint of the permanent structure has been minimised as far as possible to accommodate the necessary works therefore further mitigation is not possible.

5.8.5 The permanent loss of intertidal foreshore habitat at Heathwall Pumping Station contributes to an overall loss arising from all of the foreshore sites. Compensation for this project-wide permanent loss of foreshore habitat is described in Vol 3 (see para. 5.9.2).

5.8.6 A monitoring programme to measure the recovery of aquatic ecology receptors throughout the tidal Thames following interception of the CSO network will be implemented.

Compensation

5.8.7 Significant adverse effects would occur due to the permanent loss of intertidal and subtidal habitats, and intertidal feeding and resting habitat for fish. On site habitat compensation is not considered possible due to the limited availability of land to create new habitat within the boundary of the site. A package of off site measures which would compensate for significant adverse effects on habitats and fish has been developed and is reported in full in Vol 3 Section 5.8. It includes measures such as the creation of an intertidal terrace on the Bell Lane Creek, and the installation of fish passes on several structures which are currently inhibiting the migration of fish from the tidal Thames into freshwater tributaries.

5.9 Residual effects assessment

Construction effects

5.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 5.5 Construction effects assessment and as presented in Section 5.10.

Operational effects

5.9.2 As no mitigation measures are proposed, the residual operational effects remain as described in Section 5.6. All residual effects are presented in Section 5.10.

5.9.3 Compensation for the overall habitat loss across the Thames Tideway Tunnel project is outlined in the project wide assessment (Vol 3). At a project wide level the total habitat losses have been addressed through sites along the route of the main tunnel to compensate for adverse effects on aquatic ecology. The loss of habitat at Heathwall Pumping Station has been reported here without taking account of these compensation sites. This is to ensure that the local effects are presented. However, it is recognised that aquatic ecological resources are highly mobile and river wide. Reference should therefore be made to the project wide assessment which includes the compensation sites to understand the total effects anticipated to result from the Thames Tideway Tunnel project.

5.10 Assessment summary

Vol 15 Table 5.10.1 Aquatic ecology – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Designated sites and habitats	Loss of intertidal habitat due to temporary landtake	Minor adverse	None	Minor adverse
	Disturbance and consolidation of intertidal and subtidal habitat	Minor adverse	None	Minor adverse
	Change in intertidal and subtidal habitat due to scour and accretion	Minor adverse	None	Minor adverse
Marine mammals	Interference with the migrations of marine mammals within the Tideway	Negligible	None	Negligible
Fish	Loss of feeding, resting and nursery habitat for fish due to temporary landtake	Minor adverse.	None.	Minor adverse
	Loss of feeding, resting and nursery habitat for fish due to sediment consolidation and disturbance	Minor adverse	None	Minor adverse
	Change in feeding, resting and nursery habitat for fish due to scour and accretion	Minor adverse	None	Minor adverse
	Potential disturbance due to illumination of the river	Negligible	None	Negligible
	Interference with migratory movements of fish	Negligible	None	Negligible
	Effects of waterborne noise and vibration on fish	Minor adverse	None	Minor adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
	Reduction in water quality due to suspended sediment.	Minor adverse	None	Minor adverse
Invertebrates	Direct mortality of invertebrates due to temporary landtake, sediment disturbance and consolidation	Negligible	None	Negligible
	Loss of feeding/burrowing habitat for invertebrates due to landtake	Negligible	None	Negligible
	Loss of feeding/burrowing habitat for invertebrates due to sediment consolidation and disturbance.	Negligible	None	Negligible
	Change to burrowing and feeding habitat due to scour and accretion	Negligible	None	Negligible
	Potential disturbance due to illumination of the river	Negligible	None	Negligible
	Reduction in water quality due to suspended sediment.	Negligible	None	Negligible
Algae	Loss of habitat due to temporary landtake	Negligible	None	Negligible
	Reduction in water quality due to suspended sediment.	Negligible	None	Negligible

Vol 15 Table 5.10.2 Aquatic ecology – summary of operational assessment

Receptor	Effect	Significance of effect		Mitigation	Significance of residual effect	Compensation
		Year 1	Year 6			
Designations and habitats	Permanent loss of designated intertidal habitat	Moderate adverse	Moderate adverse	None	Moderate adverse (at the site level)	Compensation would be provided through a suite of off site habitat creation schemes which are described in Vol 3.
	Change in intertidal and subtidal habitat due to accretion	Minor adverse	Minor adverse	None	Minor adverse	None
	Improvements in habitat quality through changes in water quality	Negligible	Minor beneficial	None	Minor beneficial	None
Marine mammals	Increase in the number and/or change in the distribution of marine mammals.	Negligible	Negligible	None	Negligible	None
Fish	Permanent loss of intertidal feeding and resting habitat for fish.	Minor adverse	Minor adverse	None	Minor adverse	None
	Modification of intertidal feeding and subtidal habitats for fish	Negligible	Negligible	None	Negligible	None
	Change in feeding, resting	Minor	Minor	None	Minor adverse	None

Receptor	Effect	Significance of effect		Mitigation	Significance of residual effect	Compensation
		Year 1	Year 6			
	and nursery habitat for fish due to accretion	adverse	adverse			
	Interference with migratory movements of fish	Negligible	Negligible	None	Negligible	None
	Reduction in the occurrence of dissolved oxygen related fish mortalities.	Moderate beneficial	Moderate beneficial	None	Moderate beneficial	None
	Increase in the distribution of pollution sensitive fish species.	Negligible	Moderate beneficial	None	Moderate beneficial	None
	Improvement in the quality of foraging habitat	Negligible	Moderate beneficial	None	Moderate beneficial	None
Invertebrates	Permanent loss of intertidal feeding and burrowing habitat for invertebrates.	Negligible	Negligible	None	Negligible	None
	Modification of intertidal and subtidal habitats for invertebrates by scour protection	Negligible	Negligible	None	Negligible	None
	Change to burrowing and feeding habitat due to accretion	Negligible	Negligible	None	Negligible	None
	Localised improvements in invertebrate diversity and abundance.	Negligible	Minor beneficial	None	Minor beneficial	None

Receptor	Effect	Significance of effect		Mitigation	Significance of residual effect	Compensation
		Year 1	Year 6			
	Increase in the distribution of pollution sensitive invertebrate species.	Negligible	Minor beneficial	None	Minor beneficial	None
Algae	Permanent loss of original river wall	Negligible	Negligible	None	Negligible	None
	Changes in algal communities	Negligible	Negligible	None	Negligible	None

References

[1] Department of Environment, Food and Rural Affairs (Defra). *National Policy Statement for Waste Water* (2012). Available at: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf last accessed November 2012

[2] Environment Agency. *Pollution Prevention Guide 05: Works in, near or liable to affect water courses* (Undated)

[3] CIRIA.. *C532: Control of water pollution from construction sites: Guidance for consultants and contractors* (2001)

[4] Balanced Seas. *Marine Conservation Zone project – final recommendations* (September 2011).

[5] Thames Estuary Partnership Biodiversity Action Group. *Tidal Thames Habitat Action Plan*. Thames Estuary Partnership (undated).

[6] Natural England. *Nature on the Map* (undated). Available at: http://www.natureonthemap.co.uk/map.aspx?m=bap. Last accessed January 2012.

[7] Elliott, M. and Taylor, CJL. *The structure and functioning of an estuarine/marine fish community in the Forth estuary, Scotland*. Proc. 21st European Marine Biological Symposium (Gdansk). Polish Academy of Sciences, Institute of Oceanology, Warsaw, Poland, 227-240. (1989).

[8] Elliott, M. and Hemingway, KL. *Fishes in Estuaries*. London: Blackwell Science (2002).

[9] Colclough, SR, Gray, G, Bark, A and Knights, B. *Fish and fisheries of the tidal Thames: management of the modern resource, research aims and future pressures*. In: Journal of Fish Biology 61 Supplement A, pp 64-73. (2002).

[10] Colclough, SR, Gray, G, Bark, A & Knights, B. (2002). See citation above.

[11] Wheeler, AC. *The Tidal Thames. The History of a River and its Fishes*. Routledge and Kegan Paul, London (1979).

[12] Turnpenny, AWH., Clough, SC, Holden, SDJ, Bridges, M, Bird, H, O'Keeffe, NJ, Johnson, D, Edmonds, M, Hinks, C. *Thames Tideway Strategy: Experimental Studies on the Dissolved Oxygen Requirements of Fish*. Consultancy Report no.FCR374/04 to Thames Water Utilities, Ltd. Fawley Aquatic Research, Fawley Southampton (April, 2004).

[13] Chadd, R and Extence, C. *The conservation of freshwater macroinvertebrate populations: a community based classification scheme*. Aquatic Conservation: Marine and Freshwater Ecosystems 14: 597-624. (2004).

[14] Bratton, JH (editor). *British Red Data Books: 3. Invertebrates other than insects*. JNCC, Peterborough (1991).

[15] Shirt, DB (editor). *British Red Data Books: 2 Insects*. Peterborough: Nature Conservancy Council (1987).

[16] Aguirre, W, and Poss, SG. *Non-indigenous Species IN the Gulf of Mexico Ecosystem: Corbicula fluminea* (Muller 1774) Gulf States Marine Fisheries Commission (1999).

[17] Bailey-Brock JH, Paavo, B., Barrett, BM, and Dreyer, J. *Polychaetes associated with a tropical ocean outfall: synthesis of a biomonitoring program off O'ahu Hawai'i.* Pac. Sci. 56: 459-479. (2002).

[18] English Nature. *Thames Estuary European Marine Site: English Nature's advice given under Regulation 33(2) of the Conservation (Natural Habitats & c.). Regulations 1994* (2001).

[19] Tittley. *The Marine Algae (Seaweeds) of the Tidal Thames: a Floristic Accoun*t. The London Naturalist. No.88 (2009).

[20] Greater London Authority. *London Plan.* (2012). Available at: www.london.gov.uk/priorities/planning/londonplan. Last accessed May 2012.

[21] Environment Agency. *National Encroachment Policy for Tidal Rivers and Estuaries* (2005)

[22] HR Wallingford. Thames Estuary 2100, *Morphological changes in the Thames Estuary, Technical Note EP6.8, The development of an historical sediment budget*. Report for the Environment Agency. . (2006).

[23] HR Wallingford. November. *Effect of Thames Tideway Tunnel Construction Activities on Morphology of the Thames Estuary Designated Habitats*. Thames Tideway Tunnel Technical Note DDM6485-02, 100-RG-MDL-WALLI-000035HR. (2012).

[24] Grove, RS, Nakamura, M, and Sonu, CJ. *Design and engineering of manufactured habitats for fisheries enhancement*. In Artificial habitats for marine and freshwater fisheries (eds W. Seaman & L.M. Sprague), pp. 109-152. Academic Press, San Diego, California (1991).

[25] Turnpenny, AWH., Clough, SC, Holden, SDJ, Bridges, M, Bird, H, O'Keeffe, NJ, Johnson, D, Edmonds, M, Hinks, C. (2004) See citation above.

[26] Maitland, PS, and Hatton-Ellis, TW. *Ecology of the Allis and Twaite Shad*. Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough (2003).

[27] Veilleux, E, and de Lafontaine, Y. *Biological synopsis of the Chinese mitten crab (Eriocheir sinensis)*. Fisheries and Oceans, Canada (2007).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

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Volume 15: Heathwall Pumping Station site assessment

Section 6: Ecology - terrestrial

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 6: Ecology – terrestrial

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6 Ecology – terrestrial

6.1 Introduction

6.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on terrestrial ecology at Heathwall Pumping Station.

6.1.2 The proposed development has the potential to affect terrestrial ecology due to:

a. site clearance and habitat creation

b. construction site activities

c. temporary structures within the foreshore

d. barge movements.

6.1.3 Operational effects for terrestrial ecology for this site have not been assessed. This is on the basis that permanent operational lighting is minimal and complies with the lighting design principles to minimise light spill, and maintenance works are limited to intermittent visits to site by maintenance personnel and vehicles. No significant operational effects are considered likely and for this reason, only construction effects are assessed.

6.1.4 The following are not considered within the assessment:

a. Contaminated runoff and atmospheric pollution, as these would be controlled through the implementation of the *Code of Construction Practice (CoCP)*[i].

b. Designated sites, as there are no designated sites relevant to terrestrial ecology that lie within 250m of the site as shown on Vol 15 Figure 6.4.1 (see separate volume of figures).

6.1.5 The assessment of the likely significant effects of the project on terrestrial ecology has considered the requirements of the *National Policy Statement (NPS) for Waste Water (Defra, 2012)*[1]. In line with these requirements, designations, species and habitats relevant to terrestrial ecology are identified and measures incorporated into the proposed development described. Based on assessment findings, measures to address likely significant adverse effects are identified. Vol 2 Section 6 provides further details on the methodology.

6.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Vol 15 Heathwall Pumping Station figures).

[i] The Code of Construction Practice (CoCP) is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

6.2 Proposed development relevant to terrestrial ecology

6.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to terrestrial ecology are set out below.

Construction

6.2.2 The following elements of the construction phase have the potential to affect terrestrial ecology receptors:

a. demolition of buildings and the river wall as a result of site clearance at both the Heathwall Pumping Station and the Kirtling Street site to the west

b. construction works throughout the construction phase that would create noise and vibration, such as the use of construction machinery and vehicles, demolition and the tunnel excavation. This includes noise and vibration for a limited period during 24 hour working

c. artificial lighting of the site in evenings during winter, and continuously during the construction and secondary lining of the connection tunnel

d. use of barges and temporary structures within the foreshore

e. construction of the permanent operational structure within the foreshore at Heathwall Pumping Station including piling works.

Code of Construction Practice

6.2.3 The Code of Construction Practice (*CoCP*) is formed of Part A covering measures to be applied at all sites and Part B covering site specific measures. The *CoCP* sets out the standards, procedures, and measures for managing and reducing construction effects. These measures would be implemented through a site specific *Construction environmental management plan* (*CEMP*), which would encompass an *Ecology and landscape management plan* (ELMP). The *ELMP* would include measures to protect and minimise impacts on sensitive ecological receptors such as designated sites, sensitive habitats (e.g. trees, scrub, watercourses, grassland), and notable species.

Part A

6.2.4 The *CoCP* Part A includes the following measures to reduce impacts on terrestrial ecology:

a. consultation with a suitably qualified ecologist in preparing the control measures within the *ELMP* and *CEMP*

b. a check of the site in advance of the works to identify any ecological constraints in addition to those discussed in this *Environmental Statement* (ES)

c. supervision of works by a suitably qualified ecologist

d. protection of trees

e. measures specific to bats such as the control of lighting, noise and vibration, and procedures to follow if a bat roost is present on site

f. measures to prevent harm to nesting birds and birds that are listed on Schedule 1 of the Wildlife and Countryside Act 1981 (WCA, 1981)

g. use of capped and cowled lighting that is directed away from sensitive ecological receptors

h. controls to minimise noise and vibration, including use of noise enclosures, careful plant selection and careful programming of works

i. controls for site drainage to minimise the potential for pollution of watercourses and contamination of sensitive habitats

j. controls to prevent spread of non-native invasive plants, where present.

Part B

6.2.5 The *CoCP* Part B (Section 11) states that protection of the river bed would be provided during construction and restoration of the foreshore would be undertaken after the works.

Environmental design measures

6.2.6 To mitigate adverse effects or provide biodiversity enhancements, the planting of new trees on Nine Elms Lane has been incorporated into the project design.

6.3 Assessment methodology

Engagement

6.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. There are no specific comments relevant to this site for the assessment of terrestrial ecology.

Baseline

6.3.2 The baseline methodology follows the methodology described in Vol 2. In summary, the following baseline data has been reported in this assessment:

a. desk study

b. a Phase 1 Habitat Survey was undertaken on 7 December 2010

c. bat triggering (remote recording) bat surveys were undertaken over three nights between 6 and 8 May 2011

d. bat activity (dawn) survey was undertaken on 28 June 2011

e. wintering bird surveys were undertaken on 25 January, 24 February, 25 March, 18 October, 29 November and 13 December 2011

f. black redstart (*Phoenicurus ochruros)* surveys were undertaken on 20 May, 10 June, 21 June, 28 June and 12 July 2011.

Construction

6.3.3 The assessment methodology for the construction phase follows that described in Vol 2 Section 6. There are no site specific variations for this site. All likely significant effects throughout the duration of the construction phase are assessed.

6.3.4 The term significance is used within this volume to refer to project significance levels from negligible to major effects (adverse and beneficial). Adverse moderate or major effects are considered to be significant and require mitigation. Negligible and minor effects are not considered significant and therefore do not require mitigation. These significance criteria and their relationship with levels of significance are based on the *Institute for Ecology and Environmental Management guidelines* (IEEM, 2006)[2] is given in Vol 2 Section 6.

6.3.5 No effects on habitats are predicted beyond 10m of the site boundary. Therefore, the assessment area comprises the site and adjacent land within 10m of the site boundary.

6.3.6 The assessment considers bats, breeding birds and wintering birds within 100m of the site. This is considered to be a sufficient distance within the context of the urban environment to ensure that any significant effects on species, for example from disturbance as a result of construction lighting and noise, are assessed.

6.3.7 Section 6.5 details the likely significant effects arising from the construction at the Heathwall Pumping Station site. The nearby Thames Tideway Tunnel project site, Kirtling Street, could give rise to additional effects on terrestrial ecology. This site is therefore included in this assessment.

6.3.8 The following developments in close proximity to the site would be complete or partially complete at Site Year 1 of construction at Heathwall Pumping Station. As these developments would be replacing existing areas of buildings and hardstanding, and landscape planting would be immature, it is considered unlikely that these developments would change the base case conditions for terrestrial ecology:

a. Blocks B to F of the Riverlight development adjacent to the west of the site comprising a residential-led mixed-use development including landscaping and provision of a riverside walk.

b. Buildings A9, A10 and A11 of the Embassy Gardens development approximately 15m to the south of the site (a mixed use development).

6.3.9 No change to the base case conditions for terrestrial ecology are considered likely from any other proposed development listed in Vol 15 Appendix N that would be complete at Site Year 1, due to the isolated location of these developments from the proposed development site, within the urban context.

6.3.10 No likely significant cumulative effects have been identified with proposed developments listed in Vol 15 Appendix N that would be under construction at Site Year 1. These developments are isolated from the proposed development site within the urban context.

6.3.11 The assessment of construction effects considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Assumptions and limitations

6.3.12 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 6. Site specific assumptions and limitations are detailed below.

Assumptions

6.3.13 It is assumed for the purposes of assessment that the current use of the Heathwall Pumping Station site (see Vol 15 Section 2) would continue as at present.

Limitations

6.3.14 No site-specific limitations have been identified.

6.4 Baseline conditions

6.4.1 The following section sets out the baseline conditions for terrestrial ecology receptors within and around the site, including their value. Future baseline conditions (base case) are also described. All figures referred to in this section are contained in the Vol 15 Heathwall Pumping Station Figures (see separate volume of figures).

Current baseline

Habitats

6.4.2 Habitats recorded within the survey area during the Phase 1 Habitat Survey are described in Vol 15 Table 6.4.1 and shown on Vol 15 Figure 6.4.2 (see separate volume of figures).

Vol 15 Table 6.4.1 Terrestrial ecology – Phase 1 Habitat Survey

Habitat type / feature of note	Habitat description
Buildings, hardstanding and river wall	A number of modern buildings exist within the survey area. A stretch of river wall lies within the survey area.
Trees	There are two mature trees which are present immediately adjacent to the west of the site. There is an area of ornamental scattered trees to the east of the proposed development site, and street trees to the south.
Amenity grassland	There are areas of amenity grassland within the survey area to the east and south of the site boundary.

Habitat type / feature of note	Habitat description
Introduced shrub	Formal planting within the public gardens area to the east of the site includes introduced shrubs.
Running water and intertidal zone	A section of the River Thames intertidal zone lies within the survey area. This habitat type is part of the aquatic ecology assessment (Section 5 of this volume).

6.4.3 The buildings, hardstanding and river wall on site are not considered to have biodiversity value as habitats, and therefore are considered to be of negligible value.

6.4.4 There are two mature trees immediately adjacent to the west of the site and several ornamental trees to the east of the site. These trees are surrounded by buildings and hardstanding, and have limited biodiversity value. Consequently, the mature trees are considered to be of negligible ecological value.

Notable species

6.4.5 Survey results are set out in a notable species report, which is included in Vol 15 Appendix D.1. A summary of the results and an assessment of the value of species associated with the site are set out below.

Bats

6.4.6 During the Phase 1 Habitat Survey, the River Thames on and adjacent to the site was identified as being likely to represent an area of importance to commuting bats. Therefore, remote recording surveys and an activity survey at dawn were undertaken at this site.

6.4.7 All bats are European Protected Species (EPS) under the Conservation of Habitats and Species Regulations 2010. Seven of the 18 bat species that regularly occur in England are listed as priority species on the UK Biodiversity Action Plan (BAP). Nine bat species are listed on the London BAP including common pipistrelle (*Pipistrellus pipistrellus)*, soprano pipistrelle (*Pipistrellus pigmaeus)*, Nathusius' pipistrelle (*Pipistrellus nathusii)* and noctule (*Nyctalus noctula*). These species were all recorded on site. Detailed survey results are provided in Vol 15 Appendix D.1 and on Vol 15 Figure 6.4.3 (see separate volume of figures).

6.4.8 The remote recording surveys recorded high numbers of common pipistrelle bat passes (compared to other sites surveyed in London) throughout the night, with a maximum number of bat passes in one night at one location of 420 passes. The majority of these passes were between midnight and dawn suggesting that this activity was most likely to be associated with commuting bats along the River Thames.

6.4.9 Soprano pipistrelle, Nathusius' pipistrelle and noctule bat passes were recorded in low numbers, with each species only present on one survey night.

6.4.10 The buildings on and adjacent to the site are well maintained and the potential for bats to roost in these buildings is considered to be negligible. This is supported by remote recording survey results. No activity was recorded at the site during dawn bat activity surveys, which suggests that a roost on or adjacent to the site is unlikely.

6.4.11 Common pipistrelle are likely to be commuting through the site along the River Thames or foraging around mature vegetation near to the site. Activity elsewhere on site is likely to be minimal as the foraging habitat here is considered to be poor. Records of soprano pipistrelle, Nathusius' pipistrelle and noctule bat indicate that they occasionally pass through the site.

6.4.12 The common pipistrelle bat is the UK's most common bat species, and is a widespread species in Greater London although populations are in decline, mainly due to habitat loss (London Bat Group, 2012)[3]. Given the status of this species as EPS and a priority species on the London BAP, and the fact that it is common relative to other UK bat species, the common pipistrelle population associated with the site is considered to be of low-medium (local) value.

6.4.13 Nathusius' pipistrelle, soprano pipistrelle and noctule bats are less common in London[4]. These species are listed on the UK and London BAP. As very few passes of these bat species were recorded on the site, the populations of each of these bat species associated with the site are considered to be of low (site) value.

Wintering birds

6.4.14 During the Phase 1 Habitat Survey, the foreshore habitat along the River Thames was considered to have potential for wintering bird species and therefore, wintering bird surveys were undertaken. Details of the wintering bird survey are provided in Vol 15 Appendix D.1 and shown on Vol 15 Figure 6.4.4 (see separate volume of figures).

6.4.15 A total of 12 waterbird[ii] species were recorded on the foreshore on and adjacent to the site. Of these, six species are of nature conservation importance and are included on the Birds of Conservation Concern 3 (RSPB, 2009)[5] Red or Amber List[iii] and/or UK and London BAP as priority species (see Vol 15 Table 6.4.2).

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ii A waterbird is a species which is listed in the Wetland Bird Survey (WeBS) methodology – British Trust for Ornithology, Royal Society for the Protection of Birds, Joint Nature Conservation Committee and Wildfowl and Wetlands Trust.

iii The conservation status of all regularly occurring British birds has been analysed in cooperation with the leading governmental and non-governmental conservation organisations, including the Royal Society for the Protection of Birds (RSPB), British Trust for Ornithology (BTO) and Birdlife International Birds of Conservation Concern 3 (RSPB, 2009). The basis of species ongoing population trends are assigned to one of three lists of Conservation Concern. These are the UK Red, Amber and Green lists. Although the lists confer no legal status in themselves, they are useful in evaluating the conservation significance of bird assemblages, and for assessing the potential significance of impacts and informing appropriate levels of mitigation with respect to bird populations.

Birds of Conservation Concern (BoCC) Red List criteria for breeding birds are those which have experienced a severe decline of more than 50% of population and / or range over the last 25 years, as measured by the number of 10km squares occupied by breeding birds of the species concerned. Species listed as globally threatened by

6.4.16 The six species of nature conservation importance are gadwall *(Anas strepera)*, mallard (*Anas platyrhynchos)*, black-headed gull (*Larus ridibundus)*, common gull (*Larus canus)*, lesser black-backed gull (*Larus fuscus* ssp. *Graellsii)* and herring gull (*Larus argentatus* ssp. *argenteus*). Gadwall and mallard were recorded foraging on the muddy foreshore and along the water's edge as the tide receded. Four species of gull were recorded resting on the jetty and moored house boats to the west of the site.

6.4.17 The records of waterbirds of nature conservation importance recorded on the foreshore were compared to counts at other sites published in the *London Bird Report 2008* (London Natural History Society, 2011)[6]. The populations of all waterbird species on site are small relative to their populations in Greater London. The population of any one individual species of nature conservation importance is considered to be low-medium (local) value. The remaining six species of waterbird that are not of conservation importance are considered to each be of low (site) value.

Birdlife International and those with a historical decline in the UK between 1800 and 1995 (without evidence of recovery) are also included. BoCC Amber List criteria for breeding birds are those which have experienced a moderate decline of between 25% and 49% of population and / or range over the last 25 years. Species of European conservation concern and those with a historical decline but which are currently recovering are also included.

Vol 15 Table 6.4.2 Terrestrial ecology – wintering birds of nature conservation importance

Common name	Latin name	Conservation designation[iv]	Comments	Value
Gadwall	*Anas strepera*	Amber List	Gadwall was recorded on one occasion (January 2011) with a maximum count of four.	Low-medium (local)
Mallard	*Anas platyrhynchos*	Amber List	Recorded each month, with a maximum count of seven both in February and March 2011 and numbers varying between one and six in other months.	Low-medium (local)
Black-headed gull	*Larus ridibundus*	Amber List	Recorded each month, with a maximum count of 83 in January 2011 and numbers varying between eight and 78 in other months.	Low-medium (local)
Common gull	*Larus canus*	Amber List	Recorded each month, with a maximum count of 14 in November 2011 and numbers varying between two and six in other months.	Low-medium (local)
Lesser black-backed gull	*Larus fuscus*	Amber List	Recorded each month between February and December 2011, with a maximum count of five in February 2011 and numbers varying between one and four in other months.	Low-medium (local)
Herring gull	*Larus argentatus*	Red List, UK and London BAP Priority List	Recorded each month, with a maximum count of 35 in October 2011 and numbers varying between two and 16 in other months.	Low-medium (local)

[iv] A species that is listed in the following publications:

Batten, L.A., Bibby, C.J., Clement, P., Elliot, G.D. & Porter, R.F. (1990). *Red Data Birds in Britain*. T. & A.D. Poyser, London.

Commission of the European Communities (1979). Council Directive 79/409/EEC on the Conservation of Wild Birds. *Official Journal of European Communities, L103*.

Holliday, M & Rare Breeding Bird Panel (2011). Rare Breeding Birds in the United Kingdom in 2009. *British Birds*, 104, 9, 476-537.

Royal Society for the Protection Birds (2009). *Birds of Conservation Concern 3*. RSPB, Sandy.

United Kingdom Biodiversity Action Plan Steering Group (2011). *United Kingdom Biodiversity Action Plan* http://jncc.defra.gov.uk/page-5163 [10.11].

Black redstart

6.4.18 The Heathwall Pumping Station site, in particular the pumping station building itself, was identified as part of the Phase 1 Habitat Survey as having the potential to support nesting black redstart and breeding surveys have therefore been undertaken for this species. Full results are provided in Vol 15 Appendix D.1 and shown on Vol 15 Figure 6.4.5 (see separate volume of figures).

6.4.19 The Rare Breeding Birds Panel for the UK reported that 20–54 pairs of black redstart were identified at 49 sites in 2008, with birds reported from 21 counties nationally (Holling and Rare Breeding Birds Panel, 2008)[7]. The population in London therefore represents between 10% and 30% of the UK population (RSPB, 2012)[8].

6.4.20 Black redstart is known to nest on and around the nearby Battersea Power Station site which lies 200m to the west of the site (Battersea Power Station, 2009)[9]. The buildings on site offer potential black redstart nesting habitat. However, black redstart is an uncommon species and does not occur at every site where suitable habitat is present. There is no suitable foraging habitat on or immediately adjacent to the site, although the area surrounding the Battersea Power Station building would provide a potential foraging resource. No black redstarts were recorded on or adjacent to the site during the 2011 surveys. Hence, the black redstart resource associated with the site has been assessed as being of negligible value.

6.4.21 Black redstart is therefore not considered further in this assessment.

Noise, vibration and lighting

6.4.22 As noise, vibration and lighting have the potential to disturb species on and adjacent to the site, baseline conditions are described here.

6.4.23 Noise levels are heavily influenced by road traffic on Nine Elms Lane, and to construction noise from the nearby Tideway Walk development (see Section 9 Noise and vibration). Levels of vibration around the site are currently low.

6.4.24 At night the site currently receives relatively low levels of light spill from river traffic and riverside developments. However, there is street lighting along Nine Elms Lane which runs adjacent to the southern boundary of the site and consequently night time lighting levels are high in this location.

Construction base case

6.4.25 Assuming use of the site continues as at present, conditions on site at Site Year 1 of construction would be the same as the current ecological baseline conditions.

6.4.26 No developments are considered to change the ecological baseline.

6.4.27 The noise and vibration base case is described in detail in Section 9 of this volume. Noise levels are likely to be similar to those currently present on and in close proximity to the site, with slight increases in noise experienced due to an anticipated increase in traffic levels adjacent to the site. The levels of lighting and vibration around the site are considered unlikely to change between the present time and the base case.

6.5 Construction effects assessment

Construction impacts

Habitat clearance and creation

6.5.1 The demolition of buildings, hardstanding and the river wall, that are of negligible ecological value would be undertaken as part of construction works.

6.5.2 There is no vegetation to be removed on site and the mature trees in the immediate vicinity of the site are of negligible ecological value and would be protected through implementation of appropriate tree protection measures as detailed in the *CoCP* Part A (Section 11).

6.5.3 There would be temporary loss of an area of foreshore during construction at both the Kirtling Street and Heathwall Pumping Station site, as this additional area would be used for the construction of temporary and permanent in channel structures, currently used by wintering birds for foraging and resting. The foreshore would be reinstated following completion of works.

6.5.4 A small area of the foreshore would be permanently lost due to the construction of the operational structures within the foreshore at Heathwall Pumping Station. Therefore, there would be an overall loss of habitat for wintering birds

Movement, noise, vibration and lighting

6.5.5 Noise and vibration impacts are based upon the data and assessment in Section 9 of this volume. Noise levels are predicted to be slightly higher than the ambient noise levels throughout the construction period with works taking place during the day and night. There may be occasional sudden noises on site created by the movement of materials or the starting of vehicles. Vibration levels are likely to increase very slightly during construction

6.5.6 Construction would require there to be some lighting in the early morning and evening during the winter months to facilitate the extension of standard working hours. There would also be periods where lighting is required to facilitate 24 hour working. With the implementation of measures as detailed in the *CoCP* Part A (Section 4), light spill from construction lighting would be minimal.

6.5.7 As no bat roosts have been identified immediately adjacent to the site, bats are only likely to be present within habitat adjacent to the site whilst foraging or commuting at night. Bats are unlikely to be affected by the very small increases in noise and vibration levels, and movements of vehicles at night. There may be a small increase in light levels immediately adjacent to the site. This could cause disturbance to bats.

6.5.8 The overall increases in noise and vibration levels at the site during construction are unlikely to disturb birds. However, occasional sudden noises could cause disturbance to wintering birds on the foreshore.

6.5.9 The movement of construction workers and machinery on site could disturb birds adjacent to the site during construction.

Barging and associated facilities

6.5.10 The use of campsheds at the Heathwall Pumping Station would result in the temporary loss of habitat for wintering birds and bats on the foreshore of the River Thames. The foreshore would be reinstated following removal of the campsheds at the end of construction.

6.5.11 Existing background light levels associated with navigational lighting of the Nine Elms Pier development between the Kirtling Street and Heathwall Pumping station site are considered to be high. With the implementation of measures in the *CoCP* Part A (Section 4), additional increases in lighting levels associated with the Kirtling Street and Heathwall Pumping station site is likely to minimal, although some disturbance from lighting is anticipated on wintering birds and commuting bats.

6.5.12 Disturbance from the movement of barges in and out of the site, and wash on the foreshore, is likely to cause disturbance to wintering birds on the foreshore adjacent to the site.

Construction effects

Habitats

6.5.13 The removal of trees, buildings, hardstanding and river wall of negligible ecological value is considered to be a probable, **negligible** effect and not significant.

Species

Bats

6.5.14 As there are currently no roosts on or adjacent to the site, there would be no disturbance to roosting bats. Small changes in light levels are unlikely to create a barrier to the movement of commuting bats. Pipistrelle bats can tolerate relatively high light levels, up to 14 lux, which would not be exceeded by the installation of lighting due to control measures in the *CoCP* Part A (Section 4). There may be some minor changes in bat behaviour as bats are likely to commute over or around the barge facilities. The River Thames is a wide corridor at this point, and the function of this habitat is likely to be maintained. It is considered unlikely that changes in light levels and commuting behaviour would have an effect on the local distribution and abundance of bat populations. Therefore, the effect is considered likely to be probable, **negligible** and not significant**.**

6.5.15 There would be permanent loss of a small area of foreshore with a resultant loss of bat foraging habitat. However, the loss is small relative to the large scale of the River Thames and associated foreshore. Therefore, it is considered unlikely that this permanent loss would result in a decline in bat populations and the effect is considered to be probable, **negligible** and not significant**.**

Wintering birds

6.5.16 Works within the foreshore would result in the loss of foreshore habitat for wintering waterbirds during construction at both the Kirtling Street and Heathwall Pumping station sites. It is considered likely that waterbirds would be displaced to other areas of foreshore adjacent to the site and in the wider area. Following reinstatement of the foreshore, wintering birds are likely to return to the site. The permanent loss of a small area of foreshore is considered unlikely to significantly reduce the overall resource for wintering birds given the large scale of foreshore habitat that would remain along the River Thames. No perceptible change in wintering bird populations associated with the site are anticipated. Therefore, the effect on wintering bird populations of habitat loss at the site is considered to be probable, **negligible** and not significant.

6.5.17 There would be a temporary increase in noise and vibration levels. It is considered unlikely that waterbirds from the River Thames adjacent to the site would be displaced. Occasional displacement of birds is expected where sudden noises occur and when barges pass close by, with small numbers of wintering birds from adjacent intertidal habitat temporarily moving away from the habitat and returning shortly after. This displacement and return of wintering birds has been observed on the foreshore at other sites on the Thames, particularly where people walk along the foreshore. It is considered unlikely that this displacement would result in a perceptible change in wintering bird populations. Therefore, the effect of disturbance on wintering bird populations is probable, **negligible** and not significant.

6.5.18 Changes in light levels are considered to be small relative to the existing background levels on the foreshore. The increase in light levels is unlikely to result in the displacement of wintering birds from habitats adjacent to the site. Therefore, the effect of disturbance on wintering bird populations is probable, **negligible** and not significant.

Sensitivity test for programme delay

6.5.19 For the assessment of effects on terrestrial ecology during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above (paras. 6.5.1 - 6.5.18). While phases of other developments may shift from cumulative to base case as a result of this delay, it is considered that the base case would remain as described in paras. 6.4.25 - 6.4.27.

6.6 Operational effects assessment

6.6.1 As stated in para. 6.1.3, operational activities are limited at this site and not likely to lead to significant operational effects.

6.7 Cumulative effects assessment

Construction effects

6.7.1 No likely significant cumulative effects on terrestrial ecology have been identified as a result of construction activities from those developments identified in para. 6.3.10. Therefore, the effects on terrestrial ecology would remain as described in Section 6.5.

Sensitivity test for programme delay

6.7.2 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, the cumulative effects assessment would remain unchanged. As described above in para 6.7.1, there are no schemes anticipated to generate cumulative effects on terrestrial ecology and this would remain the case with a programme delay of approximately one year.

6.8 Mitigation

6.8.1 All measures embedded in the design and the *CoCP* of relevance to terrestrial ecology are summarised in Section 6.2. As no significant adverse effects were identified in Section 6.5 at this site, no further mitigation measures are required.

6.9 Residual effects assessment

Construction effects

6.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 6.5. All residual effects are presented in Section 6.10.

6.10 Assessment summary

Vol 15 Table 6.10.1 Terrestrial ecology – construction assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Habitats				
Buildings, trees, river wall and hardstanding	No significant change in habitat on site as the habitats to be removed are considered to be of negligible value.	Negligible	None	Negligible
Notable species				
Bats	No significant changes to bat populations as a result of disturbance from small increases in light levels and works within the foreshore.	Negligible	None	Negligible
	No change in bat populations as a result of temporary and permanent loss of foraging and commuting habitat for bats.	Negligible	None	Negligible
Wintering birds	No significant changes in wintering bird populations due to temporary and permanent loss of foreshore habitat for foraging wintering birds.	Negligible	None	Negligible
	No significant changes in wintering bird populations as a result of disturbance from noise,	Negligible	None	Negligible

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
	vibration and the movement of barges.			
	No significant changes in populations and assemblages of wintering birds due to lighting from construction activities.	Negligible	None	Negligible

References

[1] Defra, *National Policy Statement for Waste Water* (2012). http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf . Accessed November 2012

[2] IEEM. *Guidelines for Ecological Impact Assessment in the United Kingdom* (2006).

[3] London Bat Group. *Greater London Bat Action Plan (*2012). Available online at: http://londonbats.org.uk/lbpsap.htm. Accessed 19 January 2012.

[4] London Bat Group. See citation above.

[5] Royal Society for the Protection Birds. *Birds of Conservation Concern 3*. RSPB, Sandy (2009).

[6] London Natural History Society. *London Bird Report 2008*. London Natural History Society (2011).

[7] Holling and Rare Breeding Birds Panel. *Rare breeding birds in the United Kingdom in 2008*. Mark Holling and the Rare Breeding Birds Panel (2008).

[8] Royal Society for the Protection Birds. *Black Redstart.* Last updated January 2012. Available online at: http://www.rspb.org.uk/wildlife/birdguide/name/b/blackredstart/index.aspx. Accessed 18 January 2012.

[9] Battersea Power Station. *Battersea Power Station – A new energy for London: Environmental Statement for Outline Planning Application.* Battersea Power Station (July 2009).

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 7: Historic environment

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Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 7: Historic environment

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7 Historic environment

7.1 Introduction

7.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on the historic environment at the Heathwall Pumping Station site. The historic environment is defined in para. 4.10.2 of the NPS as including all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and landscaped and planted or managed flora. For the purposes of this assessment, heritage assets comprise buried and above-ground archaeological remains, buildings, structures, monuments and heritage landscapes within and around the site. Effects during construction and operation are assessed with effects on buried heritage assets presented first, followed by above-ground assets.

7.1.2 Based on a review of the noise and vibration assessment (Section 9), it is concluded that there would be no significant noise or vibration effects requiring offsite mitigation to any listed building. Such effects are therefore not considered further in this assessment.

7.1.3 An assessment of effects from ground movement resulting from the Thames Tideway Tunnel itself is covered in Volume 3 Project-wide Effects. No effects are predicted on historic receptors in the vicinity of this site, therefore no assessment of ground movement effects is presented.

7.1.4 Once the proposed development is operational, scour protection around foreshore structures would prevent scour affecting heritage assets. In the deeper mid channel of the river, where contraction scour may occur, it is unlikely that archaeological remains would be present. The operational phase would not involve any activities below-ground aside from maintenance confined within the tunnel infrastructure. For these reasons, an assessment has not been undertaken of operational effects on buried assets.

7.1.5 A separate but related assessment of effects on townscape character and visual amenity is included in Section 11 Townscape and visual.

7.1.6 The assessment of the historic environment effects of the project has considered the requirements of the National Policy Statement for Waste Water (NPS). As such the assessment covers designated and non-designated assets, and a description of the significance of each heritage asset affected by the proposed development and the contribution of their setting to that significance. The assessment covers both above and below ground assets. The effect of the proposed development on the significance of heritage assets is clearly detailed in line with the requirements of the NPS. The role of the design process in helping to minimise effects on the historic environment is explained, and where appropriate, mitigation is proposed. Vol 2 Section 7 provides further details on the methodology.

7.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station Figures).

7.2 Proposed development relevant to the historic environment

7.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to historic environment are set out below.

Construction

7.2.2 All below ground works during construction are relevant to the assessment because they would potentially truncate or entirely remove any archaeological assets within the footprint of the works.

7.2.3 The establishment of the works compound would be likely to entail preliminary site stripping to reach a depth of approximately 0.5 metres below ground level (mbgl). There would be deeper localised disturbance from temporary works, assumed for the purposes of this assessment to reach a depth of 1.0m below ground level. This includes site hoarding, supported by timber posts in concrete foundations, and foundations for shotcrete production plant and a crane base. Office and welfare facilities for the construction works would be shared with the nearby Kirtling Street Thames Tideway Tunnel project site, where they would be located.

7.2.4 Minor services within the site would be relocated, removed or abandoned where they are redundant. All of these services are assumed to be less than 2m deep.

7.2.5 Demolition works would include the top section of parts of the river wall, the removal of the existing concrete culvert below the foreshore, a 2m to 3m high brick wall running from northwest to southeast from the riverside wall to Nine Elms Lane (to be reinstated), a 3m high brick vent shaft and a single storey portacabin office on concrete support blocks. The reinforced concrete roof of the existing below ground riser shaft and flap valve chamber would also be removed. The Battersea Barge ship, currently moored within the construction site boundary, would also be temporarily relocated with two new mooring piles installed (see Demolition and site clearance plan, separate volume of figures - Section 1). The existing campshed that forms the current moorings would be extended by 7.0m, which would require ground reduction of the foreshore within the extension footprint by 0.3m depth.

7.2.6 A temporary cofferdam would be built extending into the foreshore, within which the interception chamber to the existing Heathwall Pumping Station outfall and a new valve chamber would be built.

7.2.7 For structural reasons, soft material located adjacent to the perimeter of the temporary cofferdam and adjacent to the river wall would be removed.

The soft material includes silt, peat and other materials. It is assumed for the assessment that the majority of foreshore material within the temporary cofferdam would remain *in situ*. Removal of the soft material would ensure that any settlement of the cofferdam fill material would not adversely affect the ties between the walls of the twin walled temporary cofferdam leading to structural difficulties. The exact extent and depth of the foreshore deposits to be removed would be informed by geotechnical investigations. Areas of removed material would be filled with gravel similar to the existing bed material. Cofferdam fill material would then be placed onto the foreshore on top of a geotextile layer, to a total average depth of 4.9m as assumed for the purposes of this assessment. Suitable sized plant would be utilised to reduce potential load impacts on the foreshore. A piling rig, located on a jack up barge positioned on the foreshore, would be used to construct the cofferdam. The cofferdam would be tied into the existing river wall using slots prepared in the river wall (see Construction phase 1 plan, separate volume of figures - Section 1).

7.2.8 Upon removal of the temporary cofferdam, the fill and geotextile layer would be removed by suitably sized plant and the locally excavated areas on the foreshore would be reinstated with suitable material to match the pre-existing conditions. The area of the foreshore where permanent scour protection is required would be excavated to a depth of approximately 1.5m by an excavator.

7.2.9 During construction works two temporary campsheds would be built on the Thames foreshore on the northern and northeastern sides of the temporary cofferdam, to allow the transportation of materials by barge. Up to 0.3m depth of alluvial and other soft deposits would be removed from the footprint of the campshed, as assumed for the purposes of this assessment (see Construction phase 2 plan, separate volume of figures - Section 1)

7.2.10 Permanent works which would affect buried heritage assets include a combined sewer overflow (CSO) drop shaft which would be built in the eastern part of the site on the landward side of the river wall with an interception chamber to the South West Storm Relief Sewer, an underground air treatment chamber, ventilation columns and valve chamber. The Heathwall Pumping Station interception chamber would be connected to the CSO drop shaft by a bored culvert and the CSO drop shaft would be connected to the main tunnel by a short connection tunnel. A new permanent foreshore structure would be built with a new section of riverside wall. A new outfall apron would extend into the foreshore and channel to the north of this structure. All alluvial and other soft deposits would be removed from the footprint of the permanent cofferdam and outfall apron (see Site works parameter plan, separate volume of figures - Section 1). Other, minor permanent works include the planting of three London plane trees along the southern edge of the site, new railings, brick boundary wall and ramp alongside the landward side of the river wall. It is assumed for the purposes of this assessment that ground disturbance from these activities would not extend below approximately 1.0mbgl (see Proposed landscape plan, separate volume of figures - Section 1)

7.2.11 The construction activities which would give rise to effects on the historic character, appearance and setting of heritage assets are:

a. establishment of hoardings around the boundary of the construction site

b. use of cranes and other plant during construction

c. lighting of the site when required.

Code of Construction Practice

7.2.12 Measures incorporated into the *Code of Construction Practice (CoCP)* Part A (Section 12) to protect heritage assets include:

a. The requirement for the contractor to prepare a site-specific *Heritage Management Plan* (HMP), indicating how the historic environment is to be protected. This may take form of both physical protection and working practices.

b. Protective measures, such as temporary support, hoardings, barriers, screening and buffer zones around heritage assets, and archaeological mitigation areas within and adjacent to worksites.

c. Advance assessment to inform the types of plant and working methods for use where heritage assets are close to worksites, or attached to structures that form parts of worksites.

d. Care would be taken when jack-up barges; piling or borehole rigs; mechanical excavators or other plant is operating over areas of the river channel or foreshore known to be particularly archaeologically sensitive. In exceptional cases exclusion zones may apply. Safeguards may include appropriate methods for installing and operating plant, and the use of suitable foreshore protection.

e. Security procedures to prevent unauthorised access to heritage assets and archaeological investigations, and damage to or theft from them, including by the use of metal detectors.

f. Procedures in the event of the discovery of human remains.

g. Procedures under the Treasure Act Code of Conduct 1997, to address the discovery of any artefacts defined in the Treasure Act 1996.

7.2.13 The *CoCP* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

7.2.14 Site specific measures in the *CoCP* Part B (Section 12) comprise the requirement during construction for contractors to minimise the risk of impact on the known Saxon fish trap located on the foreshore outside of the northeastern corner of the site, by selecting suitable river plant and operating procedures.

7.2.15 All the measures detailed above form part of the proposed development subject to the assessment, and therefore impacts such as strike damage on heritage assets are considered unlikely to occur and are not assessed. However, site specific measures to mitigate effects on buried heritage, which would be detailed in *Site Specific Archaeological Written Scheme of Investigation (SSAWSI)*, in line with the *Overarching Archaeological*

Written Scheme of Investigation (OAWSI) (Vol 2 Appendix E.2), would be subject to the findings of field evaluation, and are therefore reported as mitigation as detailed further in para. 7.8.6.

Operation

7.2.16 The operation of the proposed development at Heathwall Pumping Station site is described in Section 3 of this volume. The particular components of importance to this topic include the design of the public realm and the design and siting of the proposed ventilation columns.

7.2.17 The operational design has been developed through close liaison with stakeholders and in response to early iterations of the environmental impact assessment, through a series of design workshops, as well as in response to other design factors, such as operational requirements. The design process has therefore helped to minimise effects on the character, appearance and setting of heritage assets. Such design decisions are 'embedded' within the proposed development which has been assessed. Alternatives to the proposed development, including design iterations, are fully detailed in Section 3 of this volume.

Historic environment design measures

7.2.18 A design in keeping with the character of the surrounding townscape has been proposed for the development of this site to minimise adverse effects on the historic character, appearance setting of heritage assets in accordance with the design principles set out in Vol 1 Appendix B. Generic design principles of relevance to the historic environment at this site include:

a. All the principles for the integration of functional components relevant to the site including those relating to materials, the use of signature designs and careful detailing because they would inform the appearance of the completed operational infrastructure at the site.

b. All the riparian and in-river structure principles relevant to the site regarding appearance and functionality.

c. The landscape principles relevant to the site relating to the quality of soft and hard landscaping, materials and public accessibility.

7.2.19 None of the site-specific design principles are relevant to the historic environment.

7.2.20 The design intent for the river wall and fencing and gate at this site are shown in the relevant figures (see design intent drawings, separate volume of figures - Section 1)

7.3 Assessment methodology

Engagement

7.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of the historic environment are presented here. Throughout the environmental impact assessment (EIA) there has been regular liaison with English Heritage and other stakeholders. Vol 15 Table 7.3.1 below summarises the comments raised by consultees and how each comment has been addressed.

Vol 15 Table 7.3.1 Historic environment – consultation response

Organisation and date	Comment	Response
English Heritage phase two consultation response (February 2012)	Need for field evaluation survey, including Saxon fish trap. Mitigation to include proactive observation and recording of associated development works; foreshore excavation; works exclusion zone around fish trap; ongoing foreshore condition monitoring for scour during construction/operation.	The *Environmental Statement* details a range of appropriate field evaluation and subsequent mitigation measures. This includes foreshore condition monitoring.
Meeting of archaeological advisors to the City of London, London Borough of Southwark and Greater London Archaeological Advisory Service at English Heritage (April 2012)	EH recommended that fish trap be dated and recorded before it is washed away by ongoing processes. Intrusive surveys would be needed and as much information as possible should be obtained as part of the evaluation programme.	Three of the timbers of the fish trap have been dated to the Saxon period. The *Environmental Statement* details a range of appropriate field evaluation and subsequent mitigation measures. This includes foreshore condition monitoring.

Baseline

7.3.2 The baseline methodology follows the methodology described in Volume 2. It should be noted that whilst most of the topics within the ES use the term 'value' to define the sensitivity of environmental receptors within the baseline, the historic environment assessment uses 'asset significance' as per the terminology used within the NPS. Distinction is made between the significance of the resource, i.e. asset significance, and the significance of the environmental effect throughout the following assessment. In terms of site-specific variations, geotechnical investigations, some of which were close to the site and archaeologically monitored, have also been incorporated in the baseline for this site.

7.3.3 Baseline conditions for above-ground and buried heritage assets are described within a 600m-radius area around the centre point of the site, which is considered through professional judgement to be most appropriate to characterise the buried potential of the site. There are occasional references to assets beyond the baseline area, for example, Battersea Park which lies approximately 900m to the west of the site, which might contribute to current understanding of the site and its environment.

7.3.4 The assessment area for the assessment of effects on the character and setting of above-ground heritage assets has been defined using professional judgement by identifying heritage assets within the Zone of Theoretical Visibility (ZTV), generated as part of the townscape and visual assessment area, whose settings have the potential to be significantly affected by the proposed development. The setting of these assets is then described in the baseline. Where appropriate this assessment area extends beyond the 600m baseline area described above. In addition, 'Views of Heritage Value' (VHV) considered important for understanding the historic character and setting of heritage assets have been identified where appropriate. These are drawn from Pimlico, Churchill Gardens and Dolphin Square conservation area appraisals or from professional judgement based on observation and understanding of historic context and architectural purpose and design. These are shown in Vol 15 Figure 7.4.2 (see separate volume of figures).

7.3.5 A site visit was carried out in March 2011 to identify assets on or adjacent to the site. The tide was very low at approximately 98.0m ATD (above Tunnel Datum). A further site visit was carried out in January 2012 to identify assets for inclusion within the assessment of effects on setting.

Construction

7.3.6 The assessment methodology for the construction phase follows that described in Vol 2. There are no site-specific variations for undertaking the construction assessment of this site.

7.3.7 In terms of physical effects on above-ground or buried heritage assets, likely significant effects could arise throughout the construction phase. Effects arising from all stages of the construction period are therefore assessed. The construction assessment area for such effects is as defined by the site boundary.

7.3.8 In terms of effects on the character and setting of above-ground heritage assets, while there would be effects throughout the construction period the peak construction phase is Site Year 2, when the shaft would be under construction and cranes would be present at the site. This has been used as the assessment year for effects on the character and setting of heritage assets. It should be noted that in some instances, the townscape and visual assessment may differ to the historic environment assessments despite the receptors being largely coincident. This is due to the different value / sensitivity that may be attributed to a receptor and also due to consideration of different factors when assessing the magnitude of change and significance of effect (the reasoning is explained in relation to each asset as appropriate).

7.3.9 The construction assessment area for the assessment of effects on the historic character and setting of above-ground heritage assets is as per the assessment area described in para. 7.3.4 above.

7.3.10 Section 7.5 details the likely significant effects arising from the construction at the Heathwall Pumping Station site. There is one other Thames Tideway Tunnel project site which could give rise to additional effects on the historic environment within the assessment area for this site: Kirtling Street. The double drive shaft of the Kirtling Street site would be 350m to the west of the CSO shaft of the Heathwall Pumping Station site. The Kirtling Street site is therefore considered in this assessment for its potential to give rise to additional effects on the historic environment, given that it is situated in the same topographical and geological environment for the prehistoric and historical periods and would have shared a similar post-medieval industrial history. There would also be intervisibility between the two sites which could give rise to likely significant effects on the setting of above ground assets.

7.3.11 Archaeological remains are a static resource, which have reached equilibrium with their environment and do not change (ie, decay or grow) unless their environment changes as a result of human or natural intervention. At this site ongoing fluvial erosion is changing the archaeological baseline within the foreshore. However, the rate of erosion is not known so the base case is assumed to be as per the baseline. Furthermore none of the schemes in the site development schedule (Vol 15 Appendix N) would affect heritage assets within the site. Whilst the baseline within the baseline area beyond the site may change as a result of any archaeological excavation and recording carried out as part of a standard program of mitigation for other developments, such information is unlikely to significantly change the current understanding of the historic environment of the site. Therefore any changes to the surrounding baseline would not affect the assessment and are not detailed further within the construction base case. Therefore none of the schemes in the site development schedule (Vol 15 Appendix N) are considered relevant to the base case for physical effects on above-ground or buried heritage assets within the site.

7.3.12 The following schemes from the site development schedule (Vol 15 Appendix N) have been considered as part of the construction base case for the assessment of effects on historic character, appearance and setting in the construction phase:

a. Embassy Gardens, land to the south of Nine Elms Lane comprising DHL Depot and 1-12 Ponton Road and 51 Nine Elms Lane (Buildings A09, A10 & A11), 15m from the site

b. United States Embassy land on the south side of Nine Elms Lane incorporating Ponton Road Building, 130m from the site

c. Riverlight, Tideway Industrial Estate, adjacent to the site (Blocks B, C, D, E & F).

7.3.13 There are several other schemes in the site development schedule (Vol 15 Appendix N) which are classified as base case but are not considered relevant due to their distance from the site, and therefore would not affect the character and appearance of the receptors.

7.3.14 None of the schemes included in the site development schedule (Vol 15 Appendix N) are predicted to have a significant physical cumulative effect on buried heritage assets within the site. This is because there are no known assets common to the Heathwall Pumping Station site and those schemes listed in the site development schedule. It is possible that a currently unknown heritage asset may continue from a neighbouring site on to the Heathwall Pumping Station site but such remains are likely to be only of low asset significance, for example, drainage ditches or flood embankments. Therefore no further assessment of cumulative effects has been undertaken for physical effects on buried heritage assets in the construction phase.

7.3.15 The following schemes from the site development schedule (Vol 15 Appendix N) have been considered as part of the cumulative assessment of effects on historic character, appearance and setting at the construction phase:

a. Nine Elms Parkside (Plots C & D), 45m from the site

b. Embassy Gardens, land to the south of Nine Elms Lane comprising DHL Depot and 1-12 Ponton Road and 51 Nine Elms Lane (Buildings A01-05, & A07), 15m from the site

7.3.16 The assessment of construction effects on the character, appearance and setting of heritage assets also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year, for example due to changes in schemes which form part of the base case or cumulative assessment. In the case of buried heritage, as described above, whilst the baseline within the baseline area beyond the site may change as a result of any archaeological excavation and recording carried out as part of a standard programme of mitigation for other developments, such information is unlikely to significantly change the current understanding of the historic environment of the site. Therefore a delay to the Thames Tideway Tunnel project, with a consequent change in other schemes which may have been developed by the time of Thames Tideway Tunnel construction, would not lead to any change in the archaeological baseline and therefore no change in the assessment of effects on these assets.

Operation

7.3.17 The assessment methodology for the operational phase follows that described in Vol 2. There are no site-specific variations for undertaking the operational assessment of this site which is based on an assessment in Year 1 of operation, when the development's full effect upon its surroundings would be evident. As with the construction assessment, it should be noted that in some instances the townscape and visual assessments may differ to the historic environment assessments of the operational phase, despite the receptors being largely coincident. This is due to the different value / sensitivity that may be attributed to a receptor and also due to consideration of different factors when assessing the magnitude of change and significance of effect (the reasoning is explained in relation to each asset as appropriate). The operational assessment area is as described in para. 7.3.4 above, with the exception that although Churchill Gardens, Dolphin Square and Pimlico conservation areas would be affected by the construction phase proposals, the operational elements would form a negligible part of their setting and there would therefore be no effects. These conservation areas are therefore not assessed in the operational assessment.

7.3.18 Section 7.6 details the likely significant effects arising from the operation of the Heathwall Pumping Station site. There is one other Thames Tideway Tunnel project site which could give rise to additional effects on the historic environment within the assessment area for this site: Kirtling Street. The Kirtling Street site is therefore considered in this assessment for its potential to give rise to additional effects on the historic environment, given that there would be intervisibility between the two sites which could give rise to likely significant effects on the setting of above ground assets.

7.3.19 The following schemes from the site development schedule (Vol 15 Appendix N) have been considered as part of the operational base case for the assessment of effects on historic character, appearance and setting in the operational phase:

a. Nine Elms Parkside (Plots A,B,C & D), 45m from the site

b. Embassy Gardens, land to the south of Nine Elms Lane comprising DHL Depot and 1-12 Ponton Road and 51 Nine Elms Lane, 15m from the site

c. United States Embassy land on the south side of Nine Elms Lane incorporating Ponton Road Building, 130m from the site

d. Riverlight, Tideway Industrial Estate, adjacent to the site (Blocks B, C, D, E & F).

7.3.20 The Riverlight Tideway Industrial Estate and Embassy Gardens developments have been considered in terms of cumulative effects.

7.3.21 The assessment of operational effects on the character, setting and appearance of heritage assets also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year, for example due to changes in schemes which form part of the base case or cumulative assessment.

Assumptions and limitations

7.3.22 The assumptions and limitations associated with this assessment are presented in Vol 2. Site-specific assumptions and limitations are detailed below.

Assumptions

7.3.23 The assessment of effects on buried heritage assets is based on the shaft and other below-ground structures being located anywhere within the zones identified on the site works parameter plan for these structures (see Site works parameter plan, separate volume of figures - Section 1). For this site the assessment is not sensitive to variations in location within these zones because the desk-based assessment has not located any buried heritage assets of high significance within the site, which would warrant preservation *in situ*.

7.3.24 A number of assumptions have been made regarding the likely depth of temporary construction works (eg, site strip, footings for plant and accommodation), based on professional knowledge of construction projects. Whilst the precise nature of construction effects on buried heritage would vary if the depths varied, the mitigation proposed to address any effects would remain as stated, as would the residual effects. These assumptions are detailed in Section 7.2.

7.3.25 Vol 2 details assumptions made regarding the predicted impact of compression of potential archaeological assets within the foreshore from temporary cofferdam fill material. For the purposes of this assessment it has been assumed that where archaeological remains within the foreshore could contain voids, and/or are made of porous/organic material (timber structures/objects such as wattle, fishtraps, and peat), the compression predicted to occur is likely to cause some damage. Where such remains could be solid, non-porous or inorganic without voids, such as metal, stone, flint or brick, the compression is generally unlikely to lead to damage.

7.3.26 The assessment of effects on above-ground assets is similarly based on the above-ground structures being located anywhere within the zones for these structures. For this site the assessment is not sensitive to variations in location within these zones because of the open character of the surrounding townscape, especially to the north and south of the site, and the lack of nearby heritage assets.

Limitations

7.3.27 A limitation of the assessment is that no intrusive archaeological investigation has been carried out on the site in the past but several investigations have been carried out in the baseline area around the site. The assessment is therefore considered to be robust and in accordance with best practice.

7.3.28 There has also been little research into the effects of compression of buried heritage assets within foreshore alluvium from fill material placed on top of such deposits. Professional judgement has been used to estimate the likely impacts on different archaeological remains within the foreshore, and the assessment is considered to be robust.

7.4 Baseline conditions

7.4.1 The following section sets out the baseline conditions for the historic environment within and around the site. Future baseline conditions (base case), which would remain as per the baseline, are also described. The section comprises seven sub-sections:

a. a description of historic environment features within the 600m radius baseline area

b. a description of statutorily designated assets within the site and baseline area. Locally designated assets and known burial grounds are included, where relevant, as described in Volume 2

c. a description of the site location, topography and geology

d. a summary of past archaeological investigation, providing an indication of how well the area is understood archaeologically

e. a chronological summary of the archaeological and historical background of the site and its environs

f. a statement of significance for buried heritage assets, including buried heritage setting, taking account of factors affecting survival

g. a statement of significance for above-ground assets within and around the site, describing the features which contribute to their significance, including historic character, appearance and setting.

Current baseline

Historic environment features

7.4.2 The historic environment features map (Vol 15 Figure 7.4.1, see separate volume of figures) shows the location of known above-ground and buried historic environment features within the baseline area, compiled from the baseline sources set out in the methodology in Vol 2. These have been allocated a unique historic environment assessment reference number (HEA 1, 2, etc), which are listed in the gazetteer in Vol 15 Appendix E.1.

7.4.3 Heritage assets whose historic character and / or settings would be affected by the proposed development are shown on Vol 15 Figure 7.4.2 (see separate volume of figures) along with Views of Heritage Value (VHV), as described in para. 7.3.4. It should be noted that the baseline for the assessment of effects on the character, appearance and setting of heritage assets, is informed by professional judgement and the ZTV, with assets described in the 'Statement of significance: above-ground heritage assets' in paras 7.4.42 to 7.4.54 of this section.

Designated assets

International and national designations

7.4.4 The site and its immediate vicinity (ie, within a 100m-radius) do not contain any internationally designated assets, or any nationally designated (statutorily protected) heritage assets, such as scheduled monuments, listed buildings, or registered parks and gardens.

Local authority designations

7.4.5 The site is located within an archaeological priority area, as defined by Wandsworth Council in recognition of the archaeological potential of the Thames floodplain. The site does not lie within or adjacent to a conservation area, and contains no locally listed buildings.

Known burial grounds

7.4.6 There are no known burial grounds within the site or adjacent to it. The former burial ground of St. George's Church lies approximately 250m to the southwest.

Site location, topography and geology

7.4.7 The site is located in the northeastern corner of the London Borough of Wandsworth and formerly lay within the parish of St. Mary Battersea in the county of Surrey.

7.4.8 The ground level of the top of the river bank on site is 103.7m ATD rising to the west to 104.8m ATD. On the foreshore, the ground slopes down towards the river from 101.7m ATD to 96.8m ATD at the edge of the foreshore at low tide.

7.4.9 The site is located on a wide area of fine-grained alluvium on the southern side of the Thames floodplain, above Shepperton floodplain gravels. It lies at the intersection of two former tributary channels of the Thames, the Battersea Channel and the River Effra (Barton, 1992)[1]. These rivers eroded the (lower) Kempton Park gravels during the latter stages of the last Ice Age (Devensian), sculpting the subsurface topography of the floodplain area.

7.4.10 The water of the Thames would have been fresh until the late prehistoric period when it became brackish and tidal due to the effects of rising relative sea levels. As river levels rose the floodplain became increasingly wet, and peat developed across former dry land surfaces as wetland environments expanded. Evidence for the timing and nature of the transition from a freshwater to estuarine environment and from dry soils to wetland are likely to be preserved in waterlogged conditions in deeper parts of the floodplain. The higher well-drained river terrace probably remained largely dry throughout the Holocene from the Mesolithic period onwards and could have been utilised as farmland from the Neolithic period.

7.4.11 The site is effectively divided into two halves, to the north of the riverside wall is the Thames channel and to the south of it on the landward side. The potential for the survival of lower older deposits is different in the two parts of the site with dredging and modern construction works having removed substantial parts of the foreshore (see para. 7.4.32).

7.4.12 A summary of the borehole results from within the site suggests that the surface of the gravel lies at 96.8–98.4m ATD (6.8–7.3m below ground level – bgl), overlain with between 3.7m and 5.4m of alluvium (the top of which lies at 100.5–102.2m ATD, or 2.0–3.3m bgl). This is in turn overlain by made ground. Any areas of higher gravels are probably due to the naturally undulating nature of the topography within the Thames floodplain, as shaped in the Late Devensian period. These levels suggest that there would be little survival of archaeological deposits in the northern part of the site, where the modern riverbed and foreshore are likely to lie below the level of the Early Holocene topography (ie, potential land surfaces during the early Mesolithic period). This topography roughly equates to the surface of Pleistocene gravel, which is recorded as lying at around 96.0m or 97.0m ATD, whereas in the northern part of the site the modern riverbed lies significantly below this, at about 94.0m ATD.

7.4.13 Over the high gravel areas, remnant prehistoric land surfaces and soils might still exist, sealed beneath the alluvium. The alluvium potentially contains plant remains throughout which imply slow accumulation of sediment and good palaeoenvironmental preservation. As sea levels rose and the Thames became wider and the floodplain wetter following the late prehistoric period, alluvial deposits accumulated, which could preserve evidence for Roman and later medieval activities. Chalk and wood, as recorded in boreholes within the upper levels of alluvium, is characteristic of a working, post-medieval foreshore environment. The site topography and geology are discussed in more detail in Vol 15 Appendix E.2.

Past archaeological investigations

7.4.14 No past archaeological investigations have been carried out within the site itself, although several have been carried out within the baseline area.

7.4.15 A series of driven timbers interpreted as part of a fish trap was recorded adjacent to the northeast edge of the site (HEA 66). Three of these timbers have been conclusively radiocarbon-dated to the (Early) Saxon period. Walkover surveys on the foreshore to the east of the site have also uncovered post-medieval remains, reflecting the commercial use of the foreshore in the vicinity in the 19th century.

7.4.16 Past investigations concentrated to the southeast of the site have revealed predominantly post-medieval remains, including a ditch, mid- to late- 19th century infilled quarry pits, 16th–17th century soil, an 18th–19th century brewery basement and a well or cess-pit. At Battersea Power Station and South Lambeth Goods Yard, 540m to the southwest of the site, investigations revealed extensive truncation by the construction of the Southwark and Vauxhall Waterworks. Battersea Waterworks Pumping Station, 430m to the southwest of the site, was once part of these waterworks and has been subject to a standing building survey.

7.4.17 The results of these investigations, along with other known sites and finds within the baseline area, are discussed by period below. Further details of past archaeological investigations carried out in the baseline area are included in Vol 15 Appendix E.3.

Archaeological and historical background of the site

7.4.18 The following section presents a chronological summary of the archaeological and historical background of the site. Further detail is included in Vol 15 Appendix E.4.

7.4.19 There are no known remains dating to the prehistoric period (700,000 BC–AD 43) within the site. The confluence area of the Thames and its tributary channels could have provided rich natural resources for prehistoric peoples and the closeness of the high ground of the terrace could have been an attractive point for settlement and occupation. Peat in low areas (below 98.7m ATD) found within the Battersea channel area 900m to the southwest of the site, represents a swampy marshland which would have been a useful area for exploitation. This peat was dated to the early Mesolithic period when the channel and other areas of low ground away from the Thames began to silt up (Morley, 2010)[2].

7.4.20 Within the main Thames channel two Mesolithic axes were recovered (HEA 13 and 14). A Neolithic axe and a flint pick were also recovered close to the present foreshore (HEA 12). This suggests possible hunting activity in the vicinity of the site. The deep alluvial deposits on which the site lies have the potential to preserve remains related to these activities. It is possible that wooden trackways may have been located on higher ground in the vicinity of the site, as found elsewhere in the Lower Thames Estuary, although it is difficult to predict the locations of such remains for the first time.

7.4.21 The Roman provincial capital of Londinium lay on the north bank of the Thames in the Roman period (AD 43–410), approximately 3.9km to the northeast of the site, whilst on the south bank a settlement existed at Southwark, 3.7km to the northeast. The nearest Roman road to the site lay 1.3km to the southeast. The only known Roman remains from the baseline area are four coins found on the foreshore which would have lain within the Thames floodplain. Two of the coins were recovered from within the site (HEA 1G), while the others were found further away to the north (HEA 77), and east (HEA 80). Following the later prehistoric period, a rise in relative sea level led to the Thames becoming brackish and tidal, which would have made the site and the dry ground immediately adjacent less suitable as a settlement area. The limited number of finds from the baseline area suggests that it was not a focus for Roman settlement, although the intertidal marshes may have been exploited for a range of typical resources.

7.4.22 During the Saxon period (AD 410-1066) land in the vicinity would not have been suitable for settlement but the marshes could have continued to be a valuable resource for food and building materials. The remains of what is interpreted as a Saxon fish trap has been observed on the foreshore (HEA 66). This consists of a group of twenty-eight wooden stakes in parallel lines and standing at an approximate height of 0.1–0.2m (Vol 15 Appendix E.5, Plate E.9), some of which lie within the site and some beyond it. Their location at the mouth of a Thames tributary would have been ideal for fishing and other fish traps might survive in this area, obscured by the foreshore silts and mud. Three of these stakes have been firmly radiocarbon dated to the Saxon period (between AD 550–670). A dyke of this period is recorded 525m to the east of the site (HEA 18) indicating that flood defences were being built to protect a settlement or nearby farmland. The closest known settlements of Saxon date are centred on Vauxhall 1.1km to the northeast, and Battersea Village 2.8km to the southwest of the site, probably centred on St. Mary's Church, which is known to have existed by the early 9th century. The site lay outside the areas of likely occupation in this period and was probably marshland, which could have been used for pasture.

7.4.23 The only known evidence dated to the later medieval period (AD 1066–1485) within the baseline area comprises a token recovered from the Thames 300m to the east of the site (HEA 81). The location of a manor house is noted by the Greater London Historic Environment Record (GLHER) 30m to the southwest of the site (HEA 8), although there are no further details related to it and there is no evidence to support any assumption that it may have been of medieval origin. Its first appearance with this name is on a map of 1874 (Vol 15 Appendix E.5, Plate E.4). No manor is recorded in the area in Domesday Book (AD 1086).

7.4.24 The marshes on which the site was situated probably began to be reclaimed with the construction of successive river banks and walls and drainage ditches, with the new fertile land being used for pasture and cultivation during this period. The site, however, probably continued to lie within open, undeveloped land between the medieval parishes of Battersea and Lambeth.

7.4.25 The remains of buildings associated with post-medieval (AD 1485–present) industries have been identified within the baseline area. Chalk and wood deposits from boreholes may be indicative of barge beds and boat yard scatters. During the site walkover survey, three structures were observed on the foreshore including the possible remains of a slipway (HEA 1D; Vol 15 Appendix E.5, Plate E.10).

7.4.26 Throughout the 16th–18th century the land within the baseline area was largely agricultural. When the Chelsea to Battersea ferry was replaced by a wooden bridge in 1771–1772, the new means of access and transport helped to stimulate the growth of industries in the area. The land in the baseline area, and more particularly in the area of the site, was developed predominantly into warehouses, wharves, mills (HEA 11) and docks, with some clusters of domestic buildings to serve the expanding labour force.

7.4.27 During the 19th century the domestic buildings were cleared and the site and the surrounding area became entirely industrial. The industrialisation culminated in the mid- to late- 19th century with the construction of the London Gas Works, the South Western Goods Depot and the Southwark and Vauxhall Water Works (HEA 17) including the Battersea Water Pumping Station (HEA 23), outside of the site. The site itself was developed and redeveloped with various industrial works buildings and commercial wharves and docks, including the whiting and lime works, surrounding an open dock where the modern former pumping station now stands.

7.4.28 Remains related to 19th century commercial docks to the east of the site were identified during the walkover surveys carried out on the foreshore, including a dock entrance 200m to the east of the site (HEA 60), at the location of the former Nine Elms Coal Wharf (Vol 15 Appendix E.5 Plate E.4). Another dock entrance was observed approximately 35m to the east opposite the former Newcastle Wharf, constructed between 1874 and 1894 (HEA 65). Two post-medieval riverfront defences, one of brick, and the other consisting of a line of vertical timber posts, were observed approximately 155m to the east of the site (HEA 62). Consolidation layers or possible barge beds (HEA 68 and HEA 72), of uncertain post-medieval date, were also noted along the foreshore to the east of the site.

7.4.29 The Heathwall Pumping Station was constructed over the in-filled, enclosed Middle Wharf Dock in the early 1960s. The former dockside buildings of Mill Pond Wharf on its west side and goods-handling structures were removed and a tank and three small buildings constructed in the eastern part of the site. The former jetty in the northwestern part was demolished. Middle Wharf, with a jetty and crane, was realigned in the northeastern corner of the site with an outfall sewer tunnel across the foreshore to the Thames from the pumping station.

Statement of significance: buried heritage assets on the site

Introduction

7.4.30 The following section discusses past impacts on the site which are likely to have compromised asset survival, generally from late 19th and 20th century developments, eg, building foundations and dock construction, which have been identified primarily from historic maps, the site walkover survey, and information on the likely depth of deposits.

7.4.31 In accordance with the National Policy Statement for Waste Water (Defra, 2012)[3], National Planning Policy Framework (DCLG, 2012)[4] and PPS5 Planning Practice Guide (DCLG, 2010)[5], (which remains extant), this is followed by a statement on the likely potential for and significance of buried heritage assets within the site, derived from current understanding of the baseline conditions, past impacts, and professional judgement.

Factors affecting survival

7.4.32 Archaeological survival potential across the site is likely to be variable. Around half of the site is on the Thames foreshore area and whilst erosion may be occurring, there is potential for surviving post-medieval and earlier remains on the foreshore. It is likely that some scouring is taking place, as the Saxon fish trap close to the northeastern edge of the site (HEA 66), identified in 2010, was not visible when the foreshore was surveyed 10 years previously, suggesting that erosion of the overlying silts has been taking place.

7.4.33 Other than fluvial erosion, factors affecting survival include:

a. Dock construction: The excavation of a dock in the centre of the site, occupying approximately 10–15% of the total site area, in the mid-19th century, will have entirely removed earlier archaeological remains from within its footprint, although the remains of the dock itself will be of some significance for evidence of industrial history. Across the rest of the site, on the landward side of the river wall, deeply buried prehistoric and palaeoenvironmental remains, beneath the made ground, might survive intact. The Heathwall Pumping Station was largely constructed over the former dock, and its associated pumps, tanks and culverts will have necessitated localised excavation for service trenches.

b. Dredging of foreshore for dock access: A channel was maintained from the main channel of the Thames into Middle Wharf Dock in the early part of the 20th century (Vol 15 Appendix E.5, Plates E.5 and E.6). There may originally have been a natural channel here extending inland to feed a mill pond to the south, but it is likely to have been locally dredged and has subsequently become infilled.

c. Industrial buildings: Historic maps from the mid 18th century show a number of buildings on the site, outside the Middle Wharf Dock footprint. These are unlikely to have had basements or piled foundations, and were probably constructed on pad or strip footings, which would have extended into made ground used to consolidate the land behind the river wall in the 18th century. These constructions would have locally truncated earlier post-medieval remains but deeper archaeological remains in the alluvium beneath the made ground probably survive intact.

d. Existing sewer infrastructure: The South Western Storm Relief Sewer extends into the southern part of the site beneath and to the east of the pumping station. The culvert continues for approximately 80m beneath the foreshore in the northern part of the site, from the river wall and into the main channel of the Thames. Bathymetric data shows that the top of the northern end of this outfall lies at approximately 95.0m ATD. The Cross Thames Foul Water Sewer enters the site from the northwest and lies to the west of the Heathwall outfall. Within the footprint of these culverts and their associated construction works all of the archaeological remains on the foreshore side of the riverside wall will have been removed. The works will have severely truncated the upper archaeological layers on the landward side, to a depth of approximately 5.0mbgl.

e. Piled jetties: The construction of a piled jetty in c. 1950 on the foreshore in the northeastern part of the site, along with piles for the present Middle Wharf jetty and an earlier jetty immediately west of it (extant between 1894 and 1947), will have locally removed archaeological remains within the footprints of the piles.

f. Existing bargebed: The foreshore in the western part of the site, the mooring station for the Middle Wharf jetty and where the Battersea Barge boat is currently located, has been consolidated with a heavy rock base, which will have disturbed the underlying deposits with compression and erosion around it.

g. Services: service trenches, for example those within Middle Wharf (former Cemex compound) at the very southeastern part of the site, are likely to have been excavated to a depth of 0.5–2.0mbgl. These will have locally removed later archaeological remains within post-medieval and modern made ground. Earlier remains are likely to survive intact below.

Asset potential and significance

7.4.34 The following statement of asset significance takes into account the levels of natural geology and the level and nature of later disturbance and truncation.

Palaeoenvironmental

7.4.35 The site has a high potential to contain palaeoenvironmental remains. It is located entirely on the alluvial floodplain and partially on the foreshore of the River Thames at the confluence of the Thames and its ancient tributaries, the Battersea Channels and the River Effra. The part of the site not affected by the excavation of a dock, deep culverts, dredging or bargebed, has a high potential to preserve palaeoenvironmental remains within deep alluvial sediments. Such remains would potentially be of low to medium significance depending on their nature and condition as derived from their evidential value.

Prehistoric

7.4.36 The site has a low potential to contain prehistoric remains. Although the site was low-lying, prone to flooding, and therefore probably unsuitable for settlement, the wetland would have provided a range of resources which may have been exploited in this period. Any surviving remains would be within and possibly beneath the alluvium, which may survive intact beneath the made ground on the landward side of the river wall (outside the footprint of the dock and deep culverts) and on the foreshore (where not removed by dredging, culverts or bargebed). The preservation of organic remains is likely to be high due to waterlogged conditions. Redeposited finds would be of low significance. In-situ riverside timber structures or the remains of boats would potentially be of high significance, if present, depending on their nature, extent and condition. This would be derived from the evidential value of the remains.

Roman

7.4.37 The site has a low potential to contain Roman remains. It lay within the Thames floodplain and was prone to flooding and would not have been a good area for settlement. Isolated artefacts and features would be of low significance, which would be derived from their evidential value.

Early medieval

7.4.38 The site has a moderate potential to contain early medieval remains. It lay within the Thames floodplain and would have been prone to frequent flooding throughout this period, and thus unlikely to have been settled. The main potential is for remains of Saxon fish traps, such as the one noted on the site visit walkover survey, close to the northeast of the site (HEA 66). The location of the site at the mouth of a major Thames tributary, the Battersea Channel, would have made it ideal for fishing and other fish traps may survive in this area within the foreshore silts and mud. The presence of a nearby Saxon dyke suggests early attempts had also been made to reclaim the marshes at some locations. Saxon fish traps, if present, would be of high asset significance, depending on their state of preservation. Evidence of Saxon reclamation would be of low to medium significance depending on the nature and extent of the remains. The significance would be derived from the potential evidential and historical value.

The setting of buried Saxon fish trap remains

7.4.39 The known Early Saxon timber fish trap at the northeastern edge of the site is not designated (ie, a scheduled monument) but is considered to be an asset of high significance. Its current setting on the foreshore of the Thames, at the mouth of the now-infilled Battersea Channel, contributes to its significance in having the potential to supply evidence of topography, land use and historic river levels in this period. Parts of the timbers may be seen from the Thames Path and the foreshore at low tides and its setting also contributes to how the asset is currently experienced. Saxon fish traps are fairly rare and six were known on the foreshore of the Thames in the central London area in 2008. They were often constructed within the mouths of the Thames tributaries to exploit tidal ebb and flow. This is the common topographic setting for the Heathwall example and for other fish trap locations on the Chelsea and Barn Elms foreshores, also within confluences of the Thames and its former tributaries. In the latter two examples pairs of fish traps were found fairly close together. The setting makes considerable contribution to the significance of the asset, and is also of high significance.

Later medieval

7.4.40 The site has a low potential to contain later medieval remains. Towards the end of this period the marshland probably began to be reclaimed to be used as agricultural land. It is possible that reclamation river banks and walls and drainage channels may survive and the waterlogged conditions of the majority of the site may have the potential to preserve timber structures, although past impacts from the construction of a 19th century dock and 20th century sewage tunnels will probably have locally removed such remains. Remains of reclamation and flood defence would be of low significance. This would be derived from the evidential and historical value of such remains.

Post-medieval

7.4.41 The site has a high potential to contain post-medieval remains. The site and its immediate surroundings developed into an area of concentrated industrial activity from the 18th century onwards. This is reflected in the available borehole information which showed the presence of inclusions which may have represented evidence for barge beds and boat yard scatters. The site has potential to contain footings of various industrial buildings, an infilled dock and related structures, with the remains of barge beds on the foreshore. The remains of docks and industrial buildings would be of low significance, which would be derived from the evidential and historical value of such remains.

Statement of significance: above-ground heritage assets

Introduction

7.4.42 In accordance with the National Policy Statement for Waste Water and the associated guidance, the following section provides a statement of the likely significance of built heritage assets based on professional and expert judgement. The significance of assets is a reflection of their value or importance, derived from their perceived historical, evidential, aesthetic and communal value. These terms are defined in Vol 2.

7.4.43 It also describes the significance, historic character and setting of conservation areas and settings of listed buildings within the construction and operational Zones of Theoretical Visibility (ZTV) where their historic character, appearance and settings may be affected by the proposed development. Such assets are shown in Vol 15 Figure 7.4.2 (see separate volume of figures). This figure also shows the construction and operational ZTVs and Views of Heritage Value (VHV) which illustrate important views to and from heritage assets. There are no other heritage assets in the assessment area whose settings would be significantly adversely affected by the proposed development.

Within the site

7.4.44 The stretch of riverside wall within the site possibly dates to the 19th century, although there appear to be various phases of construction, and the section in front of the former Middle Wharf Dock dates to the mid 20th century. Overall it is an asset of medium heritage significance, derived from its evidential and historical value and its association with the industrial past of the area.

7.4.45 There is a small public garden beside the riverfront (HEA 1F) in the eastern part of the site. It is separated from the site by a high, foliage-covered brick wall (Vol 15 Appendix E.5, Plate E.14). The wall is probably the western boundary wall of an area of industrial buildings first shown in the late 19th century. It is an asset of low heritage significance, derived from its evidential, historical, and communal value.

7.4.46 The site is occupied by the 1960s Heathwall Pumping Station (Vol 15 Appendix E.5, Plate E.11), with an open yard and concrete surface to the east, known as Middle Wharf (Vol 15 Appendix E.5, Plate E.12). The pumping station building and its infrastructure (including existing culverts and outfall aprons), along with a group of cabins on brick supports to the east of the pumping station building wall, between the pumping station compound and the Cemex compound structures, are not more than 40 years old and are of negligible heritage significance and are not considered further in the assessment.

7.4.47 The northern boundary of the site extends on to the foreshore and includes storm outlet pipes and associated timber and concrete jetty structures projecting from the shore into the river (HEA 1H, Vol 15 Appendix E.5, Plate E.13). These are topped by a service walkway and former crane platform. Two concrete columns are present to the west of the outlet, from an earlier, but recent structure. These structures have negligible significance as heritage assets and are not considered further in the assessment.

Within the assessment area

7.4.48 The following section describes heritage assets within the construction and operational Zones of Theoretical Visibility where historic character, appearance and setting may be affected by the proposed development. Such assets – namely the former Tide Mill Dock, the Grade II* Battersea Power Station, Churchill Gardens Conservation Area, Dolphin Square Conservation Area and Pimlico Conservation Area - are considered to fall within the assessment area, and are shown in Vol 15 Figure 7.4.2 (see separate volume of figures). There are no other heritage assets within the assessment area whose historic character, appearance or setting would be adversely affected by the proposed development.

River frontage and former Tide Mill Dock

7.4.49 The area around the site remained relatively undeveloped apart from by small river docks and timber yards until the mid-19th century. Industrialisation and the need for housing led to the area around the site being occupied by paint works, gasometers, retort houses, docks and water pumping stations, set side by side with 19th century terraced housing. The last great industrial building in the area, and the most prominent is Battersea Power Station, built in 1929–1935 (HEA 22). Very little else of this 19th/early 20th century industrial and residential landscape survives within the immediate environs of the site.

7.4.50 The existing riverfront partly retains its 19th century shape. To the immediate west of the site is the former Tide Mill Dock (sometimes also called Nine Elms Dock) (HEA 73), and the Canada or Imperial Wharf alongside it. Tide Mill Dock served as the entrance to a canal that ran under Tide Mill Pond Bridge to the south. This former entrance has been blocked and the surviving brick-built river walls in this area and the former Tide Mill Dock are remnants of the area’s industrial past. These riverside walls and docks are still currently used by a small river-boat community. The value of these features as heritage assets can therefore be expressed in terms of evidential value and communal value, as there remains a relationship between the current residents and the few surviving remnants of their industrial and historic surroundings. The surviving brick-built river walls and the former Tide Mill Dock are considered to be of low to medium asset significance.

Battersea Power Station

7.4.51 The proposed development lies east of the Grade II* Listed Battersea Power Station (HEA 22), a structure of high asset significance. The structure, with its four distinctive chimneys, is a prominent heritage asset visible from many different points along the River Thames, including far-reaching views westwards from Vauxhall Bridge and southwards from the Churchill Gardens Conservation Area and Dolphin Square Conservation Area on the north bank of the river, and from Chelsea Bridge to the west. It is screened from the Grade II Registered Battersea Park to the west by the presence of intervening modern residential development. Its setting is therefore defined largely by its position on the river frontage, which strongly contributes to its significance. The nearer setting of the power station, other than its relationship with the river and the railway viaducts, makes little contribution to its significance as the majority of buildings which once surrounded and served the station are now lost. The site makes a negligible contribution to the setting of the power station when viewed from the river (see Vol 15 Plate 7.4.1 and Vol 15 Plate 7.4.2).

Vol 15 Plate 7.4.1 Historic environment – View west from Vauxhall Bridge towards the Heathwall Pumping Station development site, with the Battersea Power Station in the distance

Vol 15 Plate 7.4.2 Historic environment – view to west from the Thames path towards Battersea Power Station.

Churchill Gardens Conservation Area

7.4.52 The proposed development lies 100m from the Churchill Gardens Conservation Area – a heritage asset of high significance - on the opposite bank of the River Thames. The river frontage is characterised by a number of Grade II listed buildings aligned along Grosvenor Road including Nos 105-109 Grosvenor Road and the Churchill Gardens Estate which is noted for the scale and modernity of its architecture as well as its landscape setting and riverside frontage, forming a prominent and visible landmark from across the River Thames. There are far-reaching views out of the conservation area from the river frontage towards the site and the Battersea Power Station. However, views to and from the listed buildings are limited by the intervening presence of mature London plane trees that line the embankment. The trees provide strong uniformity to the southern edge of the estate and continue the characteristic riverside planting throughout the city. The setting of the conservation area (including the river) contributes to its high significance. The contribution of the site to this setting is, however negligible due to the distance, intervening trees and buildings and the fact that it is peripheral to more significant views, such as that towards Battersea Power station (see Vol 15 Plate 7.4.3 and Views of Heritage Value 2 & 3 (Vol 15 Figure 7.4.2, see separate volume of figures).

Vol 15 Plate 7.4.3 Historic environment – view to south towards the site from Churchill Gardens Conservation Area

Dolphin Square Conservation Area

7.4.53 The proposed development site lies 175m from the Dolphin Square Conservation Area – a heritage asset of high significance - on the opposite bank of the River Thames. The most striking aspect of the character of the Dolphin Square complex is its monumental scale which dominates its immediate surroundings and is a highly visible landmark on this part of the Thames. However, views from the Dolphin Square Conservation Area are restricted by further development on the north side of Grosvenor Road. There are no listed buildings in the Dolphin Square Conservation Area. The river frontage makes a moderate contribution to the setting of the conservation area.

Pimlico Conservation Area

7.4.54 The river frontage of the Pimlico Conservation Area – a heritage asset of high significance - adjacent to St George Square lies approximately 150m to the northeast of the site. It is largely characterised by modern residential dwellings and mature trees, and there are far-reaching views along the River Thames towards the site. St George Square, which lies adjacent to the river frontage, is characterised by substantial Victorian terraces and green squares with mature trees and planting, which limits views to and from this part of the Pimlico Conservation Area. The river frontage makes a moderate contribution to the setting of the conservation area (see Vol 15 Plate 7.4.4. and View of Heritage Value 1 and Vol 15 Figure 7.4.2, separate volume of figures).

Vol 15 Plate 7.4.4 Historic environment – view looking southwest from Pimlico Conservation Area towards the southern bank of the River Thames and Battersea Power Station in the distance

Construction base case

7.4.55 As detailed in para. 7.3.11, whilst ongoing fluvial erosion is changing the archaeological baseline within the foreshore, since the rate of erosion is not known the base case for the foreshore is assumed to be as per the baseline for the purposes of the assessment.

7.4.56 As described in para. 7.3.11, no developments identified within the site development schedule would lead to any loss of or change in the buried or above-ground assets within the site. The base case for the assessment of construction effects on buried and above-ground heritage assets within the site is therefore the same as at present.

7.4.57 In terms of the base case in Site Year 2 of construction, the schemes detailed in para 7.3.12 and 7.3.13 would result in a change to the baseline, increasing the extent, scale and form of residential development along this part of the River Thames. However, distant views to the Battersea Power Station from the opposite side of the River Thames would not be affected. The power station structure would retain its prominence on the river frontage. Furthermore, there would be no change to the historic character of the conservation areas. Therefore, the base case for the construction phase would remain the same as the baseline.

Operational base case

7.4.58 The base case for Year 1 of operation includes the schemes from the site development schedule (Vol 15 Appendix N) as described in para. 7.3.19.

Whilst these would increase the extent, scale and form of development along this part of the River Thames, distant views to Battersea Power Station from the opposite side of the River Thames would not be affected, with the power station structure retaining its prominence on the river frontage. Furthermore, there would be no change to the historic character of the conservation areas. Therefore, the base case for the operation phase would remain as per the baseline.

7.5 Construction effects assessment

Buried heritage assets

7.5.1 Effects of construction works are described in the following section in the sequence in which they would occur, with the individual impacts from each phase described. The effects on heritage assets are summarised in Section 7.10, by chronological period.

7.5.2 The archaeological impact of the two neighbouring sites at Kirtling Street and Heathwall Pumping Station would have effects on a very similar range of archaeological receptors. Although they would result in multiple effects on archaeological remains, the impacts at the two sites would either affect specific remains contained within them or constitute a very small impact on more diffuse landscape features, such as the palaeochannels and eyots of the prehistoric period or 18th and 19th century industrial developments. The effects from both sites are reflected in the assessment below.

Site setup

7.5.3 Site set-up, including preliminary demolition works, diversion of services and the establishment of the site compound, would have a localised impact on any surviving late 19th or possibly 18th century remains of low asset significance within the made ground. This would locally reduce the significance of such assets to negligible. This low magnitude of impact would result in a **minor adverse** effect.

Construction of cofferdam, scour protection, outfall apron and campsheds

7.5.4 Multi-period archaeological remains are potentially located within the foreshore alluvium and possibly cut into the underlying gravels. Within the area of the temporary cofferdam, soft material (ie alluvium) would be excavated down to the gravels adjacent to the perimeter of the temporary cofferdam and existing river wall (see assumptions in para. 7.3.25), whilst foreshore deposits would be entirely removed from within the permanent cofferdam footprint and proposed outfall apron. This would constitute a high magnitude of impact on any archaeological remains within and beneath the foreshore deposits.

7.5.5 The movement of small plant machinery used to lay the geotextile layer across the cofferdam footprints prior to infilling, and used to remove the geotextile layer subsequently, would have an impact upon any archaeological remains on the surface of the foreshore and within the upper part of the alluvium, within the temporary cofferdam footprint, through rutting and compaction, resulting in a localised high magnitude of impact.

7.5.6 The placement of temporary cofferdam fill material is predicted to have a high magnitude of impact. This would arise from the compression of any remaining buried heritage assets within the foreshore alluvium and gravels where such remains are hollow (e.g. pottery vessels, hulked boats), and/or are made of porous/organic material (timber structures/objects such as wattle, fishtraps, and peat). Where remains are solid, non-porous or inorganic without voids, such as metal, stone, flint or brick, there is unlikely to be an impact.

7.5.7 A jack-up barge would be used to insert the sheet pile walls. This would have a localised impact on any buried heritage assets within the footprint of its supports. Within the area of the campshed, foreshore deposits would be removed to an approximate depth of 0.3m, as assumed for the purposes of this assessment. Excavation to a depth of 1.5m within the footprint of permanent scour protection would remove any surviving buried heritage assets within the foreshore alluvium to this depth. These works would have a high magnitude of impact.

7.5.8 As discussed in para. 7.4.33, archaeological survival across much of the area of the proposed works is likely to be low due to dredging and disturbance from the existing culverts. Where archaeological remains survive intact, these activities would constitute a high magnitude of impact, reducing the significance of affected assets to negligible. The environmental effect would vary depending upon the heritage significance of the assets removed or compressed:

a. There is a high potential for palaeoenvironmental remains of low to medium asset significance. Removal of such remains within and around the footprint of the temporary cofferdam and campshed would result in a **minor adverse** effect.

b. There is overall a low potential for isolated prehistoric remains of low asset significance. The removal would comprise a **minor adverse** effect.

c. There is a low potential for evidence of prehistoric riverside activity (timber structures/boats), potentially of high asset significance. The removal would constitute a **major adverse** effect.

d. There is a low potential for isolated Roman remains of low asset significance. The removal of such remains would constitute a **minor adverse** effect.

e. There is a moderate potential for early medieval fish traps. Survival potential for such remains in the northeastern part of the site, near to where the known fish trap has been identified, is expected to be higher than across other parts of the foreshore. Remains of other fish traps, if present, would be of high asset significance. The removal of such remains would result in a **major adverse** effect. In terms of the setting of the known fish trap (high significance), whilst other associated unknown fish traps may be removed, the proposed development would not change its physical context on the foreshore, or its spatial relationship with the Battersea Channel, or the way that it is currently experienced. The magnitude of change would be low, and would result in a **minor adverse** effect.

f. There is a low potential for later medieval remains associated with land reclamation, of low asset significance. The removal of such remains would result in a **minor adverse** effect.

g. There is a high potential for post-medieval remains on the foreshore comprising barge beds, wharves and jetties. These would be of low asset significance. The removal of such remains would result in **moderate adverse** effect.

7.5.9 The known saxon fish trap lies across the eastern extent of the LLAU. Although no works are proposed where it is located, fragile remains such as this could be at risk from increased river traffic. However, measures are included within the CoCP Part B (Section 11) to ensure that contractors minimise the risk of impact by selecting suitable river plant and operating procedures. Therefore a **negligible** effect is predicted.

Scour around riverside structures

7.5.10 Scour around the temporary cofferdam and campsheds could have an impact upon any archaeological remains in the vicinity. The significance of any assets affected could be reduced to negligible, which would constitute a high magnitude of impact for these assets. The significance of effect on heritage assets would be as that of the cofferdam described in para. 7.5.8 above.

Construction of the CSO drop shaft, culverts and chambers

7.5.11 Permanent works include the CSO drop shaft, interception chamber, valve chamber, air treatment chamber and culvert on the landward side of the river wall, which would remove any archaeological remains within their footprints. The significance of affected assets would be reduced to negligible, constituting a high magnitude of impact for these assets. The significance of effect on heritage assets would be as that of the cofferdam described in para. 7.5.8 bullets a to f above, with the exception of the impact upon post-medieval remains on the foreshore (bullet g). Such assets would not be affected; however, there would be an impact on post-medieval remains on the landward side of the river wall of low asset significance, including 18th and 19th century river frontages, buried remains of Middle Wharf Dock, wharves, warehouses and industrial buildings. Their removal would result in a **moderate adverse** effect.

7.5.12 The connection tunnel between the CSO drop shaft and the main tunnel and the connection culvert from the Heathwall Pumping Station interception chamber to the CSO drop shaft would have no impact on archaeological remains as they would be bored beneath the existing foreshore and river bed at a level too deep to have any resulting archaeological effect.

Other permanent works

7.5.13 Construction of other permanent works (including planting, railings, construction of the boundary wall and ramp) would have a localised impact on any surviving late 19th and possibly 18th century remains of low asset significance within the made ground. This would locally reduce the significance of such assets to negligible. This low magnitude of impact would result in a **minor adverse** effect.

Above-ground heritage assets

7.5.14 The NPS recognises in para. 1.4.4 that nationally significant infrastructure projects are likely to take place in mature urban environments, with adverse construction effects on historic environment receptors likely to arise. Construction works similar to those proposed are commonplace in London, and therefore the following assessment should be viewed in this context. It should also be noted that construction effects are temporary in nature and, as assessed, relate to the peak construction phase. Effects during other phases of works are likely to be lower due to reduced levels of plant being required and a reduced intensity of construction activity.

Effects on historic character and setting of above-ground heritage assets

The river frontage and former Tide Mill Dock

7.5.15 There would be no effect on the setting of the earlier, 19th century, stretches of the river wall (medium significance), nor on the late 19th century wall that separates the public garden with the pumping station in the centre of the site (low asset significance).

Battersea Power Station

7.5.16 Due to its prominence on the River Thames, the construction works would detract from some views to Battersea Power Station, which form part of its setting, from the east, south and west. However, the height and scale of Battersea Power Station serves to reduce the effect of visual intrusions. The site would be peripheral to or absent from many important views of the building. Also the site and its environs were historically largely industrial in character and the construction works would to an extent be in keeping with the historic character of the vicinity and the setting of the power station. The magnitude of change to setting would therefore be low, resulting in a **minor adverse** effect.

Churchill Gardens Conservation Area

7.5.17 The construction works would be visible within views across the River Thames from the river frontage of the Churchill Gardens Conservation Area. However, views from the listed buildings aligned along the north side of Grosvenor Road alongside the river frontage would not be adversely affected due to the intervening presence of mature vegetation. It is also the case that the more significant views from the river frontage of the Conservation Area are up and downstream, rather than directly towards the site, and the site would be peripheral in these views. Also the site and its environs were historically largely industrial in character and the construction works would to an extent be in keeping with the historic character of the vicinity and the setting of the conservation area. The magnitude of change to the setting of Churchill Gardens Conservation

Area would be low, resulting in a **minor adverse** effect. The effect would be temporary, limited to the construction phase.

7.5.18 The separate townscape and visual assessment (Section 11) concludes that the works would have a moderate adverse effect upon the Pimlico Residential townscape character area (which includes the Churchill Gardens, Dolphin Square and Pimlico conservation areas). The difference between the two assessments derives from their different methodologies: the historic environment assessment considers the effect of the change to setting upon the heritage value of the conservation area as a whole, of which only a part is affected by the proposals; whereas the townscape assessment considers the effect upon the riverside setting of the townscape character area, and includes non-heritage factors.

Dolphin Square Conservation Area

7.5.19 The presence of construction works on the opposite bank of the River Thames would detract slightly from broad views from the river frontage of the Dolphin Square Conservation Area. However, the construction works would not detract from direct views towards the Battersea Power Station and upstream, which are more significant than the views directly across the river. Also the site and its environs were historically largely industrial in character and the construction works would to an extent be in keeping with the historic character of the vicinity and the setting of the conservation area. The magnitude of change to the setting of Dolphin Square Conservation Area would therefore be low, resulting in a **minor adverse** effect.

7.5.20 There are differences between the assessment of effects on this conservation area from a historic environment perspective, as compared to the assessment of effects on townscape character, as assessed in Section 11. The reasons for this are as detailed in para. 7.5.18 above.

Setting of Pimlico Conservation Area

7.5.21 The presence of construction works on the opposite bank of the River Thames would detract slightly from broad views from the river frontage of the Pimlico Conservation Area. However, the construction works would not detract from significant views towards Battersea Power Station or those downstream. There are no significant views directly to the site. Also the site and its environs were historically largely industrial in character and the construction works would to an extent be in keeping with the historic character of the vicinity and the setting of the conservation area. The magnitude of change to the setting of Pimlico Conservation Area would therefore be low, resulting in a **minor adverse** effect. The effect would be temporary, limited to the construction phase.

7.5.22 There are differences between the assessment of effects on this conservation area from a historic environment perspective, as compared to the assessment of effects on townscape character, as assessed in Section 11. The reasons for this are as detailed in para. 7.5.18 above.

Sensitivity test for programme delay

7.5.23 A delay to the Thames Tideway Tunnel project of approximately one year would mean that a greater proportion of the developments identified in Vol 15 Appendix N would be complete. This would not be likely to materially change the assessment findings reported above.

7.6 Operational effects assessment

Effects on the historic character and setting of above-ground heritage assets

Setting of Battersea Power Station

7.6.1 The two Thames Tideway Tunnel sites would feature in views towards the power station, which form part of its setting, from the east, south and west. Given the limited scale of the operational development at Heathwall Pumping Station and Kirtling Street, the sites would form a minor part of such views. The magnitude of change to the setting of Battersea Power Station would therefore be negligible, resulting in a **minor adverse** effect.

7.6.2 The separate townscape and visual assessment (Section 11) concludes that the works would have a minor beneficial effect upon the Battersea Industrial area. The difference between the two assessments derives from their different methodologies: the historic environment assessment considers the effect of the change to setting upon the heritage value of the listed building; whereas the townscape and visual assessment considers the effect upon the townscape character of the industrial area which includes non-heritage factors.

Sensitivity test for programme delay

7.6.3 A delay to the Thames Tideway Tunnel project of approximately one year would mean all the developments identified in Vol 15 Appendix N would be complete. This would not materially change the assessment findings reported above.

7.7 Cumulative effects assessment

Construction

7.7.1 As described in para. 7.3.14, the developments listed in the site development schedule (Vol 15 Appendix N) would not result in any cumulative effects on buried heritage assets within the site.

7.7.2 In terms of the assessment of effects on the character, appearance and setting of above ground heritage assets, the Nine Elms Parkside and the Embassy Gardens developments have been considered. These would be likely to give rise to adverse effects on the setting of Battersea Power Station and on views from the conservation areas on the opposite bank of the River Thames. The Thames Tideway Tunnel construction works would be visible among these schemes. There would be no elevated cumulative effects, as the site and its environs play a small part in the settings of the receptors assessed and the works would not significantly add to the level of change produced by the other schemes. Also the site and its environs were historically largely industrial in character and the construction works from the developments would to an extent be in keeping with the historic character of the vicinity and its role in the settings of Battersea Power Station and Churchill Gardens, Dolphin Square and Pimlico Conservation Areas.

Operation

7.7.3 The Riverlight Tideway Industrial Estate and Embassy Gardens developments would largely dominate the Thames Tideway Tunnel site and the setting of Battersea Power Station to the west and would largely alter the character of the area to the east of the Power Station. By comparison the Thames Tideway Tunnel development would form a very minor element in the new townscape and would play a limited role in the setting of the Power station. There would therefore be no elevated cumulative effects arising from the operational Thames Tideway Tunnel scheme during operation.

Sensitivity test for programme delay

7.7.4 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, a greater proportion of the schemes listed above would be built and occupied with a corresponding reduced level of cumulative construction activity. However, this would not materially change the assessment presented above.

7.8 Mitigation

7.8.1 As per the NPS, (para 4.10.19), a documentary record of a heritage asset is not as valuable as retaining the heritage asset, and it should not be a factor in the decision as to whether or not development consent is given. Nevertheless, it is the most appropriate form of mitigation available and in EIA terms serves to reduce the significance of the adverse effect, as has been agreed with English Heritage.

Buried heritage assets

7.8.2 Based on this assessment, no heritage assets of high significance are anticipated that would merit a mitigation strategy of permanent preservation *in situ*. It is therefore considered that the minor to major environmental effects of the proposed development could be successfully mitigated by a suitable programme of archaeological investigation before or during construction, to achieve preservation by record, through advancing understanding of asset significance.

7.8.3 Mitigation requirements would be informed by selective site-based assessment. This could include a variety of techniques, such as geotechnical investigation, geoarchaeological deposit modelling, archaeological test pits, foreshore walkover survey and monitoring and trial trenches. This evaluation would enable a more targeted and precise mitigation strategy to be developed for the site in advance of construction. Both evaluation and mitigation would be carried out in accordance with a scope of works *(Site Specific Archaeological Written Scheme of Investigation (SSAWSI)*, as detailed in para. 7.8.6 below.

7.8.4 Subject to the findings of any subsequent field evaluation in advance of construction, mitigation of the adverse effects upon archaeological remains within the site is likely to include the following:

a. An archaeological watching brief during site preparation and construction to mitigate impacts arising from service diversions and site establishment on the landward side of the existing river wall.

b. Archaeological survey and excavation of the foreshore, within and around the footprints of the proposed cofferdam, in order to mitigate the effects on the river side of the existing riverside wall. The precise approach to survey and excavation would depend on the detailed construction methodology.

c. Due to the depth of alluvium on the site, mitigation of the impacts of deeper proposed excavations (ie, CSO drop shaft, interception chamber, valve chamber; air treatment chamber and culvert) landward of the riverside wall would only become feasible following the insertion of the perimeter walls and shaft segments of each structure. Targeted archaeological investigation would proceed as the ground within the perimeter walls and shaft is excavated downwards.

7.8.5 A similar programme of physical data collection would be carried out at the Kirtling Street site. It may be appropriate to then combine dissemination of the results from the two sites.

7.8.6 Both evaluation and mitigation would be carried out in accordance with a scope of works *(Site Specific Archaeological Written Scheme of Investigation (SSAWSI))*, based on the principles in the *Overarching Archaeological Written Scheme of Investigation (OAWSI)*, to ensure that the scope and method of fieldwork are appropriate. The *SSAWSI* would be submitted in accordance with the application for development consent (the ‘application’) requirement.

7.8.7 Construction phase scour around the temporary cofferdam and campsheds would be mitigated through a programme of monitoring and the provision of scour protection if required, as detailed in the *CoCP* Part A (Section 12).

Above-ground heritage assets

7.8.8 All measures embedded in the proposed development and *CoCP* of relevance to the assessment of effects on the character and setting of above-ground heritage assets during construction are summarised above in Section 7.2. Since no significant adverse effects on the historic character, appearance and setting of above-ground heritage assets during construction or operation have been predicted (all effects are minor advers), no further mitigation is required.

7.9 Residual effects assessment

Construction effects

7.9.1 With the mitigation described above in place, the residual construction effects on buried and above-ground heritage assets would be **negligible**. All residual effects are presented in Section 7.10.

7.9.2 As no mitigation measures are required for effects on the character and setting of above-ground heritage assets, the residual construction effects on the setting of heritage assets remain as described in Section 7.5. All residual effects are presented in Section 7.10.

Operational effects

7.9.3 As no mitigation measures are required for effects on the character and setting of above-ground heritage assets, the residual operational effects on the setting of heritage assets remain as described in Section 7.6. All residual effects are presented in Section 7.10.

7.10 Assessment summary

Vol 15 Table 7.10.1 Historic environment – summary of construction assessment

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
Buried heritage assets				
High potential for palaeoenvironmental remains within alluvium and on foreshore (Low to medium asset significance)	Assets affected by the construction of cofferdam, outfall apron, scour protection and campsheds Assets removed by scour around temporary cofferdam and campshed Assets removed by the construction of the CSO drop shaft, culverts and chambers Asset significance reduced locally to negligible	Minor adverse	Foreshore evaluation and survey; environmental sampling during archaeological investigations; scour protection measures	Negligible
Low potential for isolated prehistoric finds (Low asset significance)	Assets affected by the construction of cofferdam, outfall apron, scour protection and campsheds Assets removed by scour around temporary cofferdam and campshed Assets removed by the construction of the CSO drop shaft, culverts and chambers	Minor adverse	Foreshore evaluation and survey; environmental sampling during archaeological investigations; scour protection measures	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
	Asset significance reduced locally to negligible.			
Low potential for prehistoric riverside activity eg, timber structures and boats (High asset significance)	Assets affected by the construction of cofferdam, outfall apron, scour protection and campsheds Assets removed by scour around temporary cofferdam and campshed Assets removed by the construction of the CSO drop shaft, culverts and chambers Asset significance reduced locally to negligible	Major adverse	Foreshore evaluation and survey; environmental sampling during archaeological investigations; scour protection measures	Negligible
Low potential for isolated Roman remains (Low asset significance)	Assets affected by the construction of cofferdam, outfall apron, scour protection and campsheds Assets removed by scour around temporary cofferdam and campshed Assets removed by the construction of the CSO drop shaft, culverts and chambers Asset significance reduced locally to negligible	Minor adverse	Foreshore evaluation and survey; environmental sampling during archaeological investigations; scour protection measures	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
Moderate potential for early medieval (Saxon) fish traps. (High asset significance)	Assets affected by the construction of cofferdam, outfall apron, scour protection and campsheds Assets removed by scour around temporary cofferdam and campsheds Assets removed by the construction of the CSO drop shaft, culverts and chambers Asset significance reduced locally to negligible	Major adverse	Foreshore evaluation and survey; environmental sampling during archaeological investigations; scour protection measures	Negligible
	Effect on buried heritage setting of the known Saxon fish trap from construction of temporary and permanent cofferdam, outfall apron and campsheds; scour around temporary cofferdam and campshed. Asset significance reduced locally to negligible	Minor adverse	Foreshore evaluation and survey; environmental sampling during archaeological investigations; scour protection measures	Negligible
Known saxon fish to east of site (High asset significance)	Although no works are proposed in this location, fragile remains could be at risk from increased river traffic. Risks would be minimised through measures in the	Negligible	None	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
	CoCP.			
Low potential for later medieval remains associated with land reclamation. (Low to medium asset significance)	Assets affected by the construction of cofferdam, outfall apron, scour protection and campsheds Assets removed by scour around temporary cofferdam and campshed Assets removed by the construction of the CSO drop shaft, culverts and chambers Asset significance reduced locally to negligible	Minor adverse	Foreshore evaluation and survey; environmental sampling during archaeological investigations; scour protection measures	Negligible
High potential for buried 18th and 19th century remains, including the barge beds, wharves and jetties on the foreshore. (Low asset significance)	Assets affected by the construction of cofferdam, outfall apron, scour protection and campsheds Assets removed by scour around temporary cofferdam and campshed Assets removed by the construction of the CSO drop shaft, culverts and chambers Asset significance reduced locally to negligible	Moderate adverse	Foreshore evaluation and survey; environmental sampling during archaeological investigations; scour protection measures.	Negligible
High potential for buried 18th and 19th century	Assets removed by construction of the CSO drop	Moderate adverse	Environmental sampling during archaeological investigations	Negligible

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
remains, including the footings of industrial buildings and yards and an infilled dock on the landward side of the river wall. (Low asset significance)	shaft, culverts and chambers Asset significance reduced locally to negligible			
	Assets removed by site setup and minor permanent works	Minor adverse	Environmental sampling during archaeological investigations	Negligible
Above-ground heritage assets				
River frontage and former Tide Mill Dock, including river wall (medium significance) and public garden (low significance).	No effect on the setting of the earlier, 19th century, stretches of the river wall, nor on the late 19th century wall that separates the public garden with the pumping station in the centre of the site.	No effect	None	No effect
Battersea Power Station (High asset significance)	The presence of the Kirtling Street site and Heathwall Pumping Station site construction works within significant views would have an additional effect on the setting of Battersea Power Station, reduced in magnitude to a low level due to the scale and mass of the structure and the role played by the sites in the significance of the building.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and environmental design principles	Minor adverse

Receptor (Heritage asset)	Effect	Significance of effect	Mitigation	Significance of residual effect
Churchill Gardens Conservation Area (High asset significance)	Construction works would detract slightly in views out from the conservation area.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and environmental design principles	Minor adverse
Dolphin Square Conservation Area (High asset significance)	Construction works would detract slightly in views out from the conservation area.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and environmental design principles	Minor adverse
Pimlico Conservation Area (High asset significance)	Construction works would detract slightly in views out from the conservation area.	Minor adverse	No mitigation required further to that embodied within the proposed design and the *CoCP* and environmental design principles	Minor adverse

Vol 15 Table 7.10.2 Historic environment – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Battersea Power Station (High asset significance)	The limited scale of the development would lead to a negligible magnitude of change to the setting of Battersea Power Station	Minor adverse	No mitigation required further to that embodied within the proposed design and environmental design principles	Minor adverse

References

[1] Barton, N. *The Lost Rivers Of London*. Historical Publications, London (1992).

[2] Morley, MW. '*The Battersea Channel: A Former Course of the River Thames?*' in London Archaeologist 12, 188-194, (Winter 2009/2010).

[3] Department of Environment, Food and Rural Affairs. *National Policy Statement for Waste Water (*2012)

[4] Communities and Local Government. *National Planning Policy Framework* (March 2012)

[5] Department of Communities and Local Government, English Heritage & Department for Culture, Media and Sport. *PPS5 Planning for the Historic Environment: Historic Environment Planning Practice Guide* (March 2010)

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 8: Land quality

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 8: Land quality

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8 Land quality

8.1 Introduction

8.1.1 This section presents the findings of the assessment of the likely significant land quality effects of the proposed development at the Heathwall Pumping Station site.

8.1.2 The scope of the land quality assessment is to:

a. describe the condition of the site in terms of contaminant history and likely presence and magnitude of soil/sediment and liquid contamination (such as groundwater or perched water within the made ground), in addition to unexploded ordnance (UXO) and the presence of Japanese Knotweed, an invasive plant species which can be regarded as a soil contaminant.

b. describe and assess the impacts and significant effects of the interaction between these contaminants and the built environment, human and environmental receptors as a result of construction of the proposed development (taking into account any embedded measures).

8.1.3 There are a number of interfaces between land quality and other topic sections, as summarised below:

a. Section 13 Water resources – groundwater assesses the likely significant effects to water resources from soil, perched water and groundwater contamination. The land quality assessment does however consider potential risks to human health receptors (eg, construction workers) from contaminated perched water and groundwater, including free phase[i] contamination

b. Section 4 Air quality and odour assesses the likely significant effects to the air quality during the construction and operation of the site. The land quality assessment does however consider potential risks from, for example, the generation of dust and soil vapour from exposed ground and soils during construction

c. Section 5 Ecology – aquatic and Section 14 Water resources – surface water, these sections consider the mobilisation of sediments associated with in-river construction and how this would impact upon the ecology and quality of water in the tidal reaches of the River Thames. The surface water section also considers the likely significant effects to controlled waters from land contamination (eg, contaminated run-off) and use of contaminating substances during construction. No further assessment is made in the land quality section.

[i] Free phase contamination – hydrocarbons that form a discrete layer within groundwater, either floating on the groundwater surface or at the base of a groundwater body.

8.1.4 Operational land quality effects for this site have not been assessed. This is on the basis of the embedded measures adopted during the construction and operational phases (refer to Section 8.2 and Vol 2 Section 8.6). No significant operational effects are considered likely and for this reason only information relating to construction is presented in the assessment of effects on land quality.

8.1.5 The assessment of the likely significant effects of the project on land quality has considered the requirements of the National Policy Statement for Waste Water (Defra, 2012)[1] section 4.8. The risk posed by construction on previously developed land is addressed in the following assessment and through measures embedded in the *Code of Construction Practice* (*CoCP*) (further details can be found in Vol 2 Section 8, Vol 2 Table 8.3.1). The *CoCP* is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

8.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Vol 15 Heathwall Pumping Station Figures).

8.2 Proposed development relevant to land quality

8.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to land quality are set out below.

Construction

8.2.2 The elements of the proposed development relevant to land quality would consist of the following:

a. demolition and removal of a number of existing above and below ground structures (including parts of the river wall) at the site.

b. dredging and construction of a temporary cofferdam, crane bases and a jack-up rig on the foreshore, including connection to the existing river wall and construction of a campshed

c. construction of pits, chambers, ducts and pipes for cables, pipes, utility connections and diversions and drainage

d. CSO drop shaft, the invert of which would be located at an approximate depth of 46m below ground level (bgl)

e. the Heathwall Pumping Station interception and valve chamber, built within a new structure within the foreshore,

f. a connection culvert from the Heathwall Pumping Station interception structure to the CSO drop shaft

g. an interception chamber on the South Western Storm Relief (SWSR) Sewer

h. a connection culvert from the SWSR interception chamber to the CSO drop shaft

i. Heathwall/SWSR connection tunnel from the CSO drop shaft to the main tunnel

j. construction of air management plant and equipment including filters and ventilation columns, ducts and valve chambers

k. permanent foreshore works comprising construction of a new river wall and scour protection.

8.2.3 The above works would involve extensive below ground construction, resulting in the excavation and removal of material, including Made Ground and natural soils below.

8.2.4 An area would also be required within the site for construction logistics, such as materials handling and storage areas, and segment storage (as shown in the Construction phase 1 plan, see separate volume of figures – Section 1).

Code of Construction Practice

8.2.5 The embedded design measures relevant to land quality at the site are set out in Section 9 of the *CoCP* and are summarised below. Reference should be made to the *CoCP Part A* (Section 9) for full details.

8.2.6 There are no site specific *CoCP* measures which are relevant to this land quality assessment.

8.2.7 Land quality issues would be managed in close liaison with the local authority London Borough (LB) of Wandsworth and the Environment Agency (EA) prior to and during construction.

Pre-construction

8.2.8 The proposed development has been characterised and assessed with respect to land quality through the application of the following steps (which are dictated by the regulatory framework outlined in Section 9 of the *CoCP Part A*):

a. completion of a desk study which includes a review of available information sources (see Vol 15 Appendix F.1) and production of an initial conceptual site model

b. undertaking of specialist site surveys, such as Japanese Knotweed and UXO, which was undertaken to inform ground investigation (see Vol 15 Appendix F.3)

c. completion of a number of boreholes and soil and groundwater quality assessment.

8.2.9 In addition to the above, land quality will continue to be assessed via the following measures:

a. preparation of a preliminary risk assessment, design of a ground investigation rationale and ground investigation survey which would include construction of exploratory test holes (such as boreholes – a number of which have already been drilled and have informed this assessment), collection of soil and water samples for laboratory chemical testing and environmental monitoring (such as soil gas and soil vapour). A phased approach would be applied to ground investigation, with additional, detailed phases of investigation implemented as necessary to supplement, target and refine the findings and conclusions of the earlier assessments

b. site-specific land quality risk assessments would identify the need for specific remediation measures. Where necessary, the risk assessment would also be used to provide re-use criteria for soil material to be permanently placed at the site.

8.2.10 Where the site-specific land quality risk assessment identifies the need, a site-specific remediation strategy would be produced and implemented, including:

a. remedial options appraisal (as required)

b. details of the remediation strategy and methodology

c. methodology for decommissioning and removal of structures, such as underground storage tanks, if and where encountered

d. details of validation requirements to document the successful clean-up works.

Construction

8.2.11 Health and safety measures for the protection of construction workers with respect to land quality issues would include:

a. the provision of adequate training for all construction site workers to recognise and appropriately respond to potential land quality issues

b. site welfare facilities and where appropriate, decontamination units (ie, dirty in, clean out welfare units)

c. use of standard construction site personal protective equipment (PPE) (eg, high visibility clothing, safety boots, hard hat, safety glasses gloves and respiratory equipment)

d. robust emergency procedures (eg, with respect to UXO, previously unidentified contamination or structures), which are periodically reviewed. In the event of previously unidentified conditions being encountered, works would be suspended, the work area evacuated and specialist advice obtained. Where appropriate, additional risk assessments would be undertaken and additional control measures implemented prior to any works recommencing.

8.2.12 During construction, effective material management procedures, such as the storage and handling of excavated soils, fuels and other chemicals (as detailed further in the surface water section of the *CoCP*), would be implemented. Excavated materials with the potential to be contaminated would be removed from site as soon as practicable. Site control measures would be implemented to reduce dust (see air quality section of the *CoCP*) and the spread of mud by vehicles (see public access, the highway and river transport section of the *CoCP*).

8.2.13 Environmental monitoring, would include the following measures:

a. on-site watching brief during potentially high risk activities and an on call watching brief for all other activities. Specialist watching brief may include: UXO; contaminated land; health and safety/occupational health; and ecological (for invasive species, such as Japanese Knotweed)

b. dust and air/vapour monitoring (see *CoCP* Section 9 for further details). Where appropriate, this would include a combination of on-site and boundary monitoring.

8.3 Assessment methodology

Engagement

8.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement.* Specific comments relevant to this site for the assessment of land quality are presented here.

8.3.2 The LB of Wandsworth was specifically consulted with respect to any land quality data they hold at the site and surrounding area. A review of this data as well as the response is presented in Vol 15 Appendix F.1 and Vol 15 Appendix F.2.

Baseline

8.3.3 The baseline methodology follows the methodology described in Vol 2. There are no site-specific variations for identifying the baseline conditions for this site.

Construction

8.3.4 The assessment methodology for the construction phase follows that described in Vol 2. There are no site-specific variations for undertaking the construction assessment of this site.

8.3.5 The construction assessment area considered for the assessment of land quality includes the limits of land to be acquired or used (LLAU) plus an additional 250m buffer area. This assessment area has been selected in order to take account of any off-site sources that could impact on the land quality of the site as well as any nearby sensitive receptors.

8.3.6 The construction assessment has been undertaken for Site Year 1 of the construction phase.

8.3.7 The base case and cumulative assessment in Site Year 1 of construction takes into account the schemes described in Vol 15 Appendix N. The baseline is anticipated to change between the base case year and Site Year 1 of construction. There are four proposed developments within the 250m buffer area (as shown in Vol 15 Table 8.3.1) which are likely to be complete and operational before the commencement of the construction phase and as a result form part of the construction base case.

8.3.8 The developments within the 250m buffer area which are not considered as part of the construction base case are those developed during and after Site Year 1 of construction, they are included within the cumulative effect assessment and are also identified in Vol 15 Table 8.3.1.

Vol 15 Table 8.3.1 Land quality – construction base case and cumulative assessment development (2017)

Development	Distance from site	Construction base case	Cumulative impact assessment
Riverlight (Tideway Industrial Estate) (redevelopment of existing site to a residential led mixed use development – blocks B, C, D, E and F).	Adjacent	✓	✗
Embassy Gardens, land to the south of Nine Elms Lane and comprising DHL Depot, 1-12 Ponton Road and 51 Nine Elms Lane (demolition of existing development and construction of a mixed use development, including residential, retail, financial and professional services, cafe/restaurant, leisure and community uses – buildings A9, A10, and A11)	15m south	✓	✗
US Embassy, land on the south side of Nine Elms Lane incorporating Ponton Road (redevelopment of site to provide new embassy and associated buildings and access)	130m southeast	✓	✗
Riverlight, (Tideway Industrial Estate) (redevelopment of existing site to a residential led mixed use development – block A).	Adjacent	✗	✓
Embassy Gardens, land to the south of Nine Elms Lane and comprising DHL Depot, 1-12 Ponton Road and 51 Nine Elms Lane (demolition of existing development and construction of a mixed use development, including residential, retail, financial and professional services, cafe/restaurant, leisure and community uses – buildings A01, A02, A03, A04, A05 and A07).	15m south	✗	✓
Nine Elms Parkside (demolition of existing buildings and redevelopment for mixed use properties – plots C and D)	45m south	✗	✓

Symbols ✓ applies ✗ does not apply

8.3.9 Section 8.5 details the likely significant effects arising from the construction at the Heathwall Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on land quality within the assessment area for this site, therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

Development of conceptual model

8.3.1 The assessment of land quality effects is based on the development of a source-pathway-receptor (SPR) conceptual model. This model aims to understand the presence and significance of potentially complete pollutant linkages.

8.3.2 The SPR conceptual model is based on guidance given in CLR11*: Model procedures for the management of land contamination* (EA, 2004)[2]. This type of assessment specifically relates to risk assessment and management of land contamination and has been used to inform the environmental impact assessment (EIA) which seeks to identify the likely significant effects of the proposed development.

8.3.3 The impact assessment considers the anticipated level of contamination likely during Site Year 1 of construction using the categories of receptor sensitivity and impact magnitude described in Vol 2 Section 8.4 and Vol 2 Section 8.5 respectively.

8.3.4 The significance of effects has been determined using the generic matrix given in Vol 2 Section 3.7. A description of the significance criteria is presented in Vol 2 Section 8.5.

8.3.5 The methodology for undertaking both source-pathway-receptor analysis and the impact assessment is provided in Vol 2 Section 8.

Assumptions and limitations

8.3.6 The assumptions and limitations associated with this assessment are presented in Vol 2. Assumptions and limitations specific to the site are detailed below.

Assumptions

8.3.7 The approach to remediation cannot be defined at this stage due to a lack of data. It is therefore assumed that some contamination would still remain on-site at the time construction commences (either because no pre-commencement remediation is deemed necessary or that following remediation of the construction area some contamination remains on the wider site).

8.3.8 The site is expected to be underlain at depth by low permeability London Clay deposits which are in turn underlain by further low permeability deposits associated with the Lambeth Group. Therefore it has been assumed that potential contamination (if any) is likely to be restricted to the overlying shallow deposits (ie, Made Ground and River Terrace Deposits).

Limitations

8.3.9 No access to Middle Wharf was available at the time of the walkover survey. These areas could however be viewed from the site perimeter and publicly accessible areas.

8.3.10 Ground investigations are ongoing and are to be reported in due course. It is however, considered that there is sufficient information currently available to provide a robust assessment.

8.4 Baseline conditions

8.4.1 The following section sets out the baseline conditions for land quality within and around the site. Future baseline conditions (base case) are also described.

Current baseline

Introduction

8.4.2 A full list of the data sets drawn upon in this assessment is presented in Vol 2.

8.4.3 A baseline report is presented in Vol 15 Appendix F.1 which details the data obtained for this site and identifies the contamination sources that may have affected the site. In addition to Vol 15 Appendix F.1, this section should also be read in conjunction with Vol 15 Figure F.1.1, Vol 15 Figure F.1.2 and Vol 15 Figure F.1.3 (see separate volume of figures).

Summary of baseline conditions

Geology

8.4.4 The site is underlain by a cover of Made Ground extending to 4.9m bgl. This is underlain (in turn) by Alluvium/River Terrace Deposits, London Clay Formation, Harwich Formation, Lambeth Group, Thanet Sand Formation and Chalk Group (see Vol 15 Appendix F.1, Vol 15 Table F.3 for the full geological succession).

Contamination

8.4.5 Prior to development as a sewage pumping station, the proposed development site was historically used as a whiting and lime works and dock.

8.4.6 The surrounding land use was historically predominantly industrial and commercial with, most notably, an extensive gas works (Nine Elms) located to the south. A former dock, lock and mill pond were also located 50m to the west of the site and were later infilled.

8.4.7 A cover of made ground and foreshore sediments (of variable thickness and quality) is present across the site which also represents a potential source of contamination.

8.4.8 Initial ground investigations on the proposed development site (and neighbouring land) found no significantly elevated concentrations of contaminants in soils in comparison with human health risk assessment screening values for a commercial/industrial land-use (Defra/EA, 2009[3] and Chartered Institute of Environmental Health, 2009)[4].

8.4.9 Testing of foreshore sediments has found elevated concentrations of heavy metals and polyaromatic hydrocarbons; however these are considered unlikely to adversely impact on the land quality aspects of the proposed development.

8.4.10 Based on the site history (and baseline report in Vol 15 Appendix F), contaminants maybe present in soil, soil vapour and groundwater (including perched water) and maybe hazardous to human health (eg, as irritants or carcinogens or by their volatile or flammable properties) depending on the potential concentration of the substance.

UXO

8.4.11 A desk based assessment for UXO threat was previously undertaken by specialists for previous ground investigation works (boreholes SR1085 and PR1086) on part of the proposed development site. The report is presented in Vol 15 Appendix F.3.

8.4.12 The report established that no damage from WWII bombing was recorded in the immediate vicinity of the boreholes, but that one bomb was reported within the exploratory site and numerous bombs were reported within a 100m radius.

8.4.13 It is considered that there is an overall low to medium threat from UXO within a 25m radius of the exploratory holes at the site.

Summary of receptors

8.4.14 The receptors identified at this site from the baseline survey (see Vol 15 Appendix F.1) and their corresponding sensitivity following the criteria set out in Vol 2 are as follows:

a. construction workers: low sensitivity for general above ground site workers such as staff in site offices and delivery drivers and high sensitivity for those site workers involved in below ground excavation works and associated activities

b. adjacent land-users: residents (high sensitivity), workers in the adjacent light industrial or commercial land and Thames Path users (low sensitivity)

c. built environment: existing Heathwall Pumping Station building, adjacent residential, light industrial and commercial buildings and river wall (low sensitivity).

Construction base case

8.4.15 For land quality, the assessment of construction effects is based on the conditions which are likely to be experienced in Site Year 1 of construction (base case).

8.5 Construction effects assessment

Construction assessment case

8.5.1 The embedded requirement for a risk assessment and potential remediation of land contamination that forms part of the proposed development (refer to the *CoCP* (Section 9) and summary presented in

Section 8.2) mean that the land quality of the site may be different to that described in Section 8.4.

8.5.2 Where deemed necessary, problematic or gross contamination, which may substantially hinder the construction programme or which cannot be adequately dealt with in a controlled manner during construction, would have been remediated prior to the commencement of the main construction works (such as the CSO drop shaft excavation and in other areas of proposed excavation, where necessary).

8.5.3 Since the approach to remediation cannot be defined at this stage, it is assumed that some contamination would remain. Therefore some contamination is considered to be present for the purposes of this assessment.

8.5.4 Unless there are any immediate (as yet unknown) unacceptable risks elsewhere (for instance off-site migration of mobile free phase hydrocarbons or vapour risk to adjacent properties), remediation in areas away from planned intrusive construction works would not take place prior to construction.

Development of conceptual model

Interactions between source-pathway-receptor

8.5.5 The following section outlines how the contamination sources summarised in paras. 8.4.5 to 8.4.10 may interact with the receptors identified during the construction phase (see para. 8.4.14 above) following the application of the embedded measures (see Section 8.2).

8.5.6 The main land quality SPR interactions are considered to be from the exposure of potential contamination to:

a. construction workers (receptor) via dermal contact, ingestion, inhalation of dust and soil vapours/soil gas and direct contact

b. adjacent land-users, including members of the public (receptor) via off-site migration of soil vapour (by diffusion or due to wind) and wind-blown dust contaminant pathways and accidental detonation of UXO

c. the built environment (on and off-site receptors) via the accidental detonation of previously unidentified UXO.

8.5.7 The SPR impacts are summarised in Vol 15 Table 8.5.1 below. For simplicity the various sources identified have been grouped together into the different phases which they may be found (ie, solid, liquid, and gaseous), as these interact with receptors in a similar manner.

Vol 15 Table 8.5.1 Land quality – source-pathway-receptor summary (construction)

Receptors / Generic sources	Construction workers	Adjacent land-users	Built environment
Contaminated soils / sediments	Inhalation, dermal contact,	Wind-blown dust and vapour migration (and subsequent	N/A

Receptors / Generic sources	Construction workers	Adjacent land-users	Built environment
	ingestion	ingestion or inhalation)	
Contaminated groundwater or liquids	Inhalation, dermal contact, ingestion	N/A	N/A
Soil gases / vapours	Inhalation	Vapour migration (and subsequent inhalation)	N/A
UXO	UXO detonation	UXO detonation	UXO detonation

N/A= Not applicable

Impacts and effects

8.5.8 The following section discusses the likely significant effects on receptors as a result of the land quality conditions at the site.

8.5.9 The assessment focuses on those linkages between sources, pathways and receptors that could generate significant effects and is based on available information and professional judgement.

Construction workers

8.5.10 A number of embedded measures set out in the *CoCP* (Section 9) are designed to effectively manage any potential land quality impacts to construction workers associated with the construction phase of the proposed development (measures are summarised in Section 8.2).

Contamination

8.5.11 The management of contamination at the site is a two stage process, the first stage comprises the assessment, quantification and if necessary the removal of the main contamination sources which could impact upon construction worker health.

8.5.12 The second stage comprises safe methods of work and management of contamination during construction; assuming that some contaminated soils could remain, or previously unidentified contamination be encountered, during the main construction works.

8.5.13 Both of these stages include measures such as site-specific risk assessments, watching brief, safe methods of work, use of PPE and mitigation from a specialist contractor who is experienced at managing such risks.

8.5.14 With these measures in place, the overall magnitude of the impact to construction workers (both below and above ground) is assessed to be negligible.

8.5.15 This would result in a **negligible** effect on above ground construction workers and a **minor adverse** effect on those involved in intensive below ground works (although the effect is defined as minor adverse, it is considered unlikely that the effects would occur).

UXO

8.5.16 The management of UXO risk comprises advice from a specialist contractor who is experienced at managing such risks. This would include an initial assessment of UXO being present at the site (such as that already undertaken) and a proportional response to this risk. With a low-medium risk site such as Heathwall Pumping Station this is likely to include site-specific risk assessments, safe methods of work/tool box talks and emergency response procedure as well as a UXO watching brief as excavations progress.

8.5.17 These measures are successfully utilised in major construction schemes within London on a regular basis. Therefore with these measures in place, the overall magnitude of the impact to construction workers (both below and above ground) is assessed to be negligible.

8.5.18 This would result in a **negligible** effect on above ground construction workers and a **minor adverse** effect on those involved in intensive below ground works (although the effect is defined as minor adverse, it is considered unlikely that the effects would occur).

Adjacent land-users

Contamination

8.5.19 Impacts on adjacent land-users could occur via excavation and exposure of previously unidentified contaminated soils. This contamination could then migrate onto neighbouring sites. The pathways via which the contamination could migrate are: wind-blown dust and vapour diffusion.

8.5.20 A number of embedded measures set out in the *CoCP* (Section 9), as summarised in Section 8.2, are designed to effectively manage any land quality impacts to the adjacent land-users associated with the construction phase of the proposed development.

8.5.21 These measures include:

a. the damping down of excavations, storage of potentially contaminated soils in secure (covered) areas, wheel washes at site entrance and the maintenance, construction and cleaning of hardstanding

b. dust and air/vapour monitoring to provide a check that volatile contamination or construction dusts do not significantly affect adjacent land users. Where appropriate, this would include a combination of on-site and boundary monitoring, which would provide either real time measurements or collect samples for subsequent analysis. For further detail and guidance reference should be made to the *CoCP* Part A (Section 9).

8.5.22 With these measures in place the overall magnitude of the impact to all adjacent land-users is assessed to be negligible.

8.5.23 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect on the adjacent light industrial and commercial land users and Thames Path users and a **minor adverse** effect on the residential land users (although the effect is defined as minor adverse, it is considered unlikely that the effect would occur).

UXO

8.5.24 Impacts on adjacent land-users could occur via accidental detonation of UXO during below ground works. The embedded measures are set out in the *CoCP* (Section 9), such as the use of specialised UXO contractors offering site-specific advice and where necessary on-site monitoring. These measures are designed to effectively manage any impacts to the adjacent land-users associated with the construction phase of the proposed development.

8.5.25 With these measures in place the overall magnitude of the impact to all adjacent land-users is assessed to be negligible.

8.5.26 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect on the adjacent light industrial and commercial land users and Thames Path users and a **minor adverse** effect on the residential land users (although the effect is defined as minor adverse, it is considered unlikely that the effect would occur).

Built environment

8.5.27 Impacts from existing land quality relate to the accidental detonation of UXO during preliminary surveys or main construction works.

8.5.28 A number of embedded design measures set out in the *CoCP* (Section 9), as summarised in Section 8.2, are designed to effectively manage any land quality impacts (eg, from UXO) to the built environment associated with the construction phase of the proposed development.

8.5.29 With these measures in place, the overall magnitude of the impact to the built environment is assessed to be negligible.

8.5.30 Based on the assessed impact magnitude and receptor sensitivity, it is considered that the proposed development would result in a **negligible** effect to the existing Heathwall Pumping Station building, adjacent residential, commercial and light industrial buildings and the river wall.

8.6 Operational effects assessment

8.6.1 Operational effects have not been assessed for land quality (see para. 8.1.4).

8.7 Cumulative effects assessment

8.7.1 Of the projects described in Vol 15 Appendix N which could potentially give rise to cumulative effects with the proposed development at Heathwall Pumping Station, three developments have been identified (see Vol 15 Table 8.3.1).

8.7.2 No cumulative effects of land quality are expected during the construction of the Thames Tideway Tunnel project, since impacts are constrained to the footprint of the development by the measures incorporated in the CoCP (Section 9).

8.8 Mitigation

8.8.1 The assessment presented above does not identify the need for mitigation during construction, over and above those measures set out in the *CoCP* (Section 9). No further mitigation, enhancement or monitoring is required.

8.9 Residual effects assessment

8.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 8.5. All residual effects are presented in Section 8.10.

8.10 Assessment summary

Vol 15 Table 8.10.1 Land quality – summary of construction assessment

Receptor (sensitivity)	Effect	Significance of effect	Mitigation	Significance of residual effect
Construction workers – general above ground site staff (Low)	Health effects from exposure to contaminated soils, sediments, soil gases / vapours	Negligible	None	Negligible
	Health effects from detonation of UXO	Negligible	None	Negligible
Construction workers – below ground site staff (High)	Health effects from exposure to contaminated soils, sediments, liquids, soil gases / vapours	Minor adverse	None	Minor adverse*
	Health effects from detonation of UXO	Minor adverse	None	Minor adverse*
Adjacent land-users, light industrial / commercial land-users and Thames Path users (Low)	Health effects from exposure to wind-blown dust or vapours	Negligible	None	Negligible
	Health effects from detonation of UXO	Negligible	None	Negligible
Adjacent land-users, residential (High)	Health effects from exposure to wind-blown dust or vapours	Minor adverse	None	Minor adverse*
	Health effects from detonation of UXO	Minor adverse	None	Minor adverse*
Built environment –existing Heathwall Pumping Station building, light industrial / commercial units and residential properties (Low)	Damage to structures from detonation of UXO	Negligible	None	Negligible

** Although the effect is minor adverse, it is considered unlikely that the effect would occur.*

References

[1] Defra. *National Policy Statement for Waste Water* (2012).

[2] Environment Agency. *Model procedures for the management of land contamination: Contaminated Land Report 11* (2004).

[3] Defra/EA. *Soil Guideline values for industrial and light commercial land use* (2009).

[4] Land Quality Management/Chartered institute of Environmental Health. *Generic Assessment Criteria for Human Health Risk Assessment*, 2nd Edition (2009).

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 9: Noise and vibration

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 9: Noise and vibration

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9 Noise and vibration

9.1 Introduction

9.1.1 This section presents the findings of the assessment of the likely significant noise and vibration effects of the proposed development at the Heathwall Pumping Station.

9.1.2 The proposed development has the potential to affect noise and vibration levels at receptors due to:

a. construction site activities (noise and vibration)

b. construction traffic on roads outside the site (noise)

c. tugs pulling river barges conveying materials to and from the site (noise)

d. operation of the proposed development (noise and vibration).

9.1.3 Each of these is considered within the assessment.

9.1.4 Groundborne noise and vibration from the tunnelling activities associated with the main tunnel, long connection tunnels and certain short connection tunnels are considered in Volume 3 Project-wide assessment[i].

9.1.5 The assessment of noise and vibration presented in this section has considered the requirements of the National Policy Statement for Waste Water Section 4.9 (noise and vibration) (Defra, 2012)[1]. Further details of these requirements can be found in Volume 2 Section 9.3.

9.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station Figures).

9.2 Proposed development relevant to noise and vibration

9.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to noise and vibration are set out below.

Construction

Construction traffic

9.2.2 During construction cofferdam fill (both import and export), excavated material from the shaft (export) would be transported by barge. For the noise assessment it has been assumed that 90% of these materials would

[i] Surface activities to facilitate construction of the short connection tunnel are considered within this assessment. Construction of the short connection tunnel at this site is not considered within Volume 3 as the connection tunnel would be constructed beneath the river away from sensitive receptors and effects from groundborne noise and vibration are therefore not considered likely.

be taken by river. This allows for periods that the river is unavailable and material unsuitable for river transport. All other materials would be transported by road. Estimated barge and vehicle numbers and haul routes are presented in Vol 15 Sections 3.3 and 12.2.

Construction activities

9.2.3 Vol 15 Section 3.3 sets out the assumed construction duration and programme for the Heathwall Pumping Station site.

9.2.4 The construction works at this location would involve the following activities that have the potential to affect noise and vibration levels in the vicinity of the site:

9.2.5 The construction works at this location would involve the following standard activities:

a. utility diversions

b. hoarding and site setup

c. demolition

d. cofferdam construction

e. shaft construction

f. connection tunnel construction

g. shaft secondary lining

h. Interception works and culvert works

i. landscaping (including construction and fit-out of permanent facility).

9.2.6 Further detail on the plant used in these construction stages is given in Vol 15 Appendix G.2.

9.2.7 Working hours have been subject to consultation with the local authority. As part of the Code of Construction Practice (CoCP) requirements, Section 61 consents would be agreed with local authority to confirm methodologies. Construction activities would be carried out during the following periods, as identified within the CoCP:

a. standard hours (08.00-18.00 weekdays and 08.00-13.00 Saturdays).

b. continuous working (24 hours a day, 7 days a week) for construction of the short connection tunnel from the shaft to the main tunnel. This would be carried out over a period of approximately four months.

Code of Construction Practice

9.2.8 The *Code of Construction Practice* (*CoCP*) is provided in Vol 1 Appendix A. It contains general requirements (*Part A*), and site specific requirements for this site (*Part B*).

a. The *CoCP Part A* (Sections 4.3 and 6.4) specifies the use of best practicable means (BPM) to reduce noise and vibration effects. Generic measures include careful selection of construction plant, construction methods and programming

b. equipment would be suitably sited so as to minimise noise impact on sensitive receptors

c. use of site enclosures, and temporary stockpiles to provide acoustic screening

d. choice of routes and programming for the transportation of construction materials, excavated material and personnel to and from the site

e. careful programming so that activities which may generate significant noise would be planned with regard to local occupants and sensitive receptors

f. hoarding would be of a standard height of 2.4m and of an extent to achieve appropriate noise attenuation.

9.2.9 Site specific measures incorporated into the *CoCP Part B* (Sections 4 and 6) to reduce noise and vibration effects include:

a. construction of 2.4m noise screen to the edge of the temporary cofferdam to screen boat-based receptors

b. the loading and unloading of barges would only be carried out during standard working hours

c. compaction of material on site would be undertaken using machinery generating the lowest practicable vibration levels which still enables the required level of compaction to be completed. Specifically, the use of large twin-drum vibrating rollers would only occur on occasions where vibration levels can be controlled to less than the impact criteria

Operation

9.2.10 A below-ground air treatment chamber would be connected to ventilation columns. Air discharging through the ventilation columns would have the potential to create noise impacts. Additionally, electrical and control equipment would be located within the pumping station building and would contain plant to control penstocks and to monitor the operation of the tunnel. This operational plant would have the potential to create noise impacts, and these are considered in the assessment.

9.2.11 During tunnel filling events water would descend via two vortex structures through the drop shaft to the connection tunnel below. The potential for noise generated by this movement of water through the shaft has been assessed.

Environmental design measures

9.2.12 The operational plant associated with the surface structures would incorporate environmental design measures to control noise emission to the nearest noise sensitive receptors to acceptable noise limits. These limits are as defined by the Local Authority in which the receptor lies; at Heathwall Pumping Station, receptors within the London Borough (LB) of Wandsworth have been considered alongside receptors on the opposite bank which lie within the City of Westminster (see para. 9.3.18). The environmental design measures have considered the following noise sources:

a. hydraulic plant for penstock operation (motors, pumps)

b. uninterruptable power supply (UPS) plant.

9.2.13 In considering the noise from the above items, the sound insulation of the housing for the equipment and the building structure has been taken into consideration

9.2.14 The design of the drop shaft would control the descent of water by channelling the flow around the internal face of a vortex drop tube within the drop shaft, rather than allowing the water to free fall. The vortex design allows large volumes of water to descend with less noise generation than a falling cascade design.

9.3 Assessment methodology

Engagement

9.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of noise and vibration are presented here.

9.3.2 The survey methodology, monitoring locations and limits for plant noise from the operation of the site were agreed with the LB of Wandsworth.

9.3.3 The limits for plant noise from the operation of the site were also agreed with the Westminster City Council.

9.3.4 Written confirmation on the survey methodology was received from the LB of Wandsworth in May 2011.

9.3.5 No other site-specific noise and vibration consultation responses have been received from the LB of Wandsworth or other stakeholders at scoping or other consultation stages.

Baseline

9.3.6 The baseline methodology follows the methodology provided in Volume 2. There are no site specific variations for this site.

Construction

9.3.7 The assessment methodology for the construction phase follows that described in Volume 2. There are no site specific variations for undertaking the construction assessment of this site.

9.3.8 Section 9.5 details the likely significant effects arising from the construction at the Heathwall Pumping Station. The Thames Tideway Tunnel project site at Kirtling Street has the potential to give rise to additional noise effects on receptors within the assessment area for this site as the Kirtling Street site would still be under construction for approximately 24 months after the development at Heathwall Pumping Station is complete. The assessment of effects from the construction of the nearby Kirtling Street site, on receptors within the Heathwall Pumping Station assessment area, is contained in Vol 14 Section 9.

9.3.9 The construction noise and vibration assessment has considered the effects across the whole duration of the construction phase (Years 1 to 3) and the worst-case exposure levels are reported.

9.3.10 Of the schemes outlined in the site development schedule (Vol 15 Appendix N) the following are considered relevant to the construction assessment base case as they are assumed to be complete and operational before or during the Thames Tideway Tunnel project construction period:

a. Embassy Gardens – blocks A09 and A10

b. Riverlight – Block F.

9.3.11 The Riverlight development contains other blocks which would be complete at the time of the Heathwall Pumping Station development, however the rest of the development would be screened from noise from the development by block F, and further consideration is not required.

9.3.12 Of the schemes outlined in the site development schedule (Vol 15 Appendix N) the following are considered relevant to the cumulative construction assessment as they are assumed to be under construction at the same time as the Thames Tideway Tunnel project:

a. Embassy Gardens – blocks A01-A05 and A07

b. Nine Elms Parkside – plots C and D.

c. Riverlight – Block A.

9.3.13 All other schemes in the site development schedule (Vol 15 Appendix N) are outside of the screening distance of 300m, or screened by a receptor already assessed and are therefore not considered in this assessment.

9.3.14 The assessment also considers the temporary relocation of the Battersea Barge during the construction period.

9.3.15 Traffic flows on construction traffic routes have been examined to determine if there are any routes where there is the potential for traffic noise changes of 1dB(A) or more. This is according to the flow, speed or composition change criteria specified in Vol 2. The results show that there are no traffic changes on the road network associated with this site which meet the relevant criteria. This is discussed further in the assessment section from para. 9.5.41.

9.3.16 The assessment of construction effects also considers the extent to which the effects on noise and vibration would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Construction assessment area

9.3.17 As described in Vol 2 the assessment area considers unscreened receptors up to a maximum of 300m from the site boundary based on professional judgement of the likelihood of significant effects. The assessment primarily concentrates on those receptors closest to the site which would generally be most affected, rather than those further away which would be well screened by intervening buildings. Effects at more distant receptors beyond those closest to the site have been considered where necessary by reference to the impacts determined at the primary (closest) receptors.

Operation

9.3.18 The operational phase assessment methodology follows the methodology provided in Vol 2. Site specific variations to this methodology are set out below.

9.3.19 For residential receptors, the LB of Wandsworth and Westminster City Council require that noise emissions from this type of source are designed to meet a rating level (as defined in BS4142 (British Standards Institution, 1997[2]) which is 10dB below the typical background noise level over the operational period of the plant at 1m from the facade of the nearest residential receptor

9.3.20 The operational assessment year is taken to be Year 1 of operation.

9.3.21 Section 9.6 details the likely significant effects arising from the operation of the Heathwall Pumping Station site. Although the Thames Tideway Tunnel development at Kirtling Street is within 200m, all operational structures at Kirtling Street would be screened by intermediate buildings from the plant at Heathwall. Therefore no other Thames Tideway Tunnel project sites are considered in this operational assessment.

9.3.22 Of the schemes outlined in the site development schedule (Vol 15 Appendix N) the following are considered relevant to the operational assessment base case as they are assumed to be complete and operational during Year 1 of the operational period:

a. Riverlight (Block A)

b. Embassy Gardens.

9.3.23 All other schemes in the site development schedule (Vol 15 Appendix N) are outside of the screening distance of 300m, or screened by a receptor already assessed and are therefore not considered in this assessment.

9.3.24 There are no developments relevant to the operational cumulative assessment for noise and vibration at this site, because due to their use, none are expected to generate significant noise or vibration levels during their operation.

9.3.25 Based on the traffic flow, speed or composition change criteria specified in Vol 2, there are no routes where potential for operational traffic noise effects would occur.

9.3.26 The assessment of operational effects also considers the extent to which the effects on noise and vibration would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Operational assessment area

9.3.27 Operational effects are considered up to 300m from the site boundary, although the focus is on those receptors closest.

Assumptions and limitations

9.3.28 The generic assumptions and limitations associated with this assessment are presented in Vol 2. The site-specific assumptions are presented in the following section.

Assumptions

9.3.29 The working hours assumed for the assessment are as described in para. 9.2.7.

Limitations

9.3.30 There are no limitations to the assessment at this site.

9.4 Baseline conditions

9.4.1 The following section sets out the baseline conditions for noise and vibration within and around the site. Future baseline conditions (base case) are also described.

Current baseline

9.4.2 The current baseline noise conditions are as described in the baseline survey. The specific details of this survey, such as the measurement times, locations measured, results and local conditions are described in Vol 15 Appendix G.1. Vol 15 Table 9.4.1 below shows that the noise levels at all periods are relatively high, the noise levels being heavily influenced by traffic noise from Nine Elms Lane, and other roads in the vicinity.

Receptors

9.4.3 This section describes the setting and receptor characteristics of the site for the purposes of this assessment.

9.4.4 The closest noise and vibration sensitive receptors selected for the noise and vibration assessment are identified in Vol 15 Table 9.4.1 below (and shown in plan view in Vol 15 Figure 9.4.1, see separate volume of figures). These were selected as they are representative of the range of noise climates where sensitive receptors are situated around the site. The approximate number of residential properties affected at each location (where known) is indicated in Vol 15 Table 9.4.2.

9.4.5 The nearest residences to the site are the house boats at Nine Elms Pier, located west. To the east lie residences at Elm Quay. All these receptors lie within the LB of Wandsworth. On the north bank of the Thames, lie River Lodge and Icon Apartments within the City of Westminster. The restaurant/bar the Battersea Barge is a non-residential receptor on the south bank to the west of the site. This vessel would be temporarily relocated during the construction approximately 7m to the west.

9.4.6 Beyond these closest receptors there are other residential locations, which are screened from the site by intervening buildings or are located further from the site than the buildings included in the assessment. These include other blocks in the Riverlight development and residences to the north of River Lodge and Icon Apartments in the City of Westminster and have been considered as secondary receptors to the closest receptors.

Receptor sensitivity

9.4.7 The noise and vibration sensitive receptors have been assessed according to their sensitivity, using the methodology outlined in Vol 2 Section 2.3. The sensitivities of all assessed receptors are presented in Vol 15 Table 9.4.1.

Vol 15 Table 9.4.1 Noise and vibration – sensitive receptors and noise levels

Ref	Receptor addresses	Sensitivity	Local authority	Measured average ambient noise level, day/ evening/ night, dBL_{Aeq}*	Noise survey location
HE1	Elm Quay (residential)	High	LB of Wandsworth	68/65/62	HEA02
HE2	Nine Elms Pier Houseboats (residential)	High	LB of Wandsworth	69/67/64	HEA01
HE3	River Lodge and Icon Apartments (residential)	High	Westminster City Council	75/74/67	HEA03
HE4	Riverlight (residential)	High	LB of Wandsworth	69/67/64	HEA01
HE5	Embassy Gardens A09 and A10 (residential)	High	LB of Wandsworth	73/74/68	KST01
HE6	Battersea Barge (bar/ restaurant)	Medium	LB of Wandsworth	69/67/64	HEA01

** Noise level includes correction for façade acoustic reflection unless receptor position is an open outdoor space (eg park)*

9.4.8 The baseline noise level is considered representative of the relevant receptor. Consideration is given to the distance of the measurement location to the receptor, the orientation of the primarily affected façade and location of the controlling noise source(s).

9.4.9 The criteria for determining the significance of noise effects at residences from construction sources are partly dependent upon the existing ambient noise levels. From the ambient noise levels measured during the baseline survey, the assessment category and assessment noise threshold levels for the residential receptors near the Heathwall Pumping Station site are as shown in Vol 15 Table 9.4.2.

9.4.10 The assessment of significance at non-residential receptors is made according to the construction noise level relative to the ambient noise level (see Vol 15 Table 9.5.2) using the impact criteria described in Vol 2 Section 9.5 (where appropriate) and other factors described in Volume 2.

Vol 15 Table 9.4.2 Noise – residential receptors and assessment categories

Ref	Noise sensitive receptor (No. of dwellings)	Ambient noise level, rounded to nearest 5dBL_{Aeq}* day/ evening/ night	Assessment category* day/ evening/ night	Impact criterion threshold level day, dB$L_{Aeq\ 10hour}$/ evening dB$L_{Aeq\ 1hour}$/ night, dB$L_{Aeq\ 1hour}$
HE1	Elm Quay (60)	70/65/60	C/C**/C**	75/66/62
HE2	Nine Elms Pier House boats(25)	70/65/65	C/C**/C**	75/67/64
HE3	River Lodge and Icon Apartments (120)	75/75/65	C/C**/C**	75/74/67
HE4	Riverlight (376)	70/65/65	C/C**/C**	75/67/64
HE5	Embassy Gardens A09 and A10 (-)	75/75/70	C/C**/C**	75/74/68

** From 'ABC' method – BS5228:2009*[3]

*** Where the ambient noise level is greater than category C levels the ambient noise level shall be used as the significance criterion threshold*

Construction base case

9.4.11 The base case in Site Year 1 of construction taking into account the schemes described in Section 9.3 would include Riverlight block F, and Embassy Gardens blocks A10 and A09 as additional sensitive receptors.

9.4.12 The noise levels, as measured during the baseline noise survey in 2011, are assumed for the base case. However, there is the potential for variations to occur in the ambient noise levels between 2011 and the base case year. If the noise levels were to vary, it is likely that they would increase compared to the measured data from 2011 (due to natural traffic growth and the potential for additional construction noise from adjacent developments). The estimated traffic increases for the construction base case in Site Year 1 are such that noise levels would be expected to increase by less than 1dB(A) from those measured in 2011. The assessment based on data from 2011 therefore presents a worst case assessment.

9.4.13 It is considered that there are no other circumstances at this location that would cause the baseline noise levels at the receptor locations to change significantly between 2011 and the first year of construction.

9.4.14 There are no major vibration sources immediately alongside the site on Nine Elms Lane. It is considered that vibration levels are unlikely to change between the present time and the base case. This is because there are no major vibration sources in the vicinity, and the substantial redevelopment of the area does not, at present, include uses which would be likely to generate high levels of vibration.

Operational base case

9.4.15 The base case in Year 1 of operation taking into account the schemes described in Section 9.3 would include Riverlight block F, and Embassy Gardens blocks A10 and A09 as additional sensitive receptors.

9.4.16 The operational base case has been estimated from traffic flow expectations for the Year 1 of the operational phase as result of natural growth and new development in the vicinity. The estimated traffic increases for the operational base case in Year 1 of operation are such that noise levels would be expected to increase by less than 1dB(A) from those measured in 2011.

9.5 Construction effects assessment

Noise

9.5.1 The results of the assessment of construction noise are presented in Vol 15 Table 9.5.1 and Vol 15 Table 9.5.2. The tables show the range of predicted construction noise levels during the entire period of the works and a typical monthly construction noise level. The typical monthly level is the most frequently occurring monthly noise level during the works. The tables also show the total number of months across all construction stages that the noise level would be likely to exceed the impact criterion threshold level indicating potential significance. The final columns in the tables show the worst-case excess above the impact criterion together with the duration of the worst-case noise level. In cases when the impact criterion is exceeded (as marked by an asterisk in Vol 15 Table 9.5.1), further assessment of the likely noise ingress to the interior of the building has been carried out to more precisely estimate the resulting noise impact on the occupants. The noise ingress would depend on the degree of façade noise insulation of the particular buildings which is considered in further detail in these cases.

9.5.2 To illustrate the predicted variation in construction noise levels at each receptor position across the duration of the construction phase, Vol 15 Appendix G Plate G.7 to Plate G.17 show the estimated noise levels plotted month-by-month over the duration of the works. The appendix also lists the construction plant and operations assumed for the calculations. The predicted impacts and assessed effects at each representative receptor location are described below.

Impacts at residential receptors

9.5.3 The results for residential receptors are shown below.

Vol 15 Table 9.5.1 Noise – impacts at residential receptors (high sensitivity)

Ref/ receptor[a] (No. of noise sensitive properties)	ABC impact criterion threshold level (potential significance for residential), dBL_{Aeq}[b]	Range of construction noise levels, dBL_{Aeq}[c,d]	Typical[e] monthly construction noise levels, dBL_{Aeq}	Magnitude		
				Total duration above criterion for <u>all</u> works, months	Worst-case excess above criterion, dBL_{Aeq}[f] (further assessment undertaken for excess above criterion*)	Duration of worst-case excess above criterion, months
HE1 Elm Quay (60)	75	58 – 70 (day)	64	0	-5	0
	66	62 – 62 (eve)	62	0	-4	0
	62	62 – 62 (night)	62	0	0	0
HE2 Nine Elms Pier House boats(25)	75	55 – 73 (day)	64	0	-2	0
	67	50 – 50 (eve)	50	0	-17	0
	64	49 – 49 (night)	49	0	-15	0
HE3 River Lodge and Icon Apartments (120)	75	56 – 65 (day)	58	0	-10	0
	74	55 – 55 (eve)	55	0	-19	0
	67	54 – 54 (night)	54	0	-13	0
HE4 Riverlight (376)	75	69 – 76 (day)	71	1	+1	1
	67	62 – 62 (eve)	62	0	-5	0
	64	62 – 62 (night)	62	0	-2	0

Ref/ receptor[a] (No. of noise sensitive properties)	ABC impact criterion threshold level (potential significance for residential), dBL_{Aeq}[b]	Range of construction noise levels, dBL_{Aeq}[c,d]	Typical[e] monthly construction noise levels, dBL_{Aeq}	Magnitude		
				Total duration above criterion for <u>all</u> works, months	Worst-case excess above criterion, dBL_{Aeq}[f] (further assessment undertaken for excess above criterion*)	Duration of worst-case excess above criterion, months
HE5 Embassy Gardens (-)	75	63 – 75 (day)	68	0	0	0
	74	67 – 67 (eve)	67	0	-7	0
	68	67 – 67 (night)	67	0	-1	0

[a] Floors subject to highest noise level assessed – not necessarily the highest floor level

[b] The potential significance threshold is based on the ambient noise level as defined in Volume 2

[c] Construction noise only, excludes ambient noise. Refer to Volume 2 Section 9.5

[d] Noise level includes correction for façade acoustic reflection

[e] Most frequently occurring monthly construction noise level during works

[f] Positive value indicates exceedance, negative value indicates noise below criterion

Elm Quay (HE1)

9.5.4 Elm Quay is a medium rise building. The upper floors, from the first floor and above, would directly overlook the site, albeit at a distance of some 80m from the site boundary, and due to the height of the building it would not be screened by the site hoardings.

9.5.5 The predicted noise levels at these dwellings due to construction activities are shown in Vol 15 Table 9.5.1.

9.5.6 The typical daytime noise levels (most frequently occurring monthly level) is $64dBL_{Aeq}$. The construction of the cofferdam and river wall works are expected to cause the worst-case noise level of $70dBL_{Aeq}$.

9.5.7 During the evening and night time, the construction of the connection tunnel is expected to cause the worst-case noise levels of $62dBL_{Aeq}$ for both periods.

9.5.8 However, the construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore considered **not significant**.

9.5.9 Other than those assessed there are no other residential properties in the vicinity of this receptor that are close enough to be subject to significant adverse effects.

Nine Elms Pier House boats (HE2)

9.5.10 A number of moorings for house boats are located at the redeveloped Nine Elms site, which lie approximately 45m from the site boundary.

These would not be screened from construction works until the temporary cofferdam has been completed, and the noise barrier erected at the edge.

9.5.11 The predicted noise levels at these dwellings due to construction activities are shown in Vol 15 Table 9.5.1.

9.5.12 The typical daytime noise levels (most frequently occurring monthly level) is 64dBL_{Aeq}. The construction of the cofferdam and river wall works are expected to cause the worst-case noise level of 73dBL_{Aeq}.

9.5.13 During the evening and night time, the construction of the connection tunnel is expected to cause the worst-case noise levels of 50dBL_{Aeq} and 49dBL_{Aeq} respectively.

9.5.14 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore **not significant**.

9.5.15 Other than those assessed there are no other residential properties in the vicinity of this receptor that are close enough to be subject to significant adverse effects.

River Lodge and Icon Apartments (HE3)

9.5.16 River Lodge and Icon Apartments are medium rise buildings which would directly overlook the site, albeit at a distance of some 150m from the site boundary. To enable the loading and unloading of barges, there are no site hoardings on this side of the site which would provide screening to the buildings.

9.5.17 The predicted noise levels at these dwellings due to construction activities are shown in Vol 15 Table 9.5.1.

9.5.18 The typical daytime noise levels (most frequently occurring monthly level) is 58dBL_{Aeq}. The site establishment and demolition works are expected to cause the worst-case noise level of 65dBL_{Aeq}.

9.5.19 During the evening and night time, the construction of the connection tunnel is expected to cause the worst-case noise levels of 55dBL_{Aeq} and 54dBL_{Aeq} respectively.

9.5.20 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore **not significant**.

9.5.21 To the north of these apartments are other residential properties which lie further from the development than the receptors considered here. The impact from construction noise at these buildings would therefore be lower and so these would not be subject to significant adverse effects either.

Riverlight (HE4)

9.5.22 Block F of the Riverlight development is a large high rise building which at upper floors would directly overlook the site, at a distance of some 10m from the site boundary. There are no site hoardings on this side of the development which would provide screening to the buildings. The predicted noise levels at these dwellings due to construction activities are shown in Vol 15 Table 9.5.1.

9.5.23 The typical daytime noise levels (most frequently occurring monthly level) is 71dBL_{Aeq}. The construction of the cofferdam and river wall works are expected to cause the worst-case noise level of 76dBL_{Aeq} for one month.

9.5.24 During the evening and night time, the construction of the connection tunnel is expected to cause the worst-case noise levels of 62dBL_{Aeq} for both periods.

9.5.25 Because potentially significant effects have been identified during the daytime using the ABC criterion, noise levels within the rooms most exposed to the construction works have been estimated. This has been based on conservative assumptions regarding the noise transmission through the façade with the windows closed. The approach to estimating internal noise levels is described in the methodology in Volume 2. Thermal double glazing has been assumed for this receptor (based on the age of the property and external observations) and takes into account a typical glazed area of the façade and a typical reverberant characteristic for a domestic room.

9.5.26 The worst case internal noise level during the day is estimated to be 37dBL_{Aeq} for one month with windows closed or approximately 58dBL_{Aeq} if windows were opened on the most exposed facade. There are no other periods for which the potential significance threshold is exceeded, although construction noise is estimated to be at the threshold of potential significance for three months. The worst case internal guidance noise level would be just below the BS8233 internal guidance[4] noise level of 40dBL_{Aeq} with windows closed. The noise level is also only just below the levels where speech communication would be affected if windows were left partially open.

9.5.27 Given the internal noise levels, the magnitude of noise impact (increase) and its duration, this is assessed as **significant**.

9.5.28 During the evening and night-time, the construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore considered **not significant** for these periods.

9.5.29 The other buildings in the Riverlight development all lie much further away from the site and are screened from the majority of activities on site by block F. As such these would not be subject to adverse effects from the Heathwall Pumping Station development.

Embassy Gardens (HE5)

9.5.30 Blocks A10 and A09 of the Embassy Gardens development are medium rise buildings which at upper floors would directly overlook the site, at a distance of some 25m from the site boundary. The site hoardings which would provide screening to the lowest two floors of the buildings.

9.5.31 The worst-case predicted noise levels at these dwellings due to construction activities are shown in Vol 15 Table 9.5.1.

9.5.32 The typical daytime noise levels (most frequently occurring monthly level) is 68dBL_{Aeq}. During the daytime, the activity expected to cause the worst-case noise level of 75dBL$_{Aeq}$ would be the site establishment and demolition works.

9.5.33 During the evening and night-time, the construction of the connection tunnel is expected to cause the worst-case noise level of 67dBL$_{Aeq}$.

9.5.34 The construction noise levels are not estimated to exceed the potential significance criteria for a residential receptor. The effect is therefore **not significant**.

9.5.35 The other buildings in the Embassy Gardens development lie further away from the site and are screened from the majority of activities on site by blocks A10 and A09 of the development. As such these would not be subject to adverse effects from the Heathwall Pumping Station development.

Impacts at non-residential receptors

9.5.36 The results for non-residential receptors are shown below.

Vol 15 Table 9.5.2 Noise – impacts at non-residential receptors

Ref/receptor	Receptor sensitivity[a]	Range of construction noise levels, dBL$_{Aeq}$[b,c,d]	Ambient baseline noise level, dBL$_{Aeq}$[d]	Typical[e] monthly construction noise levels, dBL$_{Aeq}$	Magnitude	
					Total duration above ambient for all works, months	Worst-case excess above ambient, dBL$_{Aeq}$
HE6 Battersea Barge	Medium	50 – 50 (eve)	67	50	0	-17
		49 – 49 (night)	64	49	0	-15

[a] *Assumed typical façade transmission loss and appropriate internal noise guidelines*

[b] *Floors subject to highest level assessed – not necessarily the highest floor level*

[c] *Construction noise only, excludes ambient noise. Refer to Volume 2*

[d] *Noise level includes correction for façade acoustic reflection unless receptor position is an open outdoor space (eg park)*

[e] *Most frequently occurring monthly construction noise level during works*

Battersea Barge HE6

9.5.37 The Battersea Barge bar/restaurant ship would not be screened from the works until the cofferdam is completed, when a noise barrier would be erected on the edge of the temporary cofferdam.

9.5.38 The Battersea Barge is advertised as open until at least 2am, however the Barge does not open until the evening. The assessment has considered the impacts of evening and night-time construction works.

9.5.39 The worst-case evening and night-time noise levels of 50dBL_{Aeq} and 49dBL_{Aeq} would occur during one month during the construction of the connection tunnel. This is below the existing ambient noise level for both evening and night-time periods.

9.5.40 Given the degree of impact and the level of construction noise ingress to the bar/restaurant, this is assessed as **not significant**.

Road-based construction traffic

9.5.41 The location of the site at Heathwall Pumping Station provides direct access to the major road network through London. The construction programme would result in varying traffic generation over a period of three years. During the peak construction period the traffic generation is forecast to average 18 heavy vehicles (HGVs) (equivalent to 36 HGV movements) per day.

9.5.42 The major road links adjacent to and leading from the site are Battersea Park Road and Nine Elms Lane. Vehicles would not use local roads to access the site.

9.5.43 A flow change of about 25% is required to cause a change in noise level of 1dB and by 100% to cause a change of 3dB, which is considered to be the minimum change perceptible to the human ear. Additionally, a change in proportion of heavy vehicles (HGV) of 5% is also considered to cause a change in noise level of approximately 1dB.

9.5.44 The traffic modelling shows that the Annual Average Weekday Traffic (AAWT) 18hr flow on Nine Elms Lane, which is adjacent to the site, is currently over 27,000 vehicles per day (vpd), with average speeds of 30 mph (48 kph) and 20.6 % heavy vehicles (HGVs). The total number of HGVs is therefore currently over 5,600 per day.

9.5.45 The section of Battersea Park Road which is to the south west of Kirtling Street currently has the highest 18hr flow, with over 28,000 vpd and 9.7% HGVs. The AAWT 18hr flows on the other roads major roads are very similar. However, Nine Elms Lane has a significantly higher HGV percentage (20%) compared to Battersea Park Road.

9.5.46 The modelling of construction traffic on these links shows that the highest percentage increase in total flow due to construction HGVs would occur on Nine Elms Lane. The average daily number of construction HGV movements on this link during the peak month of construction is 192 (this includes HGVs from other Thames Tideway Tunnel sites). This represents a percentage increase of less than 1%.

9.5.47 Therefore, the percentage flow change and change in HGV percentage do not meet the criteria for causing a 1dB change in noise level. As the percentage flow change and change in HGV percentage criteria are not met on the link where such changes were expected to be greatest, the additional numbers of HGVs would not cause any change to the traffic noise levels.

9.5.48 Therefore there noise due to road based traffic is **not significant**.

River-based construction traffic

9.5.49 The use of barges for the transport of materials to and from the site could result in noise impacts at nearby receptors.

9.5.50 The movement of these tugs delivering and removing barges would be at appropriate stages in the tide. In between times and during standard working hours, the moored barges would be unloaded or loaded. The engine noise from movement of the barges on the river Thames is limited to 75dB(A) at 25m (Peter Brett Associates)[5].

9.5.51 At peak use, two barges (pulled by tugs) would be operating each day with the tide. Each movement (delivery and removal) would be approximately 20 minutes in duration.

9.5.52 The operation, loading and removal of the river barges which takes place within the site boundary has been considered in the construction noise assessment in paras. 9.5.1 to 9.5.40.

9.5.53 The operation of the tugs on the river outside of the site boundary have been assessed in relation to the nearest residential receptors, Elm Quay to the east and Nine Elms Pier to the west.

9.5.54 At Elm Quay the tugs would operate at a minimum distance of 70m. At this distance the predicted daytime (7am to 11pm) noise from this activity would be 49dB$L_{Aeq,}$ at the dwellings. The survey indicates the daytime noise level at this location is 68dBL_{Aeq},(see Vol 15 Appendix G Vol 15 Table G.9) which is greater than the tug noise and therefore the noise from river based construction traffic is considered to be **not significant**.

9.5.55 At Nine Elms Pier Houseboats the tugs would operate at a minimum distance of 20m. At this distance the predicted daytime (7am to 11pm) noise from this activity would be 60dB$L_{Aeq,}$ at the dwelling. The survey indicates the daytime noise levels at this location is 69dBL_{Aeq} (see Vol 15 Appendix G Vol 15 Table G.9) which is greater than the tug noise and therefore the noise from river based construction traffic is considered to be **not significant**.

Vibration

9.5.56 The assessment of construction vibration considers events which have the potential to cause human disturbance, or damage to buildings and structures. The assessments of human disturbance and effects on building structures are carried out separately using different parameters.

9.5.57 The assessment has been conducted using the methodology defined in Vol 2.

9.5.58 The assessment of human disturbance due to construction vibration impacts at neighbouring receptors has been assessed using the predicted estimated Vibration Dose Value (eVDV). The results from the assessment are presented in Vol 15 Table 9.5.3.

Vol 15 Table 9.5.3 Vibration – impact and magnitude of human response to vibration impacts

Ref	Receptor	Impact (highest predicted eVDV across all activities, $m/s^{1.75}$)*	Value/ sensitivity	Magnitude
HE1	Elm Quay	0.2	High	Low probability of adverse comment - No impact
HE2	Nine Elms Pier House boats	0.2**	High	Low probability of adverse comment -No impact
HE3	River Lodge and Icon Apartments	0.1	High	Below low probability of adverse comment -No impact
HE4	Riverlight	0.2	High	Low probability of adverse comment - No impact
HE5	Embassy Gardens	0.5	High	Below Low probability of adverse comment -No impact
HE6	Battersea Barge	0.4**	Medium	Below Low probability of adverse comment -No impact

**Most affected floor*
*** Predicted vibration levels assume groundborne transmission. For boats moored in the river it is expected that vibration transmission could be reduced and the vibration levels would be lower than those estimated*

9.5.59 All of the predicted eVDV levels at each of the receptor locations within or fall below the 'Low probability of adverse comment' band, as described in Vol 2. These levels are based upon the highest anticipated exposures during the most intense vibration activities (piling and compaction) within the site.

9.5.60 The assessment of potential construction vibration effects at adjacent buildings / structures has been assessed using the predicted Peak Particle

Velocity (PPV), according to the criteria given in Vol 2. The results of the assessment of construction vibration are presented in Vol 15 Table 9.5.4.

Vol 15 Table 9.5.4 Vibration – building vibration impacts and their magnitudes

Ref	Receptor	Impact (highest predicted PPV across all activities, mm/s)	Value/ sensitivity	Magnitude*
HE1	Elm Quay	0.1	High	Below threshold of potential cosmetic damage - No impact
HE2	Nine Elms Pier House boats	0.1*	High	Below threshold of potential cosmetic damage - No impact
HE3	River Lodge and Icon Apartments	0.1	High	Below threshold of potential cosmetic damage - No impact
HE4	Riverlight	0.5	High	Below threshold of potential cosmetic damage - No impact
HE5	Embassy Gardens	0.4	High	Below threshold of potential cosmetic damage - No impact
HE6	Battersea Barge	0.3*	Medium	Below threshold of potential cosmetic damage - No impact

** Predicted vibration levels assume groundborne transmission. For boats moored in the river it is expected that vibration transmission could be reduced and the vibration levels would be lower than those estimated.*

9.5.61 The vibration levels reported here are well below the levels likely to cause cosmetic building damage according to the criteria described in Vol 2.

9.5.62 Vibration levels are below levels likely to cause even minor cosmetic building damage at all buildings, and below the ‘Low probability of adverse comment’ threshold for human comfort at all buildings. As this impact would last less than two days this is not significant. Vibration effects are therefore **not significant** to any receptors.

Sensitivity test for programme delay

9.5.63 For the assessment of noise and vibration effects during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors. Based on the site development schedule (Vol 15 Appendix N), there would be no new receptors, within the assessment area, requiring assessment as a result of a one year delay.

9.6 Operational effects assessment

Impacts from potential noise and vibration sources

9.6.1 The following section describes the potential noise and vibration effects from various sources identified for assessment.

Noise from operational plant at above ground structures

9.6.2 A passive ventilation system is to be installed at Heathwall Pumping Station and therefore there is no requirement to install active ventilation equipment at this location. Plant which has been included in this section is as described in para. 9.2.12.The prediction method and assumptions are described in Vol 2.

9.6.3 The appropriate emission limits are shown below in Vol 15 Table 9.6.1, based on local authority requirements to ensure that no adverse effects would occur. As there is no active ventilation plant for the drop shaft to generate noise at this site, these limits would only apply to any minor plant equipment. It is not planned to include any cooling fans for the kiosks but if detailed design showed this to be necessary, these small wall-mounted units would be controlled to meet the criteria in Vol 15 Table 9.6.1. However, it should be noted that any such small fans would be expected to have a relatively low noise emission (approximately 45dB(A) at 3m).

9.6.4 There would be a pump to maintain hydraulic pressure in the hydraulic pipe-work and rams for the penstocks although the noise emission would be short and infrequent. It is expected that this would produce a whirring noise about once a week with a duration of 30 seconds to 2 minutes depending on the size of the penstock and hydraulic system. The plant would be operated for testing purposes once every three months. The power pack, pump and motor would be located within the kiosk and would be shielded with an acoustic surround if necessary to meet the requirements in Vol 15 Table 9.6.1.

9.6.5 Vol 15 Table 9.6.1 shows, for each receptor, that the estimated plant noise level is below the local authority limit or is less than ambient levels for residential and non-residential receptors respectively.

Vol 15 Table 9.6.1 Noise – operational airborne noise impacts

Ref	Receptor	Lowest baseline noise level	Impact	Value/ sensi-tivity	Magnitude
HE 1	Elm Quay	47dBL_{A90},	Plant noise emission rating level at receptor less than 37dB$L_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact

Ref	Receptor	Lowest baseline noise level	Impact	Value/ sensi-tivity	Magnitude
HE 2	Nine Elms Pier House boats	$50dBL_{A90}$,	Plant noise emission level at receptor less than $40dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
HE 3	River Lodge and Icon Apartments	$48dBL_{A90}$,	Plant noise emission level at receptor less than $38dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
HE 4	Riverlight	$50dBL_{A90}$,	Plant noise emission level at receptor less than $40dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
HE 5	Embassy Gardens	$66dBL_{A90}$	Plant noise emission level at receptor less than $66dBL_{Ar,Tr}$	High	Plant noise level below local authority limit*,– no adverse impact
HE 6	Battersea Barge	$64dBL_{Aeq}$	Plant noise emission level at receptor less than $64dBL_{Aeq}$	Mediu m	Plant noise level below ambient evening level – no adverse impact

** Limit referred to is that identified for the Local Authority in which the receptor is located (see para.9.3.19).*

9.6.6 The results given above in Vol 15 Table 9.6.1 show that there are no adverse impacts and the effects of plant noise at these emission levels is assessed as **not significant**. In the case of the residential receptors, this is based on compliance with the local authority requirements to prevent disturbance. For the non-residential receptor the noise levels would be below ambient noise levels and therefore considered not to result in significant effects.

Noise and vibration from tunnel filling

9.6.7 Measurements taken during storm and non-storm events at operational drop structures in the United States, equivalent to those being considered for the Thames Tideway Tunnel, have been used to inform the assessment of noise and vibration during tunnel filling events. These studies (Jain, SC and Kennedy, JF., 1983)[6] are described in Vol 2. The highest noise level measured on a mesh grille directly over a similar drop shaft, during this study, was 61dBL_{Aeq} during a severe storm event.

9.6.8 These events are not typical and only occur during severe rain storms. At Heathwall Pumping Station, the drop shaft would be enclosed and any noise at the surface would be attenuated by the structure or the carbon filters. At the surface the noise level would be approximately 46dBL_{Aeq}, which is less than the prevailing ambient noise level at this site.

9.6.9 The highest peak particle velocity (PPV) measured directly at the existing drop shaft sites used in the case studies as described in Vol 2 was 0.034mm/s. These measured PPV values are well below the levels for vibration to be perceptible, according to the criterion given in Vol 2. Similarly, the levels are well below the transient and continuous vibration guideline criterion associated with the potential onset of minor cosmetic building damage.

9.6.10 The noise and vibration from tunnel filling events would occur only occasionally during heavy rainfall events and, in any case, is predicted to be not perceptible/ less than the ambient noise level at the receptors. Therefore this is assessed as **not significant**.

Operational maintenance

9.6.11 As part of the operation of the tunnel, there would need to be routine but infrequent maintenance carried out at the site. Two cranes would be required for ten yearly shaft inspections. This would be carried out during normal working hours, using equipment which is likely to increase ambient noise levels. Given the infrequency of this operation, it is considered that a significant noise effect would not occur.

9.6.12 Routine inspections, lasting approximately half a day, would occur every three to six months and would not require heavy plant. As this would be carried out during the daytime with minimal noisy equipment operating over short periods of time, it is considered that further assessment of noise generated by this activity is not required.

9.6.13 As no impacts have been identified from the operation of the site, this is assessed as **not significant**.

Noise from operational traffic

9.6.14 Additional traffic associated with operation of the site would be limited to vehicles used by maintenance and inspection workers. This is likely to be a number of light commercial vehicles used during routine inspection visits every three to six months and shaft inspections approximately every ten years.

9.6.15 As a proportion of the existing traffic on the road network these vehicles would not contribute to the traffic noise level and the noise effects of these movements are assessed as **not significant**.

Sensitivity test for programme delay

9.6.16 For the assessment of noise and vibration effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors as the operational effects of the Thames Tideway Tunnel are considered to be not significant. Based on the site development schedule (Vol 15 Appendix N), there would be no new receptors, within the assessment area, requiring assessment as a result of a one year delay.

9.7 Cumulative effects assessment

9.7.1 Of the projects described in Section 9.3, the Embassy Gardens, Nine Elms Parkside site and Riverlight developments could give rise to cumulative effects on noise and vibration.

Construction effects

9.7.2 It is likely that the ongoing construction of the Embassy Gardens (blocks A01-A05 and A07) throughout the Heathwall Pumping Station construction phase would increase noise levels at all receptors considered in this assessment. Blocks A09 and A10 of the Embassy Gardens development would be close to both construction sites and would also be subject to noise from the adjacent construction of the Nine Elms Parkside site, which would last the duration of construction at the Heathwall Pumping Station site.

9.7.3 As Elm Quay and Riverlight block F have a significant noise impact from the Heathwall Pumping Station development, the cumulative impact would be the same. There is a strong likelihood of a cumulative significant impact at Embassy Gardens blocks A09 and A10, owing to the distance from the other sites.

9.7.4 It is not considered that there would be cumulative effects at the Battersea Barge or houseboats, as these are further away from the other construction sites and would be screened by the pumping station and hoarding, although they would be closer to the development of Riverlight block A.

9.7.5 In the event that the programme for the Thames Tideway Tunnel is delayed by approximately one year, more of the Embassy Gardens, Nine Elms Parkside and Riverlight developments may be built and occupied which would lead to a corresponding reduced level of cumulative activity. Cumulative effects would therefore be no greater than described above.

Operational effects

9.7.6 None of the projects described in Section 9.3, are considered relevant to the operational cumulative assessment at Heathwall Pumping Station as due to their use, they are not expected to generate significant noise or vibration levels during their operation. As such, no cumulative operational noise or vibration effects are identified. This would also be the case if the programme for the Thames Tideway Tunnel project was delayed by approximately one year.

9.8 Mitigation and compensation

Construction

9.8.1 The above assessment has concluded that there are significant adverse noise effects during the construction phase at the Riverlight block F development. However, no further practicable noise mitigation can be adopted on site above those measures identified in the *CoCP*.

9.8.2 A *noise insulation and temporary re-housing policy* has been established (see Schedule 2 of the *Statement of Reasons*, which accompanies this application). The policy seeks to offset the potential adverse noise effects arising from construction and would be available to those residents where predicted or measured construction noise levels exceed trigger levels published in the policy. As there is no guarantee that the noise control measures would be accepted by the affected party, the two scenarios (with and without implementation of the policy) are presented in the residual effects section below.

9.8.3 Riverlight Block F may be eligible for noise insulation as described in the policy. This is a commonly used measure to control construction noise ingress to residential properties.

9.8.4 The effect of noise insulation on noise exposure inside the properties has been assessed in Section 9.9.

9.8.5 No significant effects have been identified as a result of vibration at this site.

Operation

9.8.6 The above assessment has concluded that there are not likely to be any significant adverse effects during the operational phase that would require mitigation.

Monitoring

9.8.7 Monitoring of construction noise would be carried out as described in the *CoCP*. It is not anticipated that there would be any need for monitoring of operational noise.

9.9 Residual effects assessment

Construction effects

9.9.1 The construction noise assessment set out above in Section 9.5 has identified significant effects at Riverlight block F development

9.9.2 The significant noise effects could be addressed by noise insulation as set out in the *noise insulation and temporary re-housing policy* (see para. 9.8.2). It must be recognised, however, that the affected residents may not wish to take up the offer of noise insulation and thus the residual construction noise effects remains as presented in Section 9.5.

9.9.3 If a noise insulation package as described in the *Thames Tideway Tunnel noise insulation and temporary re-housing policy* were installed, the internal daytime noise levels at Riverlight block F are estimated to reduce during the short period of worst-case noise levels to below the guidance criteria for living rooms. At night, noise levels are also estimated to be below internal night-time guidance levels for bedrooms. The inclusion of mechanical ventilation as part of the insulation package would allow windows to be closed at night-time to realise the full benefit of the noise insulated glazing. With the inclusion of a noise insulation package the construction noise effects would be rated as **not significant**.

Operational effects

9.9.4 As no mitigation measures are proposed, the residual operational effects remain as presented in Section 9.6.

9.10 Assessment summary

Vol 15 Table 9.10.1 Noise – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Surface construction noise				
HE1 - Elm Quay	Noise	Not significant	None	Not Significant
HE2 - Nine Elms Pier Houseboats	Noise	Not significant	None	Not significant
HE3 - River Lodge and Icon Apartments	Noise	Not significant	None	Not significant
HE4 – Riverlight (Block F)	Noise	Significant	No further on site mitigation practicable	Significant, however properties may be eligible for noise insulation, which if accepted, would reduce the effect to not significant. See para 9.9.3.
HE5 - Embassy Gardens	Noise	Not significant	None	Not significant
HE6 - Battersea Barge	Noise	Not significant	None	Not significant
Road-based construction traffic				
Residential and non-residential properties adjacent to the proposed vehicle route	Noise	Not significant	None	Not significant
River-based construction traffic				
HE2 - Nine Elms Pier Houseboats	Noise	Not significant	None	Not significant
HE1 - Elm Quay	Noise	Not significant	None	Not significant

Vol 15 Table 9.10.2 Vibration – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
HE1 - Elm Quay	Vibration	Not significant	None	Not significant
HE2 - Nine Elms Pier House boats	Vibration	Not significant	None	Not significant
HE3 - River Lodge and Icon Apartments	Vibration	Not significant	None	Not significant
HE4 - Riverlight	Vibration	Not significant	None	Not significant
HE5 - Embassy Gardens	Vibration	Not significant	None	Not significant
HE6 - Battersea Barge	Vibration	Not significant	None	Not significant

Vol 15 Table 9.10.3 Noise – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
HE1 - Elm Quay	Noise	Not significant	None	Not significant
HE2 - Nine Elms Pier House boats	Noise	Not significant	None	Not significant
HE3 - River Lodge and Icon Apartments	Noise	Not significant	None	Not significant
HE4 - Riverlight	Noise	Not significant	None	Not significant
HE5 - Embassy Gardens	Noise	Not significant	None	Not significant
HE6 - Battersea Barge	Noise	Not significant	None	Not significant

Vol 15 Table 9.10.4 Vibration – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
HE1 - Elm Quay	Vibration	Not significant	None	Not significant
HE2 - Nine Elms Pier House boats	Vibration	Not significant	None	Not significant
HE3 - River Lodge and Icon Apartments	Vibration	Not significant	None	Not significant
HE4 - Riverlight	Vibration	Not significant	None	Not significant
HE5 - Embassy Gardens	Vibration	Not significant	None	Not significant
HE6 - Battersea Barge	Vibration	Not significant	None	Not significant

References

[1]Department of Environment, Food and Rural Affairs. *National Policy Statement for Waste Water*. (2012). Available at: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf last accessed November 2012

[2] British Standards Institution. BS 4142. *Method for rating industrial noise affecting mixed residential and industrial areas*. (1997).

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

[4] BRITISH STANDARDS INSTITUTION, BS 8233 Code of Practice for Sound insulation and noise reduction for buildings, British Standards Institution (1999)

[5] Peter Brett Associates on behalf of Lafarge Cement UK, Northfleet Works Bulk Aggregates Import Terminal. Document 2h: *Environmental Statement* Volume 3 Appendices: Appendix D.3.

[6] Jain, S.C. and Kennedy, J.F. *Vortex-Flow Drop Structures for the Milwaukee Metropolitan Sewerage District Inline Storage System*. Iowa Institute of Hydraulic Research. IIHR Report No 264 (Jul 1983).

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

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Volume 15: Heathwall Pumping Station site assessment

Section 10: Socio-economics

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 10: Socio-economics

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10 Socio-economics

10.1 Introduction

10.1.1 This section presents the findings of the assessment of the likely significant socio-economic effects of the proposed development at the Heathwall Pumping Station site. At this site effects during construction are considered on the Battersea Barge bar and restaurant vessel, on users of the Thames Path National Trail and Right of Way (Thames Path) and on nearby residents. During the operational phase, effects are considered on users of the Thames Path and the associated future public amenity space that would be created as a result of the project.

10.1.2 The likely significant project-wide socio-economic effects, including employment generation, stimulation of industry, and leisure and recreation related effects on users of the River Thames are described in Volume 3 Project-wide effects assessment.

10.1.3 The assessment of socio-economics presented in this section has considered the requirements of the National Policy Statement for Waste Water Sections 4.8 (land use) and 4.15 (socio-economic) (Defra, 2012)[1]. Further details of these requirements can be found in Volume 2 Environmental assessment methodology Section 10.3.

10.1.4 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station Figures).

10.1.5 This assessment has drawn on the findings of the air quality and odour, noise and vibration and townscape and visual assessments (Sections 4, 9 and 11 respectively within this volume).

10.2 Proposed development relevant to socio-economics

10.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to socio-economics are set out below.

Construction

10.2.2 A temporary cofferdam would extend into the river requiring the temporary relocation of a business, the Battersea Barge bar and restaurant vessel, for the duration of the construction phase. The vessel would be relocated approximately 7m upstream of its current location.

10.2.3 Construction would occur partly on the vacant Middle Wharf (a former concrete batching plant site) and partly within the Heathwall Pumping Station compound.

10.2.4 Works at the site are expected to last approximately three years. For detail on construction working hours, see Section 3.3 of this volume.

10.2.5 Construction related activities, including traffic and lorry movements, could result in amenity effects (caused by air quality impacts, construction dust, noise, vibration, and visual impacts) being experienced by a range of sensitive socio-economic receptors in proximity to the proposed activities (refer to Volume 2 Environmental assessment methodology for further information on the amenity assessment methodology).

Direct employment creation on site

10.2.6 Construction is expected to require a maximum workforce of approximately 40 workers at any one time. The number and type of workers is shown in Vol 15 Table 10.2.1.

Vol 15 Table 10.2.1 Socio-economics – construction worker numbers

Contractor		Client
Staff*	**Labour****	**Staff*****
08:00-18:00	**08:00-18:00**	**08:00-18:00**
15	20	5

** Contractor Staff – engineering and support staff to direct and project manage the engineering work and site.*
***Labour – those working on site doing engineering, construction and manual work.*
****Client Staff – engineering and support staff managing the project and supervising the Contractor*

Code of Construction Practice

10.2.7 Measures applicable to all sites incorporated into the *Code of Construction Practice (CoCP) Part A* to limit significant adverse air quality, construction dust (Section 7), noise, vibration (Section 6), and visual impacts (Section 4) would help to reduce socio-economic effects, particularly amenity effects.

10.2.8 The *CoCP Part A* also confirms that all land, including highways, footpaths, public open spaces, river embankments / waterways, loading facilities or other land occupied temporarily would be made good to the satisfaction of Thames Water[i] and the local authority where required. This would be in accordance with the Ecology and landscape management plan and the approved landscape design for the site (see Section 4 within the *CoCP Part A*).

10.2.9 Further site specific measures, which could reduce socio-economic effects and particularly amenity effects, are incorporated into the *CoCP Part B*. See the *CoCP* sections in the air quality and odour, noise and vibration, and townscape and visual construction effect assessment sections (Sections 4.2, 9.2 and 11.2 respectively within this volume) for details on the type of measures that would be employed.

10.2.10 Section 5 within the *CoCP Part B* also includes the following provisions:

[i] Thames Water Utilities Ltd (TWUL). The Draft Development Consent Order (DCO) contains an ability for TWUL to transfer powers to an Infrastructure Provider (as defined in article 2(1) of the DCO) and / or, with the consent of the Secretary of State, another body.

a. That access will be maintained to and from Battersea Barge during construction, including during its temporary relocation.

b. The *CoCP Part B* also makes provision for signage, safe crossing points, and other required measures to be provided for pedestrians and cyclists at site accesses to address the potential hazards (see Section 5 within the *CoCP Part B*).

Operation

10.2.11 The requirement for above ground structures, as described in Section 3 of this volume, would result in the extension of the existing river wall out into the River Thames. These structures would be within the parameter areas shown on the Site parameter plan (see separate volume of figures – Section 1). This would create a small area of new public amenity space and a publicly accessible riverside walkway between Middle Wharf and the Riverlight development linking the Thames Path on either side, available for passive recreational use by the public. Middle Wharf would remain safeguarded, and there would be no public access to this area of land.

Environmental design measures

10.2.12 Measures which have been incorporated into the design of the proposed development (described in the design principles) include:

a. a new, publicly accessible riverside walkway (minimum width of 4m, if practicable) providing access to the foreshore structure. Provision would be made for its closure during essential maintenance activities and the operation of the safeguarded wharf if required. A diversion via Nine Elms Lane (along the route of the existing Thames Path) would be clearly signposted when the riverside walkway is closed.

b. incorporation of materials and furniture in the public realm which would be in accordance with the public realm strategy in the *Vauxhall Nine Elms Battersea Opportunity Area Planning Framework* and would coordinate with materials used in the adjacent St James Riverlight development.

c. provision of high quality fencing to the southern (back) edge of the riverside walkway which would incorporate secure access gates to the pumping station and Middle Wharf and would have fencing finishes that tie in with the adjacent Riverlight development.

10.3 Assessment methodology

Engagement

10.3.1 Vol 2 Section 10 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of socio-economics are presented in Vol 15 Table 10.3.1.

Vol 15 Table 10.3.1 Socio-economics – stakeholder engagement

Organisation	Comment	Response
Environment Agency, April 2011	It is considered that the use of foreshore sites is likely to lead to a number of detrimental effects in relation to flood risk management, biodiversity and recreation.	Consideration of the impact of the proposed development at the site on recreational facilities has been considered where appropriate.
London Borough (LB) of Wandsworth, May 2011	Consideration needs to be given to the fact that the proposals for the Tideway Walk (Riverlight) residential development could be the first to occur in the Vauxhall Nine Elms Battersea (VNEB) Opportunity Area. This development could therefore potentially act as a catalyst for development in the wider VNEB Opportunity Area.	Although the identified site to which this comment applies is no longer included in the project, the assessment has considered the potential impacts on the Tideway Walk (Riverlight) residential development.
LB of Wandsworth, May 2011	Noise, air quality and visual effects should be scoped in, and considered in relation to impact on existing house boats and expected nearby future development (at Tideway Industrial Estate and Battersea Power Station).	An assessment of amenity effects caused by air quality, noise and visual impacts was scoped in, and has been undertaken in this report. The assessment has considered relevant residential receptors present in the base case, including the house boats.
London Councils, February 2012	The noise, pollution and congestion caused by site traffic will impact on quality of life for local residents.	Consideration of the impact of the proposed development on residential amenity has been considered as part of this assessment.
Greater London Authority (including Transport for London), February, 2012 Appendix 1	The current site is broadly acceptable; however Thames Water need to ensure that a good quality signposting of the Thames Path, during the construction works.	It is not proposed to divert the Thames Path at this site during construction as the Thames Path does not run along the river frontage at this location. However, Section 5.3 of the *CoCP Part A* includes provision to ensure suitable

Organisation	Comment	Response
		signage, lighting and barriers will be provided for any diverted right of way; and also that any proposed temporary diversionary signage for pedestrians on TLRN will be agreed with TfL.
LB of Wandsworth, September 2012	Thames Water must find a suitable alternative location that is agreeable to the owners of the Battersea Barge and the Council and facilitate its return post construction.	The defined development includes provision for the temporary relocation of the Battersea Barge to the west including provision of associated mooring and access. An assessment of the effect on the Battersea Barge business of its temporary relocation is included in Section 10.5. The Battersea Barge would be returned to its existing location after construction is completed.

Baseline

10.3.2 The baseline methodology follows the methodology described in Vol 2 Section 10. There are no site specific variations for identifying the baseline conditions for this site.

Construction

10.3.3 For this site, the base case is the peak year of construction works. The assessment area is as set out in Vol 2 Section 10.5.

10.3.4 The assessment methodology for the construction phase follows that described in Vol 2 Section 10. There are no site specific variations for undertaking the construction assessment of this site.

10.3.5 Section 10.5 details the likely significant effects arising from the construction at Heathwall Pumping Station. Another nearby Thames Tideway Tunnel project site which could give rise to additional effects at this site on the Thames Path is Kirtling Street. This site is therefore included in this assessment.

10.3.6 Of the developments listed in the site development schedule (see Vol 15 Appendix N), there are four which have been considered relevant for the types of effects considered within the construction assessment base case. These developments are:

a. Embassy Gardens (Buildings A09, A10 and A11) – approximately 15m from the site at its closest point and including residential and commercial floorspace, social and community facilities.

b. Riverlight (Blocks B, C, D, E & F) – adjacent to the site at its closest point and including residential, commercial, community floorspace.

c. Battersea Power Station (Phases 1 and 2) – approximately 360m west of the site, involving provision of open space and landscaping (including pedestrian and cycle routes that would facilitate improved access to and from the Thames Path in the vicinity).

d. St George's Wharf, Vauxhall Tower – approximately 550m from the site and including improvements to the Thames Path and public realm.

10.3.7 These developments (or parts thereof as described) would be complete and operational by the base case year. They are relevant as they would alter the baseline by increasing the number of residential receptors within 250m of the site that would be potentially sensitive to amenity effects and by affecting the provision of recreational assets (including public open space and amenity space within 400m of the site and the Thames Path within 1km of the site).

10.3.8 Of the developments listed in the site development schedule (see Vol 15 Appendix N), there are three which have been considered relevant in relation to the construction effects cumulative assessment:

a. Embassy Gardens (Buildings A01, A02, A03, A04, A05 & A07) – approximately 15m south from the site at its closest point

b. Nine Elms Parkside (Plots C & D) – approximately 45m south of the site at its closet point

c. Riverlight (Block A) – Riverlight is adjacent to the site although Block A is located on the far western side of the Riverlight development.

10.3.9 These developments, located within 250m of the site, would be under construction at the same time as the Thames Tideway Tunnel project (both in Site Year 1 of construction and the peak year). Therefore, they could potentially also give rise to cumulative amenity effects on nearby sensitive receptors. The only non-amenity related effect considered at this site is with regard to the displacement of Battersea Barge and none of the developments that would be under construction at the same time as the Thames Tideway Tunnel project would give rise to any cumulative effects on that receptor.

10.3.10 The assessment of operational effects also considers the extent to which the effects on socio-economics would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Operation

10.3.11 The base case is Year 1 of operation. The assessment area is as set out in Vol 2 Section 10.5.

10.3.12 The assessment methodology for the operational phase follows that described in Vol 2 Section 10. There are no site specific variations for undertaking the operational assessment of this site.

10.3.13 Section 10.6 details the likely significant effects arising from the operation of the proposed development at Heathwall Pumping Station. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on socio-economics within the assessment area for this site in the operational phase, therefore no other Thames Tideway Tunnel project sites are considered in this assessment.

10.3.14 Of the developments listed in the site development schedule (see Vol 15 Appendix N), there are none would introduce new receptors into the operational base case; significantly alter circumstances for those receptors covered by the operational assessment, or give rise to cumulative effects. This is because the only receptor covered in the operational assessment is users of the new public amenity space and new section of riverside Thames Path and none of the developments would affect those users.

Assumptions and limitations

10.3.15 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 10.

Assumptions

10.3.16 The following assumption is specific to the assessment of this site. As a result of developments in the surrounding area, it is assumed that the number of pedestrians and cyclists using the Thames Path and public open spaces will gradually increase from the existing levels, as developments are completed and occupied, but that user numbers would not peak until some time after the completion of construction at the site.

Limitations

10.3.17 There are no limitations specific to the assessment of this site.

10.4 Baseline conditions

Current baseline

10.4.1 The following section sets out the baseline conditions for socio-economics within and around the site. Future baseline conditions (base case) are also described.

Local context

10.4.2 The local areas surrounding the site predominantly comprise light industrial and warehouse employment premises. There is currently a relatively limited amount of residential development to the east along the riverfront which forms the majority of housing within 250m of the site. A pocket park sized amenity space lies adjacent to the east of the site at Elm Quay (see Vol 15 Figure 2.1.2 in separate volume of figures). The River Thames and Thames Path both run past the site. Beyond 250m and up to 1km, there is further housing, although the majority of it is separated from the site by major roads, railway lines and industrial sites.

Community profile

10.4.3 A detailed community profile is outlined in Vol 15 Appendix H.1[ii]. The following points provide a summary of the community profile and provide context for this socio-economic assessment:

a. The resident population was approximately 775 people within 250m of the site[iii] and approximately 33,225 within 1km[iv] at the time of the last census for which data is available[v].

b. Within 250m the proportion of under 16 year olds (6.2%) is approximately one third that within 1km and the LB of Wandsworth, and even lower in comparison to Greater London overall (20.2%).

c. The proportion of over 65 year olds within 250m (18.6%) is moderately higher than within 1km (12.6%) and Greater London (12.4%).

d. Within 250m, White residents comprise over four fifths of the population (88.3%), somewhat higher than within 1km and higher still than across Greater London (71.2%). Correspondingly, the proportion of Black and Minority Ethnic (BME) residents within 250m (11.7%) is approximately half that within the LB of Wandsworth and almost a third of the Greater London proportion (28.8%).

e. Within 250m, the proportion of residents suffering from a long term or limiting illness (13.5%) is broadly in line with the LB of Wandsworth but slightly lower than the Greater London average (15.5%). Within 250m the proportion of residents claiming disability living allowance (3.0%) is considerably lower than within 1km (5.4%) and across London (4.5%).

f. The level of adult obesity in the local area is around the Greater London average. Adult residents within the LB of Wandsworth are amongst the most physically active adults in Greater London but children in the local area are amongst the least physically active. Female life expectancy within the local area is also relatively low.

g. The incidence of income deprivation within 250m of the site (19.7%) is considerably lower than within 1km (27.5%) and Greater London (30.8%). There is no recorded incidence of overall deprivation within 250m; contrasting strongly with both the area within 1km (21.3%) and the average for Greater London (24.5%).

10.4.4 The above community profile suggests that the occupants of local housing, especially those living within 250m of the site, are often older White residents. The picture on health is mixed, with local residents having a fairly low life expectancy despite lower than average levels of deprivation for residents within 250m in comparison to Greater London.

[ii] Information sources are provided in the appendix.

[iii] The statistics presented for the assessment area within 250m of the site include only that area on the same side of the River Thames as the proposed development.

[iv] The statistics presented for the assessment area within 1km of the site include both sides of the River Thames.

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

Economic profile

10.4.5 A local economic profile (based on 2012 data) is presented in Vol 15 Appendix H.2. The following points provide a summary of the community profile and provide context to this socio-economic assessment:

a. Within approximately 250m of the site there are approximately 1,700 jobs and 140 businesses[vi].

b. The three leading employment sectors as measured by employment within approximately 250m are: Wholesale and Retail Trade / Repair of Motor Vehicles and Motorcycles; Administrative and Support Services; and Other Service Activities.

c. The three leading employment sectors as measured by number of businesses at locations / units within approximately 250m are: Wholesale and Retail Trade / Repair of Motor Vehicles and Motorcycles; Professional, Scientific and Technical Activities and. Administrative and Support Service Activities sectors.

d. At all geographical levels, most businesses fall within the micro size band (one to nine employees). However, within approximately 250m of the site, the proportion of small businesses (ten to 24 employees) and medium sized businesses (25 to 249 employees) is considerably greater than within both the LB Wandsworth and Greater London.

e. Businesses within the micro size banding account for the majority within each of the leading sectors within 250m. Within the Administrative and Support Service Activities sector, small businesses comprise 21% and medium sized businesses 16% of the total, considerably greater than the average proportions for all geographical levels.

Receptors

Business – the Battersea Barge

10.4.6 Battersea Barge is a permanently moored vessel to the west of the Heathwall Pumping Station. The barge operates as a restaurant and bar business. Vol 15 Figure 10.4.1 (see separate volume of figures) shows the location of this receptor.

10.4.7 The Battersea Barge is accessed by a gangway from the Thames Path. The barge has indoor drinking, dining and entertainment facilities with views across the river. An outdoor deck space provides views across the River Thames; however this deck is mostly used for circulation and not as a regular dining or drinking space. While the precise number of employees is not known, it is estimated that the business is equivalent to a micro (one to nine employees) size enterprise.

[vi] Source: Experian 2012. Data is aggregated for seven digit post-code units falling wholly or partially within a 250m of the limits of land to be acquired or used (LLAU), including post code units on the opposite side of the River Thames if relevant. Employee data reflect a head count of workers on-site rather than Full Time Equivalent (FTE) jobs. The count of businesses relates to business ‘locations’ or ‘units’; an enterprise may have a number of business locations / units. Businesses as defined here include private sector, public sector and voluntary / charitable entities.

10.4.8 It is understood that the barge largely relies on trade from evening events, dining and private events. The barge does not operate during lunchtime hours, aside from weekends when it may be hired for private events.

10.4.9 The sensitivity of the Battersea Barge to its temporary relocation relates to the availability of an alternative location (ie, an alternative river mooring) that can enable the business to continue as a viable operation, including being able to attract customers in the same way as it does now. There is an alternative mooring position available close by, approximately 7m upstream of the barge's current location.

10.4.10 The sensitivity of the business to amenity effects is directly linked to the sensitivity of their customers to amenity impacts. If customers are sufficiently deterred from dining and drinking at the Battersea Barge by amenity impacts such as noise, dust or unpleasant views, then the business would in turn suffer deterioration in trade. The Battersea Barge's drinking, dining and staging areas are mostly indoors; this would limit customers' sensitivity to certain effects, such as noise and visual effects.

10.4.11 In terms of the sensitivity of employees working at the business, the hotel, catering and leisure industry typically employs high rates of part time staff and has one of the highest UK labour turnover rates (People1st, 2011)[2].

10.4.12 On the basis of the above factors, it is considered that the sensitivity of the business to impacts associated with the project would be medium.

Thames Path

10.4.13 The Thames Path is a recreational asset and national trail. It follows the river for almost its entire length and in west and central London it runs on both sides of the river. At this location, the Thames Path runs along the river either side of the pumping station and Middle Wharf, and along the southern edge of the pumping station along Nine Elms Lane. This section of the Thames Path is also known as 'Tideway Walk'.

10.4.14 Vol 15 Figure 10.4.1 (see separate volume of figures) shows the location of this receptor.

10.4.15 The nature and appearance of the path varies in this area. To the east, the path is in reasonable condition, but adjacent to the site on Nine Elms Lane and to the west of the site the path is worn and unevenly paved. While the character of the path varies in its surroundings and views, it is generally not as pleasant as most other sections of the Thames Path elsewhere in London.

10.4.16 During two site visits the path was observed to be lightly used. The few pedestrians who made use of the path appeared to be local residents.

10.4.17 These observations are corroborated by pedestrian surveys undertaken as part of Section 12 of this volume. These recorded a peak hourly usage of 12 pedestrians in the AM peak hour, who routed along the western boundary of the Heathwall Pumping Station site to access the Thames Path from Nine Elms Lane. During the PM peak hour, 2 pedestrians routed along the western boundary of the site to access the Thames Path. On the basis of this data, it is concluded that the Thames Path is lightly used at this location.

10.4.18 The main factor affecting the sensitivity of users of the Thames Path is the availability of alternatives. The Thames Path is a metropolitan-wide recreational asset and users have access to alternative and comparable stretches of the Thames Path on both sides of the river across west and central London. More locally, with regard to the section of the path that runs past the site, there is an alternative route available of comparable length and quality on the other side of Nine Elms Lane.

10.4.19 In terms of their sensitivity to amenity impacts, users of the path are only likely to be in the vicinity for the time that it takes them to pass by the site (likely to be a minute or two for most users). Therefore the duration for which users would experience amenity effects would be limited.

10.4.20 On the basis of the above factors, it is considered that the sensitivity of Thames Path users to impacts associated with the project would be low.

Public amenity space (future) associated with the Thames Path

10.4.21 An area of riverfront public amenity space would be created as part of the proposed development. This space would be accessed by the realigned Thames Path route in the operational phase of the development.

10.4.22 In terms of the value of this space and the rerouted path and the consequent sensitivity of users, the availability of comparable amenity and open space is a key factor to consider. As well as the existing spaces available for passive recreation along the Thames noted above, there will be several additional public amenity and open spaces associated with the development that is due to come forward in the surrounding area (as outlined in Section 10.3).

10.4.23 Taking these factors into account, it is considered that the sensitivity of users of the future riverside public amenity space to the creation of additional public amenity space would be low.

Residential

10.4.24 There are existing and base case residential developments near the proposed construction site, as identified by the air quality and construction dust, noise and vibration and visual assessments.

10.4.25 Land that is predominantly used for residential development is shown in the land use plan for this site, see Vol 15 Figure 2.1.2 (see separate volume of figures).

10.4.26 It is considered that the sensitivity of nearby residents to overall amenity effects would vary by time of day, with residents being somewhat less sensitive to amenity effects, particularly noise, during the day and more sensitive to such effects during the evening and night.

10.4.27 Therefore, as outlined in the methodology for this socio-economic impact assessment (see Vol 2 Section 10) the sensitivity of nearby residential receptors to amenity impacts would be medium during the day and high during the evening and night.

Summary

10.4.28 A summary of receptors as described in the baseline and their sensitivity is provided in Vol 15 Table 10.4.1.

Vol 15 Table 10.4.1 Socio-economics – receptor values / sensitivities

Receptor	Value / sensitivity and justification
Business – Battersea Barge	Medium – an alternative mooring point a short distance upstream would allow the relocated barge to replicate its current business model. Business activities are mostly indoors, so customers would have limited exposure to possible amenity impacts.
Users of the Thames Path	Low – alternative and comparable routes are available. Most users would be near the site for a short duration.
Users of the public amenity space (future) associated with the rerouted Thames Path	Low – future users would have access to several (newly developed) alternative areas of public amenity and open space nearby.
Residents	Medium / High – residents have limited opportunity to avoid effects. They would have medium sensitivity to amenity effects overall during the day and high sensitivity to amenity effects overall during the evening and night.

Construction base case

10.4.29 The construction assessment year and area are as set out in para. 10.3.3.

10.4.30 The base case in the peak year of construction taking into account the schemes described in 10.3.6 would differ from the baseline in the following ways:

a. There would be an increase in the number of residential dwellings by the base case year located within 250m of the site that could potentially be affected by amenity impacts arising from the proposed development. These new residential receptors are identified in the air quality, noise and vibration and townscape and visual assessments.

b. In association with new surrounding development that would be in place:

   i Certain sections of the Thames Path, including those nearby Vauxhall Tower, Riverlight and Battersea Power Station will have been enhanced and in some cases realigned along the riverfront resulting in an improved recreational facility for pedestrians and cyclists.

   ii New areas of public amenity space and public open space will be created in association with all of the new residential development.

   iii It is assumed that the number of people using the existing and new facilities would be likely to increase substantially, in line with the increase in the number of workers and residents in the nearby area (although it is assumed that the number of users would not peak until sometime after the completion of construction).

10.4.31 These proposals, together with proposals in the wider VNEB Opportunity Area, are likely to increase the number of pedestrians and cyclists using the Thames Path on a regular basis in the area.

Operational base case

10.4.32 The operational assessment year and area are as set out in para. 10.3.11.

10.4.33 As described in para. 10.3.14, there are no developments relevant to the operational assessment within the assessment area that would alter the base case.

10.5 Construction effects assessment

Temporary displacement of a business – the Battersea Barge

10.5.1 The Battersea Barge would be temporarily relocated a short distance upstream prior to the commencement of construction. At the end of the construction phase the Battersea Barge would be returned to its original mooring position.

10.5.2 The magnitude of the impact is influenced by the following factors:

a. The duration of the relocation would be medium term.

b. The extent of the impact in terms of locational factors would be limited as the Battersea Barge would be moved only a short distance and whatever benefits that the business derives from being in its baseline riverside setting would effectively be the same in the new location.

c. The Thames Path, significantly enhanced in the base case as part of the Riverlight development, would still pass by the vessel. It is not anticipated that any reduction in footfall past the Battersea Barge's temporary mooring would occur during construction. Instead, it is likely that the level of pedestrians using the path (recorded as low for the baseline situation) would rise as nearby developments complete.

d. The effect on the Battersea Barge of being temporarily relocated and then returning to its permanent mooring position could be potentially significant as there would be costs and expenditure associated with the move including but not limited to removal expenses, legal and surveyor fees, taxes, costs of securing and adapting new premises, and diminution of goodwill following the move.

e. However, in accordance with the Thames Tideway Tunnel Compensation Programme (included within Schedule 2 of the *Statement of Reasons*, which accompanies the application), compensation would be available. Given that Thames Water would comply with the provisions of the programme, it is assumed for the purposes of this assessment that reasonable costs and expenditure incurred in association with the two moves would be met.

10.5.3 Taking account of the above, it is considered that the magnitude of the impact arising from the temporary relocation of the Battersea Barge would be low.

10.5.4 Given the low magnitude of impact and the medium sensitivity, there would be a **minor adverse** impact on the Battersea Barge business arising from its temporary displacement.

Effect on the Battersea Barge due to construction activity

10.5.5 If customers are sufficiently deterred from dining and drinking at the Battersea Barge by amenity-related impacts, then the business would in turn suffer deterioration in trade. For this reason the effect on environmental amenity, as it would be experienced by customers of the Battersea Barge, is relevant and considered below.

10.5.6 Assessments have been undertaken to examine the likelihood of significant air quality, construction dust, noise, vibration, and visual effects of the project arising during construction. For further information, refer to the respective construction effects sections within this volume (see Section 4 Air quality and odour, Section 9 Noise and vibration, and Section 11 Townscape and visual). The following points summarise the residual effect findings of those assessments in relation to the Battersea Barge:

a. Local air quality effects would be **negligible**. Construction dust effects would be **minor adverse**.

b. Both noise effects and vibration (human response) effects would be **not significant**.

c. No visual receptors were identified as requiring assessment in relation to the Battersea Barge.

10.5.7 In assessing the overall magnitude of impact on customers and therefore on the business, the above findings have been taken into consideration together with the following factors that are relevant to the overall experience of amenity at this site:

a. Given the three year construction programme, the effects noted above would be likely to be experienced over a medium term period.

b. The surrounding area will have undergone a high degree of change by the base case assessment year. At present, the business is located within an area that is relatively industrial in character surroundings, though there are some more scenic views (mostly extending to the north). As outlined in Section 10.3, the Riverlight and Nine Elms Pier developments will be largely complete and operational by the base case year. These schemes are going to change the character of the immediate area considerably by improving the quality of access routes and generally bringing more people to the area, substantially improving views from the Barge to the south east and making the Barge's surroundings more pleasant in general.

c. It is also noted that the majority of the Barge's areas are inside the Barge which would limit to some degree the experience of effects for guests. Furthermore, the Barge operates in the evening and at night, and, with the exception of construction of the connection tunnel, the works at this site would take place during standard working hours (ie, outside of the operational hours of the Barge).

d. Taking account of these improvements in the Battersea Barge's surrounding environment and the above presented topic assessment findings, the likelihood that people may be deterred from dining at the Battersea Barge is considered to be low. However, perceptions of the potential decline in amenity may exceed the actual decline and there is a small risk that this could lead to deterioration in trading conditions for the business.

10.5.8 On the basis of the above, it is considered that there is a limited possibility of a small downturn in trade due to construction activities on the site Therefore, it is assessed that the magnitude of impact would be low.

10.5.9 Taking account of the low magnitude of impact and the medium sensitivity of the business, the effect on the Battersea Barge due to construction activity would be **minor adverse**.

Effect on amenity of Thames Path users

10.5.10 Assessments have been undertaken to examine the likelihood of significant air quality, construction dust, noise, vibration, and visual effects of the project arising during construction. For further information, refer to the respective construction effects sections within this volume (see Section 4, Section 9 and Section 11). The following points summarise the residual effect findings of those assessments in relation to the Thames Path:

a. Both local air quality would be **negligible**. Construction dust effects would be **minor adverse**.

b. No noise or vibration (human response) receptors were identified for assessment in relation to the Thames Path.

c. No visual receptors were identified for assessment in relation to the Thames Path on the same side of the river and within 250m of the proposed construction site.

10.5.11 In assessing the overall magnitude of impact, the above findings have been taken into consideration together with the following factors that are relevant to the receptor's overall experience of amenity at this site:

a. Given the three year construction programme, the effects noted above would be likely to be experienced over a medium term period.

b. In the base case and during the period of the works the Thames Path is likely to be increasingly well used. Sections of the path, particularly to the immediate west where it runs through the Riverlight development are also likely to be of significantly improved quality.

c. Given that the Thames Path, in terms of its function as a recreational asset, is mostly used for walking, jogging and cycling, the time taken to pass by the site would be a relatively short period of time (eg, a minute or two for most users).

10.5.12 On the basis of the above findings and factors, it is considered that the magnitude of impact would be negligible.

10.5.13 Given the negligible magnitude of impact and the low sensitivity of Thames Path users, it is considered that the effect on the amenity of Thames Path users would be **negligible**.

Effect on the amenity of residents

10.5.14 Assessments have been undertaken to examine the likelihood of significant air quality, construction dust, noise, vibration, and visual effects of the project arising during construction. For further information, refer to the respective construction effects sections within this volume (see Section 4, Section 9 and Section 11). The following points summarise the residual effect findings of those assessments in relation to nearby residential receptors:

a. Local air quality effects would be **minor adverse** at three of the four receptors (Riverlight, Embassy Gardens, Elm Quay Court) and **negligible** at the other receptor. Construction dust effects would be **minor adverse** at three receptors (houseboats , Riverlight, Embassy Gardens) and **negligible** at the remaining receptor.

b. Noise effects would be **significant** at one (Riverlight Block F) of the five residential receptors identified[vii] and **not significant** at the remaining four receptors. This finding is informed in part by the estimate that construction noise levels would exceed the potential significance criteria for a residential receptor during the day for one month. In regard to road-based and river-based construction traffic, the noise assessment found that the noise effects would be **not significant**. Vibration effects would be **not significant** at all five receptors.

c. At the three residential viewpoints which are located within 250m of the site and on the same side of the River Thames, visual effects would be **major adverse** at one (viewpoint 1.8) and **moderate adverse** at the remaining two (1.3 and 1.4).

10.5.15 In assessing the overall magnitude of impact, the above findings have been taken into consideration together with the following factors:

a. Given the three year construction programme, the effects noted above would be likely to be experienced over a medium term period. The exception is that local air quality effects may not be minor adverse over the whole construction period as the assessment is based on the peak construction year and effects may be negligible in other years.

b. For noise, the effects would be experienced over a short period of time and would be experienced during the daytime only.

[vii] The noise and vibration assessment reports that the residual effect for Riverlight (Block F) is considered significant, however properties may be eligible for a noise insulation package, which if accepted, would reduce the effect to not significant (see Vol 15 Section 9.9).

c. While it is assessed that there would be significant adverse visual effects at three viewpoints, it is considered that views from a residential property form one of many elements that contribute to the quality of a residential environment. Although properties represented by viewpoint 1.8 would overlook the site and have foreground views of the site, in the case of the next nearest viewpoint (1.4), the effect is caused by oblique visibility of construction activity at Heathwall Pumping Station in the foreground and the river jetty at Kirtling Street in the background. Many of the dwellings at the receptors represented by these viewpoints would have views in other directions that are either not as severely affected or not affected at all.

10.5.16 Taking account of the above findings and factors, it is considered that the magnitude of impact would be low.

10.5.17 Given the low impact magnitude and the medium sensitivity, it is considered that the overall effect on the amenity of a limited number of residential receptors would be **minor adverse**.

10.5.18 This assessment relates primarily to those residential receptors that would experience adverse local air quality, construction dust, noise and visual effects. For residential receptors not subject to these effects, it is considered that there would be a negligible effect on their amenity.

10.5.19 Construction activities would be taking place at the Kirtling Street site (approximately 150m west of the site) concurrent with construction activity at Heathwall Pumping Station. The air quality, construction dust, noise, vibration and visual topic assessments have had regard (where appropriate in light of their respective assessment methodologies) to the Kirtling Street site and any effects that it would give rise to in reaching their assessment of effects on receptors at Heathwall Pumping Station. Therefore, the effect of the works at Kirtling Street has been considered within the above assessment.

Sensitivity test for programme delay

10.5.20 For the assessment of socio-economic effects during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors. Based on the development schedule (Vol 15 Appendix N), there would be no new receptors, within the assessment area, requiring assessment as a result of a one year delay.

10.6 Operational effects assessment

Permanent gain of public amenity space and rerouting of the Thames Path

10.6.1 This section of the Thames Path does not currently run directly adjacent to the River Thames, but in the operational phase it would be rerouted along the riverfront. The extension of the river wall out into the foreshore would also permanently provide an increased area of landscaped and functional public amenity space in association with the Thames Path measuring approximately 0.06ha.

10.6.2 The amenity space would be publicly accessible via the riverfront section of the Thames Path which intersects Middle Wharf with the provision for it to be closed for maintenance or when required by the operation of the safeguarded wharf. Pedestrians would be diverted along a signposted diversion route running via Nine Elms Lane (ie, the existing route) when the new riverfront section of Thames Path is closed to pedestrian access.

10.6.3 The magnitude of the impact is influenced by the following factors:

a. This new area of public amenity space would provide for new passive recreational opportunities within an area equivalent to the size of a small pocket park under the Mayor's Public Open Space Hierarchy. Accordingly, it would typically serve a catchment area of up to 400m.

b. The impact would be long term and permanent.

c. The rerouting of the Thames Path along the riverfront create a more direct route and would complete a missing riverfront link in the existing route connecting the Elm Quay pocket park to the improved section of Thames Path in front of Riverlight. This would reduce the overall distance by approximately 90m and improve amenity for users.

d. Given the number of new residents likely to be living in the area in the operational base case, the new space and rerouted path are likely to benefit a high number of users from both local and wider communities.

e. Given the local community profile, a high proportion of Thames Path users are likely to be aged 65 or above. As such, a high number of older residents would be likely to benefit (see para. 10.4.3c). It is acknowledged that the operational base case demographic profile of the local community is likely to differ from that of the baseline.

10.6.4 Taking account of the above factors, in particular the way in which the rerouted Thames Path would provide a riverfront connection between two existing riverfront sections as well as providing a permanent increase in associated amenity space, it is considered that the magnitude of the impact would be medium.

10.6.5 Given the medium magnitude of impact and the low sensitivity, the effect on users of the permanent gain of public amenity space and rerouting of the Thames Path would be **minor beneficial**.

Sensitivity test for programme delay

10.6.6 For the assessment of socio-economic effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above for the existing and proposed receptors as the operational effects of the Thames Tideway Tunnel project are considered to be not significant. Based on the development schedule (see Vol 15 Appendix N), there would be no new receptors, within the assessment area, requiring assessment as a result of a one year delay.

10.7 Cumulative effects assessment

Construction effects

10.7.1 For the purposes of this cumulative assessment, the assessment year is the peak construction year.

10.7.2 As described in Section 10.3, three projects, Embassy Gardens, Nine Elms Parkside and Riverlight, would be under construction at the same time as the proposed development at the Heathwall Pumping Station site.

10.7.3 In respect of non-amenity related effect assessments undertaken in Section 10.5, as these developments are not located on or within the proposed project site, it would not be possible for them to give rise to cumulative effects in respect of the displacement of the Battersea Barge business that is situated within the proposed project site.

10.7.4 In respect of the amenity effect assessments undertaken in Section 10.5, the developments are located within the assessment area for amenity effects and so they could give rise to cumulative effects on the amenity of potentially sensitive receptors, namely the Battersea Barge, Thames Path users and nearby residents.

10.7.5 The other topic assessments of amenity related cumulative effects (see Section 4, Section 9 and Section 11) have concluded:

a. For air quality and construction dust that the cumulative effect has been accounted for and that there would be no additional cumulative effect.

b. For noise and vibration that there would be a strong likelihood that there would be significant adverse cumulative effects at sites including Riverlight block F, Elm Quay, Embassy Gardens blocks A09 and A10, owing to the distance from the other sites. However, it is considered there would not be cumulative effects at the Battersea Barge or the houseboats.

c. For visual effects arising as a result of cumulative developments and construction traffic associated with those developments, one residential and three recreational visual assessment viewpoints, and the effect on these viewpoints would be significant when taking into account construction at the developments described in Section 10.3. However, none of these viewpoints are within the 250m amenity assessment limit of the site.

10.7.6 Therefore, it is considered that there could be elevated and significant cumulative amenity effects on potentially sensitive receptors, in particular some residential receptors, near the site.

10.7.7 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately one year, more of the Embassy Gardens, Nine Elms Parkside and Riverlight developments may be built and occupied which would lead to a corresponding reduced level of cumulative activity. Cumulative effects would therefore be no greater than described above.

Operational effects

10.7.8 As described in Section 10.3, there are no developments that would have the same type of effect as that considered in Section 10.6 and so there would be no cumulative effects. This would also apply in the event of a programme delay to the Thames Tideway Tunnel project of approximately one year.

10.7.9 Therefore, the effects would remain as described in Section 10.6.

10.8 Mitigation

Construction effects

10.8.1 The above assessment has concluded that there would not be any major or moderate adverse effects in the construction phase at the site requiring additional mitigation.

Operational effects

10.8.2 The above assessment has concluded that operational effects would be beneficial and therefore mitigation is not needed.

10.9 Residual effects assessment

Construction effects

10.9.1 As no additional mitigation measures are proposed, the residual construction effects remain as described in Section 10.5.

10.9.2 All residual effects are presented in Section 10.10.

Operational effects

10.9.3 As no mitigation measures are proposed, the residual operational effects remain as described in Section 10.6.

10.9.4 All residual effects are presented in Section 10.10.

10.10 Assessment summary

Vol 15 Table 10.10.1 Socio-economics – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Business – the Battersea Barge	Temporary displacement of business	Minor adverse	None	Minor adverse
Business – the Battersea Barge	Effect on business due to construction activity	Minor adverse	None	Minor adverse
Users of the Thames Path	Effect on the amenity of Thames Path users	Negligible	None	Negligible
Residents	Effect on the amenity of residents	Minor adverse	No further on site mitigation practicable	Minor adverse

Vol 15 Table 10.10.2 Socio-economics – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Future users of Thames Path and public amenity space	Rerouting of the Thames Path and permanent gain of a new public amenity space	Minor beneficial	None required	Minor beneficial

References

[1] Department of Environment, Food and Rural Affairs. *National Policy Statement for Waste Water* (2012). Available at: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf. Accessed November 2012.

[2] People1st. *State of the Nation Annual Report Executive Summary* (2011). Available at: http://www.goskills.org/webfiles/Research/State%20Of%20The%20Nation/2011/State_of_the_Nation_2011_Executive_Summary.pdf. Accessed August 2012.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 11: Townscape and visual

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 11: Townscape and visual

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11 Townscape and visual

11.1 Introduction

11.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on townscape and visual amenity at Heathwall Pumping Station. The assessment describes the current conditions found within and around the site – the nature and pattern of buildings, streets, open space and vegetation and their interrelationships within the built environment – and the changes that would be introduced as a result of the proposed development during construction and operation.

11.1.2 The effects of these changes during construction and operation are assessed. The assessment includes effects on townscape character areas, and visual effects during daytime for the peak construction year, and Year 1 and Year 15 of operation. The assessment also identifies mitigation measures where appropriate.

11.1.3 Effects arising from lighting during the construction and operational phases have not been assessed. This is on the basis that there would not be any significant effects (this is further explained in para. 11.3.10 for construction and para. 11.3.18 for operation).

11.1.4 Each section of the assessment is structured so that townscape aspects are described first, followed by visual.

11.1.5 The assessment of the likely significant townscape and visual effects of the project has considered the requirements of the National Policy Statement (NPS) for Waste Water (Defra, 2012)[1]. In line with these requirements, the townscape and visual assessment considers effects during construction and operation on townscape components, townscape character and visual receptors. The construction and design of the proposed development also takes account of townscape and visual considerations in line with the NPS recommendations. Vol 2 Section 11 provides further details on the methodology.

11.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station Figures).

11.1.7 A separate but related assessment of effects on the setting of heritage assets is included in Section 7 of this volume.

11.2 Proposed development relevant to townscape and visual

11.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to the townscape and visual assessment are set out below.

Construction

11.2.2 The specific construction works which may give rise to effects on townscape character and visual receptors are listed as follows, with the activities likely to give rise to the most substantial townscape and visual effects described first:

a. use of cranes during shaft sinking and secondary lining of the Heathwall/SWSR connection tunnel

b. construction of a temporary cofferdam using a piling rig

c. installation of 2.4m high hoardings around the boundary of the construction site

d. vehicular construction access to the site off Nine Elms Lane.

Code of Construction Practice

11.2.3 Measures incorporated into the *Code of Construction Practice (CoCP*)[i] *Part A* to reduce townscape and visual impacts include:

a. protection of existing trees in accordance with *BS5837 'Trees in Relation to Construction – Recommendations'* (Section 11)

b. installation of well-designed, visually attractive hoardings (Section 4)

c. the use of appropriate capped and directional lighting when required (Section 4).

11.2.4 Measures incorporated into the *CoCP Part B* (Section 4) to reduce townscape and visual impacts include provision for incorporating suitable art work on public facing sections of hoarding.

Operation

11.2.5 The particular components of importance to this topic include the:

a. design, layout and materials used in the public realm including paving, seating, railings, gates and lighting

b. design, siting and materials used for the above ground structures, and the zones within which these may be located

c. design and materials used for the river wall around the foreshore structure.

Environmental design measures

11.2.6 Figures illustrating the proposed development during operation are contained in a separate volume (Vol 15 Heathwall Pumping Station Figures – Section 1). Where photomontages have been prepared to assist the assessment of effects, these are referenced in the appropriate viewpoint in Section 11.6.

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[i] The *Code of Construction Practice (CoCP)* is provided in Vol 1 Appendix A. It contains general requirements *(Part A)* and site specific requirements for this site *(Part B).*

11.2.7 Measures which have been incorporated into the design of the proposed development include (refer to the *Design Principles* report in Vol 1 Appendix B):

a. the use of high quality materials for the public realm, including paving, seating, railings, gates and lighting, in line with the Nine Elms Lane Public Realm Design document and materials used in the adjacent Riverlight development

b. new trees would be planted along Nine Elms Lane

c. barbed wire would be removed from the boundary and pumping station walls and replaced with a suitable and appropriate security measure, and the walls would also be cleaned and painted

d. high quality fencing would be provided to the southern edge of the riverside walkway

e. the integration of large hatches into the surrounding paving

f. siting the above ground structures within the Heathwall pumping station compound

g. the use of timber fenders on the river wall, in keeping with the surrounding townscape character.

11.3 Assessment methodology

Engagement

11.3.1 Volume 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Specific comments relevant to this site for the assessment of townscape and visual effects are presented here.

11.3.2 The London Borough (LB) of Wandsworth, neighbouring authorities the LB of Lambeth and City of Westminster Council, and English Heritage have been consulted on the detailed approach to the townscape and visual assessment, including the number and location of viewpoints. The LB of Lambeth (March 2011) requested an additional view from the centre of Vauxhall Bridge, which has been included in the visual assessment (as shown in Vol 15 Figure 11.4.6, see separate volume of figures). The LB of Wandsworth (May 2011), City of Westminster Council (March 2011) and English Heritage (May 2011) have confirmed acceptance of the proposed viewpoints.

11.3.3 The stakeholders were also consulted on proposed changes to the viewpoints following the preliminary assessment findings, including removing some viewpoints, adding some additional viewpoints and removing some viewpoints from the operational assessment. The LB of Wandsworth (October 2012) and LB of Lambeth (July 2012) confirmed acceptance of the proposed changes. The Royal Borough of Kensington and Chelsea, City of Westminster and English Heritage have not commented on the proposed changes.

11.3.4 A description of how the on-site alternatives to the proposed approach have been considered and the main reasons why these alternatives have not been adopted is included in Section 3.6 of this volume.

Baseline

11.3.5 The baseline methodology follows the methodology described in Vol 2 Section 11. In summary, the following surveys have been undertaken to establish baseline data for this assessment:

a. Preliminary site visit to check the zone of theoretical visibility (ZTV), establish the extents of townscape character areas and identify locations for visual assessment viewpoints (March 2011)

b. Photographic surveys of townscape character areas (August 2011)

c. Winter photographic surveys of the view from each visual assessment viewpoint (November 2011, December 2011, January 2012, January 2012 and February 2012)

d. Summer photographic survey of the view from visual assessment viewpoints considered in the operational assessment (August 2011)

e. Verifiable photography (April 2011 and May 2011) and verifiable surveying (May 2011) for the viewpoints requiring a photomontage to be produced, as agreed with the stakeholders (described in para.11.3.2).

11.3.6 With specific reference to the Heathwall Pumping Station site, baseline information on conservation areas and townscape character has been gathered through a review of:

a. The *Core Strategy for the LB of Wandsworth* (LB of Wandsworth, 2010)[2]

b. The *Core Strategy for the LB of Lambeth* (LB of Lambeth, 2011)[3]

c. The *Core Strategy for the City of Westminster* (City of Westminster, 2011)[4]

d. Pimlico, Churchill Gardens and Dolphin Square Conservation Area General Information Leaflets, produced by the City of Westminster Council (City of Westminster, 2004)[5].

Construction

11.3.7 The assessment methodology for the construction phase follows that described in Vol 2 Section 11. Site specific variations are described below.

11.3.8 With reference to the Heathwall Pumping Station site, the peak construction phase relevant to this topic would be during Site Year 1 of construction, when the shaft would be under construction. Cranes would be present at the site and materials would be brought to the site and taken away by river and road. This has therefore been used as the assessment year for townscape and visual impacts. The intensity of construction activities would be similar during Site Year 2 of construction, during the secondary lining of the Heathwall/SWSR connection tunnel, involving the import of materials by road.

11.3.9 One verifiable photomontage has been prepared for this site to assist the assessment of construction effects. This is shown in Vol 15 Figure 11.5.1 (see separate volume of figures).

11.3.10 No assessment of effects on night time character is made for this site during construction on the basis that:

a. the site would generally only be lit in the early evening during winter, except for short durations of 24 hour working during the construction of the Heathwall/SWSR connection tunnel

b. all site lighting would have minimal spill into the wider area due to the measures set out in the *CoCP Part A* (Section 4)

c. the surrounding area is lit in the early evening by street lighting and by light spill from surrounding buildings

d. visual receptors have limited sensitivity to additional lighting in the early evening.

11.3.11 The assessment area, defined using the methodology provided in Vol 2 Section 11, is indicated in Vol 15 Figure 11.4.5 for townscape and Vol 15 Figure 11.4.6 for visual (see separate volume of figures). The scale of the townscape assessment area has been set by the maximum extents of all character areas located partially or entirely within the construction phase ZTV, except in those locations upstream of the site where the construction works would be obscured by Grosvenor Bridge, and downstream of the site with the construction works would be obscured by Vauxhall Bridge. The visual assessment area has been set by the maximum extent of the construction phase ZTV, except in those locations upstream of the site where the construction works would be obscured by Grosvenor Bridge, and downstream of the site with the construction works would be obscured by Vauxhall Bridge. All visual assessment viewpoints are located within the ZTV.

11.3.12 Section 11.5 details the likely significant effects arising from the construction at Heathwall Pumping Station. Other nearby Thames Tideway Tunnel project sites which could give rise to additional effects on townscape and visual receptors are Kirtling Street, Albert Embankment Foreshore and Chelsea Embankment Foreshore. These sites are therefore included in this assessment.

11.3.13 For the construction base case for the assessment of effects arising from the proposed development at the Heathwall Pumping Station site, it is assumed that the following developments within the townscape and visual assessment area, identified within the site development schedule (Vol 15 Appendix N), would be complete and occupied by Site Year 1 of construction:

a. blocks B, C, D, E and F of Riverlight - a residential led mixed use development to the east of the site

b. phases 1 and 2 of the Battersea Power Station redevelopment, comprising the residential and mixed use plots to the west of the power station and the power station itself

c. the US Embassy development, 130m southeast of the site

d. buildings A09, A10 and A11 of the Embassy Gardens mixed use development surrounding the US Embassy development

e. Vauxhall Sky Gardens mixed use development, 570m east of the site

f. St George’s Wharf (Vauxhall Tower), 550m northeast

g. Market Towers mixed use development 500m to the east of the site, comprising two buildings at 58 storeys and 43 storeys

11.3.14 For the purposes of the cumulative effects assessment, it is assumed that the following development would be under construction within the townscape and visual assessment area during Site Year 1 of construction at the Heathwall Pumping Station site:

a. block A of the Riverlight mixed use development

b. phase 3 of the Battersea Power Station development

c. buildings B1, B2, B3, B4, B5 and B6 of the New Covent Garden Market development, approximately 340m south of the site

d. buildings A01, A02, A03, A04, A05 and A07 of the Embassy Gardens development

e. plots C and D of Nine Elms Parkside, 45m south

f. Vauxhall Square mixed use development, approximately 560m east of the site

g. the Northern Line Extension, approximately 420m southeast (to the proposed station at Nine Elms) and 565m southwest (to the proposed station at Battersea Power Station).

11.3.15 The assessment of construction effects also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Operation

11.3.16 The assessment methodology for the operational phase follows that described in Vol 2 Section 11. Any site specific variations are described below.

11.3.17 Two verifiable photomontages have been prepared for this site to assist the assessment of operational effects. These are shown in Vol 15 Figure 11.6.1 and Vol 15 Figure 11.6.2 (see separate volume of figures).

11.3.18 The operational phase assessment has been undertaken for Year 1 of operation and Year 15 of operation. The operation of the proposed development would have no substantial lighting requirements apart from low level lighting associated with the area of public realm. Therefore, no assessment of effects on night time character is made for this site during operation.

11.3.19 The assessment area, defined using the methodology provided in Vol 2 Section 11, is indicated in Vol 15 Figure 11.4.5 for townscape and Vol 15 Figure 11.4.6 for visual (see separate volume of figures). The scale of the townscape assessment area has been set by the maximum extents of all character areas located partially or entirely within the operational phase ZTV, except in those locations upstream of the site where the proposed development would be obscured by Grosvenor Bridge, and downstream of the site where the proposed development would be obscured by Vauxhall Bridge. The visual assessment area has been set by the maximum extent of the operational phase ZTV, except in those locations upstream of the site where the proposed development would be obscured by Grosvenor Bridge, and downstream of the site where the proposed development would be obscured by Vauxhall Bridge. All visual assessment viewpoints are located within the ZTV.

11.3.20 Section 11.6 details the likely significant effects arising from the operation at Heathwall Pumping Station. Other nearby Thames Tideway Tunnel project sites which could give rise to additional effects on townscape and visual receptors are Kirtling Street and Albert Embankment Foreshore. These sites are therefore included in this assessment.

11.3.21 In terms of the operational base case for the assessment of effects on Heathwall Pumping Station, it is assumed that the following developments within the assessment area would be complete and occupied by Year 1 of operation, over and above those detailed in para 11.3.13:

a. block A of the Riverlight mixed use development
b. phases 3 and 4, parts of phase 5 and phase 6 of the Battersea Power Station redevelopment, comprising the mixed plots to the southeast of the power station
c. buildings B1, B2, B3, B4, B5, B6 and the site entrance of the New Covent Garden Market development, comprising mixed use plots to the north of the development adjacent to Nine Elms Lane
d. all plots in the Embassy Gardens development
e. Vauxhall Square development
f. plots A, B, C and D of the Nine Elms Parkside development
g. the Northern Line Extension would be fully complete.

11.3.22 For the purposes of the Year 15 assessment, it is assumed that all of the above developments would be fully complete and occupied by Year 15 of operation.

11.3.23 There are no schemes identified in the site development schedule (Vol 15 Appendix N) which are of relevance to the assessment of cumulative effects for the townscape and visual topic. Therefore, no assessment of cumulative effects has been undertaken for Heathwall Pumping Station in the operational phase.

11.3.24 As with construction (para. 11.3.15), the assessment of operational effects also considers the extent to which the assessment findings would be likely to be materially different, should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Assumptions and limitations

11.3.25 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 11. Site specific assumptions and limitations are detailed below.

Assumptions

11.3.26 For the purposes of the construction phase assessment, it is assumed that the construction activities and plant, site hoardings and access points are in the location shown on the Construction phase 1 (site setup, shaft construction and tunnelling) plan (see separate volume of figures – Section 1). The assessment of effects would be no worse if these elements of the proposed development were within the maximum extent of working area (shown on Construction phase plans in separate volume of figures– Section 1), with the permanent structures under construction located within the zones shown on the Site works parameter plan (separate volume of figures – Section 1).

11.3.27 For the purposes of the operational phase assessment, it is assumed that the above ground structures are in the location shown on the Proposed landscape plan. The assessment of effects would be no worse if these elements of the proposed development were in different locations within the zones shown on Site works parameter plan (see separate volume of figures – Section 1).

Limitations

11.3.28 The assumed completion of the Riverlight development adjacent to the site in the construction phase base case would introduce additional visual receptors. Effects on these receptors are assessed with reference to viewpoint 1.8, (para. 11.4.85). Due to suitable representative publicly accessible locations for this viewpoint not being available at present, no photo has been included from this location and the assessment has been undertaken based on professional judgement.

11.3.29 Despite the limitations identified above, the assessment is considered robust.

11.4 Baseline conditions

11.4.1 The following section sets out the baseline conditions for the townscape and visual assessment within and around the site as follows:

a. Information on the physical elements that make up the overall townscape character of the assessment area (topography, land use, development patterns, vegetation, open space and transport routes), which inform the identification of townscape character areas. These form the receptors for the townscape assessment.

b. Information on the townscape character (including setting), condition, tranquillity, value and sensitivity of the site and each townscape character area.

c. Information on the nature of the existing views towards the site from all visual assessment viewpoints, during both winter and summer where relevant. This is ordered beginning with the most sensitive receptors through to the least sensitive.

d. Future baseline conditions (base case) are also described.

Current baseline

Townscape baseline

Physical elements

11.4.2 The physical elements of the townscape in the assessment area are described below.

11.4.3 The assessment area includes a number of conservation areas, which are shown on Vol 15 Figure 11.4.1 (see separate volume of figures).

Topography

11.4.4 The site is located on relatively flat ground on the south bank of the river, with no notable topographic features in the wider assessment area.

Land use

11.4.5 In the vicinity of the site, the south bank of the river is characterised by commercial and industrial uses located between the river and the railway line between Vauxhall and London Waterloo mainline stations, with the exception of the extensive St George's Wharf residential development south of Vauxhall Bridge. There are also large areas of disused land, some of which are planned to be redeveloped (as described in para. 11.3.13).

11.4.6 On the north bank of the river, land use is predominantly residential apart from some educational, leisure and tourism related uses.

Development patterns and scale

11.4.7 Vol 15 Figure 11.4.2 (see separate volume of figures) illustrates the pattern and scale of development and building heights within the assessment area.

11.4.8 Within the assessment area, the south bank river frontage is characterised by dense blocks of buildings with large footprints, many of which are above 40m high. Industrial buildings form a large area of enclosed and inward looking development with closed façades.

11.4.9 On the north bank of the river, opposite the site, residential properties are arranged in a grid formation, dominated by two to four storey terraces with intermittent high-rise developments.

Vegetation patterns and extents

11.4.10 Vol 15 Figure 11.4.2 (see separate volume of figures) illustrates the pattern and extent of vegetation, including tree cover, within the assessment area.

11.4.11 South of the river, street trees are uncommon within the assessment area, with the exception of the river frontage. Vegetation on the southern bank is largely associated with disused plots of land which have been largely unmaintained.

11.4.12 Street trees are a more important element of the character of the townscape on the northern bank, with numerous roads densely planted with mature avenues. Mature tree planting is also a key characteristic of the public and private open spaces throughout the area.

11.4.13 A number of trees in the assessment area are protected by Tree Preservation Orders (TPOs), and trees on both sides of the river are protected by conservation area status.

Open space distribution and type

11.4.14 The assessment area south of the river is characterised by a notable absence of open spaces, apart from a small number of spaces alongside the Thames Path to the east of the site. The Thames Path itself is designated as a Green Chain.

Transport routes

11.4.15 Vol 15 Figure 11.4.3 (see separate volume of figures) illustrates the transport network within the assessment area, including cycleways, footpaths and Public Rights of Way.

11.4.16 The site is located to the north of Nine Elms Lane, which is characterised by high levels of traffic. The wider area on the south bank of the river is dominated by transport infrastructure, including the railway line running east-west, connecting Clapham Junction and Vauxhall/London Waterloo mainline stations, and the railway running north-south, connecting Clapham Junction and Victoria mainline stations.

11.4.17 The north bank of the river is characterised by Grosvenor Road running along the river frontage, dominated by relatively heavy traffic. The remainder of the area is predominantly characterised by quiet residential streets.

11.4.18 On the north bank, the Thames Path runs along the riverside. To the south, the Thames Path partially runs along the river frontage, but is diverted inland around St George’s Wharf residential development to the east of the site, and the Battersea Power Station industrial area to the west. The Thames Path is also locally diverted around the site at present.

Site character assessment

11.4.19 The site is located partially on land, in the confines of Heathwall Pumping Station and the adjacent unoccupied safeguarded wharf, Middle Wharf, and partially within the River Thames.

11.4.20 The site boundary incorporates:

a. Heathwall pumping station and the surrounding hardstanding within the walled compound

b. Middle Wharf walled compound, comprising hardstanding

c. Middle Wharf jetty structure, comprising a disused piled deck

d. an electrical substation along Nine Elms Lane.

11.4.21 The river is characterised by a wide area of foreshore in the site boundary.

11.4.22 The character of the site is illustrated by Vol 15 Plate 11.4.1 and the components of the site are described in more detail in Vol 15 Table 11.4.1.

Vol 15 Plate 11.4.1 The character of the site

Date taken: 18 August 2011. 18mm lens.

Vol 15 Table 11.4.1 Townscape – site components

ID	Component	Description	Condition
01	River wall	Sheet piled wall.	Poor condition
02	Boundary planting	Line of small trees and shrubs forming the eastern and western boundaries of the site.	Poor condition
03	Heathwall Pumping Station	Brick and concrete built flat roofed pumping station set within a walled compound.	Poor condition
04	Middle Wharf	Area of hardstanding enclosed by brick walls.	Poor condition

ID	Component	Description	Condition
05	Middle Wharf jetty	Long linear concrete piled deck.	Poor condition
06	Electrical substation	Small brick built, flat roofed electrical substation building on the boundary with Nine Elms Lane	Poor condition
07	Battersea Barge	Moored recreational and events boat venue.	Fair condition

11.4.23 The condition of the townscape within the site is poor due to the industrial use of the pumping station and disused nature of Middle Wharf.

11.4.24 The industrial use of the site, set amongst the wider industrial area and adjacent to the busy Nine Elms Lane, means the site has a low level of tranquillity.

11.4.25 The site has limited townscape value due to the lack of open space and the industrial use of the area.

11.4.26 Due to the poor condition and limited townscape value, the site has a low sensitivity to change.

Townscape character assessment

11.4.27 The townscape character areas surrounding the site are identified in Vol 15 Figure 11.4.5 (see separate volume of figures). Townscape character areas are ordered beginning with the river reach, then to the north of the site and continuing around the site in a clockwise direction. Each area is described below.

River Thames – Nine Elms Reach TCA

11.4.28 This reach of the river extends from Chelsea Bridge in the west to Vauxhall Bridge in the east. The reach is largely characterised by a mix of residential development and industrial, commercial and disused frontages, much of which is planned for redevelopment. The character of this area is illustrated by Vol 15 Plate 11.4.2.

Vol 15 Plate 11.4.2 River Thames – Nine Elms Reach TCA

Date taken: 2 August 2011. 18mm lens.

11.4.29 The river itself, within the assessment area, is characterised by a varying frontage with different river wall characters and numerous piers, jetties and small inlets. Both banks have a relatively wide area of foreshore at low tide.

11.4.30 The river walls and structures are well maintained. The overall townscape condition is fair.

11.4.31 Despite the residential character along parts of the river frontage, the presence of heavy industries in the immediate area, in turn generating industrial river transport, means the reach has a moderate level of tranquillity.

11.4.32 The reach is a regionally valued stretch of the river, forming the backdrop to a number of conservation areas on the north side of the river, in addition to the high profile regeneration of Battersea Power Station.

11.4.33 Due to the fair condition and moderate levels of tranquillity, this character area has a medium sensitivity to change.

Nine Elms Lane Residential TCA

11.4.34 This character area comprises a narrow band of residential apartments along the riverfront, bounded to the south by Nine Elms Lane and the industrial and commercial units further inland. The residential buildings are brick built and are seven to nine storeys high. The Thames Path runs along the river, connecting small areas of public open space at either end of the area, characterised by amenity grassland and scattered mature and semi-mature trees. The character of this area is illustrated by Vol 15 Plate 11.4.3.

Vol 15 Plate 11.4.3 Nine Elms Lane Residential TCA

Date taken: 2 August 2011. 18mm lens.

11.4.35 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.36 Tranquillity within the area is limited by pedestrian movements along the riverside path and the presence of Nine Elms Lane, although this is partially moderated by the presence of green open spaces and the residential character. Therefore, the area has moderate levels of tranquillity.

11.4.37 The area is likely to be locally valued by residents within the character area, but has limited value in the wider area.

11.4.38 Due to the good condition and local value of the townscape, and the moderate levels of tranquillity, this area has a medium sensitivity to change.

St George's Wharf Residential TCA

11.4.39 St George's Wharf is characterised by a recent residential development comprising five 22 storey towers orientated towards the river and set amongst extensive semi-private open space. The character area also incorporates Market Towers, a 23 storey commercial tower. Part of the area is currently undergoing redevelopment with the construction of a residential tower. The character of this area is illustrated by Vol 15 Plate 11.4.4.

Vol 15 Plate 11.4.4 St Georges Wharf TCA

Date taken: 2 August 2011. 18mm lens.

11.4.40 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.41 The area has moderate levels of tranquillity by virtue of the residential character and density of open space amongst the residential blocks, slightly moderated by the presence of the busy Nine Elms Lane running through the character area.

11.4.42 The high rise riverfront development is likely to be locally valued by the residents that live there. Due to the good condition, moderate levels of tranquillity and local value of the townscape, this area has a medium sensitivity to change.

Nine Elms Lane Commercial TCA

11.4.43 This character area is dominated by commercial and industrial uses focused around the railway line between Clapham Junction, Vauxhall and London Waterloo mainline stations. Commercial premises are four to five storeys high, with the exception of one 16 storey high-rise office. Industrial units, further south are one to three storeys high. The railway arches also incorporate small mixed industrial and commercial uses. The area is characterised by a lack of public open space, with spaces between buildings typically hard surfaced and used for car parking or storage. There are few mature or semi-mature trees present in the area. The pattern of development is focused around the railway and is enclosed and segregated from the river by residential uses. Buildings include the Royal Mail depot and Flower Market. The character of this area is illustrated by Vol 15 Plate 11.4.5.

Vol 15 Plate 11.4.5 Nine Elms Lane Commercial TCA

Date taken: 2 August 2011. 31mm lens.

11.4.44 The buildings and public realm within the area are relatively poorly maintained. The overall townscape condition is poor.

11.4.45 Tranquillity within the area is limited by high levels of vehicular traffic, the presence of the busy railway line, lack of street trees and open spaces, and the commercial land uses.

11.4.46 The area has limited townscape value by virtue of the poor condition of the public realm and the commercial land use.

11.4.47 Due to the poor condition and limited value of the area, this character area has a low sensitivity to change.

Battersea Industrial TCA

11.4.48 This character area is dominated by commercial and industrial uses, and brownfield land focused around the Grade II* listed Battersea Power Station. The area comprises a large area of open hardstanding around the power station, a waste transfer station and concrete batching plant on the riverfront and a series of low lying commercial warehouses, depots and offices, including in the Tideway Industrial Estate adjacent to the site. The character of this area is illustrated by Vol 15 Plate 11.4.6.

Vol 15 Plate 11.4.6 Battersea Industrial TCA

Date taken: 15 August 2011. 18mm lens.

11.4.49 A baseline description of the Grade II* listed Battersea Power Station as a heritage asset is provided in Section 7.4 of this volume.

11.4.50 The buildings and public realm within the area are relatively poorly maintained. The overall townscape condition is poor.

11.4.51 Tranquillity within the area is limited by high levels of vehicular traffic, the presence of the busy railway line, a lack of street trees and open spaces, and the commercial land uses.

11.4.52 The area has limited townscape value by virtue of the poor condition of the public realm and the commercial land use. However, Battersea Power Station represents a component of the character area that is regionally valued by virtue of its contribution to London's skyline.

11.4.53 Due to the poor condition and overall limited value of the area, this character area has a low sensitivity to change.

Pimlico Residential TCA

11.4.54 This area is dominated by residential uses and incorporates the following conservation areas:

a. Pimlico Conservation Area

b. Churchill Gardens Conservation Area

c. Dolphin Square Conservation Area.

11.4.55 The character of the area is dominated by residential terraces aligned in a grid formation, although there are also parades of small retail units, churches (including the Grade I listed St James-the-Less) and some leisure uses. Churchill Gardens and Dolphin Square Conservation Areas each form enclosed residential estates, with small areas of public and private open space. There is a general abundance of mature street trees and dense vegetation in open spaces, providing a green character to the area. The development pattern comprises a mix of large blocks up to around nine to eleven storeys, set amongst terraces of two to four storey properties. The area is largely enclosed in character. The character of this area is illustrated by Vol 15 Plate 11.4.7.

Vol 15 Plate 11.4.7 Pimlico Residential TCA

Date taken: 2 August 2011. 18mm lens.

11.4.56 A baseline description of Churchill Gardens, Dolphin Square and Pimlico Conservation Areas as heritage assets is provided in Section 7.4 Historic environment.

11.4.57 The buildings and public realm within the area are well maintained. The overall townscape condition is good.

11.4.58 Despite the presence of some busy roads through the area, the townscape has moderate levels of tranquillity due to the residential character and the enclosed nature of the area.

11.4.59 The townscape of the character area is valued at the borough level, by virtue of the conservation area designations.

11.4.60 Therefore, because of the borough level value attributed to the townscape, the enclosed nature of the built environment and moderate levels of tranquillity, this character area has a medium sensitivity to change.

Visual baseline

11.4.61 Vol 15 Figure 11.4.6 (see separate volume of figures) indicates the location of viewpoints referenced below. All residential and recreational receptors have a high sensitivity to change, and transport receptors have a medium sensitivity to change. For each viewpoint, the first part of the baseline description relates to the view during winter, while the second part relates to the summer view considered in the operational assessment.

Residential

11.4.62 Residential receptors have a high sensitivity to change, as attention is often focused on the townscape surrounding the property rather than on another focused activity (as would be the case in predominantly employment or industrial areas). The visual baseline for residential receptors (represented by a series of viewpoints, agreed with consultees) is described below.

Viewpoint 1.1: View southwest and northeast from residences on Grosvenor Road opposite St George's Square

11.4.63 This viewpoint is representative of the oblique view from residential properties adjacent to the Thames Path on the north bank of the river, on Grosvenor Road opposite St George's Square.

Vol 15 Plate 11.4.8 Viewpoint 1.1: winter view towards Heathwall Pumping Station and Kirtling Street (southwest)

Date taken: 9 December 2011. 18mm lens.

11.4.64 The view (illustrated in Vol 15 Plate 11.4.8) is an open panorama across the river towards Battersea Power Station (far right of the view illustrated). The view is characterised by industrial buildings along the south bank of the river. The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the Heathwall Pumping Station and Kirtling Street sites from this viewpoint are partially obscured by an existing pier in the foreground of the view.

Vol 15 Plate 11.4.9 Viewpoint 1.1: winter view towards Albert Embankment Foreshore (northeast)

Date taken: 15 February 2012. 50mm lens.

11.4.65 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Albert Embankment Foreshore (refer to para. 11.3.12). The view (illustrated in Vol 15 Plate 11.4.9) is an open panorama over the river, focused towards the St George's Wharf development and Vauxhall Bridge, which form dominant components of the background of the view. Views of the Albert Embankment Foreshore site are largely obscured by Vauxhall Bridge, apart from the part of the site to the west of the bridge which is directly visible.

Viewpoint 1.2: View southwest and northeast from residences on Grosvenor Road near Balvaird Place

11.4.66 This viewpoint is representative of the oblique view from residential properties adjacent to the Thames Path on the north bank of the river, on Grosvenor Road, near Balvaird Place.

Vol 15 Plate 11.4.10 Viewpoint 1.2: winter view towards Heathwall Pumping Station and Kirtling Street (southwest)

Date taken: 22 November 2012. 35mm lens.

11.4.67 The view (illustrated in Vol 15 Plate 11.4.10) is an open panorama over the river towards Battersea Power Station (just beyond the field of view illustrated). The view is characterised by industrial buildings along the south bank of the river, in addition to residential premises along Nine Elms Lane in the foreground of the view (far left of the image). The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the Heathwall Pumping Station and Kirtling Street sites, partially located on the foreshore, are unobstructed from this viewpoint.

Vol 15 Plate 11.4.11 Viewpoint 1.2: winter view towards Albert Embankment Foreshore (northeast)

Date taken: 9 December 2011. 35mm lens.

11.4.68 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Albert Embankment Foreshore (refer to para. 11.3.12). The view (illustrated in Vol 15 Plate 11.4.11) is an open panorama over the river, focused towards the St George's Wharf development and Vauxhall Bridge, which form dominant components of the background of the view. Views of the Albert Embankment Foreshore site are largely obscured by Vauxhall Bridge, apart from the part of the site to the west of the bridge which is directly visible.

Viewpoint 1.3: View southwest and northeast from residences along Nine Elms Lane

11.4.69 This viewpoint is representative of the oblique view from residences between the Thames Path and Nine Elms Lane.

Vol 15 Plate 11.4.12 Viewpoint 1.3: winter view towards Heathwall Pumping Station and Kirtling Street (southwest)

Date taken: 9 December 2011. 35mm lens.

11.4.70 The linear view (illustrated in Vol 15 Plate 11.4.12) up the river is focused on Battersea Power Station in the middle ground of the view, which dominates the skyline. The remainder of the view is characterised by commercial and residential premises along the southern bank of the river. Views of the parts of the Heathwall Pumping Station and Kirtling Street sites located on the foreshore are visible from this location.

Vol 15 Plate 11.4.13 Viewpoint 1.3: winter view towards Albert Embankment Foreshore (northeast)

Date taken: 21 November 2011. 18mm lens.

11.4.71 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Albert Embankment Foreshore (refer to para. 11.3.12). The linear view (illustrated in Vol 15 Plate 11.4.13) down the river is characterised by residential and commercial premises along the southern bank, including residences along Nine Elms Lane in the foreground, the St George's Wharf development in the middle ground and Camelford House in the background, adjacent to the Albert Embankment Foreshore site. Vauxhall Bridge forms a key component of the background of the view, and largely obscures views of the Albert Embankment Foreshore site.

Viewpoint 1.4: View southwest from residences along Nine Elms Lane close to the site

11.4.72 This viewpoint is representative of the oblique view from residences between the Thames Path and Nine Elms Lane.

Vol 15 Plate 11.4.14 Viewpoint 1.4: winter view towards Heathwall Pumping Station and Kirtling Street

Date taken: 9 December 2011. 35mm lens.

11.4.73 The linear view (illustrated in Vol 15 Plate 11.4.14) up the river is focused on Battersea Power Station, which dominates the skyline in the middle ground of the view. The foreground of the view is characterised by the Thames Path in front of residences along Nine Elms Lane, and commercial premises along the river frontage, including Heathwall Pumping Station. Grosvenor Bridge forms the background to the view. Views of the parts of the sites located on the foreshore are visible from this location.

11.4.74 In summer, the view towards the sites is largely unchanged although deciduous trees provide partial screening.

Viewpoint 1.5 View northeast from residences along Battersea Park Road

11.4.75 This viewpoint is representative of the typical view from residences at the junction of Battersea Park Road and Sleaford Street.

Vol 15 Plate 11.4.15 Viewpoint 1.5: winter view towards Heathwall Pumping Station and Kirtling Street

Date taken: 9 December 2011. 18mm lens.

11.4.76 The linear view (illustrated in Vol 15 Plate 11.4.15) along Nine Elms Lane is bounded to the north and south by industrial and commercial premises which line the road. The wall surrounding Heathwall pumping station and Middle Wharf is visible in the background of the view (obscured by traffic in the image shown). Views of the majority of the Heathwall Pumping Station site (just beyond the field of view illustrated) are largely obscured from this location by the existing pumping station and boundary walls.

11.4.77 Existing buildings within the southern extent of the Kirtling Street site are visible in the foreground of the view which obscure wider views of this site.

Viewpoint 1.6: View southeast from residences along Grosvenor Road, close to Telford Terrace

11.4.78 This viewpoint is representative of the oblique view from residences along Grosvenor Road, close to Telford Terrace on the north bank of the river.

Vol 15 Plate 11.4.16 Viewpoint 1.6: winter view towards Heathwall Pumping Station and Kirtling Street

Date taken: 9 December 2011. 18mm lens.

11.4.79 The foreground of the view (illustrated in Vol 15 Plate 11.4.16) is characterised by the area of public realm and mature tree planting adjacent to the river. Battersea Power Station forms the dominant skyline feature in the background of the view, on the opposite side of the river. The remainder of the view across the river incorporates industrial and commercial premises along the frontage, including Heathwall pumping station. Views of the sites, partially located on the foreshore, are partially screened by foreground vegetation.

Viewpoint 1.7: View southeast and south from residences along Grosvenor Road, close to Churchill Gardens Estate

11.4.80 This viewpoint is representative of the typical view from residential properties adjacent to the Thames Path on the north bank of the river, on Grosvenor Road opposite Claverton Street.

Vol 15 Plate 11.4.17 Viewpoint 1.7: winter view towards Heathwall Pumping Station (southeast)

Date taken: 9 December 2011. 35mm lens.

11.4.81 The view towards Heathwall Pumping Station (illustrated in Vol 15 Plate 11.4.17) is across the river, focused on residential, commercial and industrial premises along the river frontage. The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the Heathwall Pumping Station site, largely located on the foreshore, are unobstructed from this viewpoint.

Vol 15 Plate 11.4.18 Viewpoint 1.7: summer view towards Heathwall Pumping Station (southeast)

Date taken: 22 August 2011. 35mm lens.

11.4.82 In summer, the view towards the Heathwall Pumping Station site (illustrated in Vol 15 Plate 11.4.18) is largely unchanged.

Vol 15 Plate 11.4.19 Viewpoint 1.7: winter view towards Kirtling Street (south)

Date taken: 6 May 2011. 18mm lens.

11.4.83 The view towards Kirtling Street (illustrated in Vol 15 Plate 11.4.19) is characterised by industrial and commercial premises along the river. Views of the river frontage of the Kirtling Street site are unobstructed from this viewpoint. Inland views of the site are largely obscured by intervening buildings.

Vol 15 Plate 11.4.20 Viewpoint 1.7: summer view towards Kirtling Street (south)

Date taken: 8 August 2012. 18mm lens.

11.4.84 In summer, the view towards the Kirtling Street site (illustrated in Vol 15 Plate 11.4.20) is largely unchanged.

Viewpoint 1.8: View east from newly built residences in the Riverlight development (base case scheme)

11.4.85 This viewpoint is representative of the typical view for residents of new residential blocks adjacent to the site which are anticipated to be complete in advance of the proposed construction at Heathwall Pumping Station commencing. The view at present is dominated by Heathwall pumping station in the foreground, with industrial and commercial premises along Nine Elms Lane beyond. Views of the part of the site located on the foreshore would be unobstructed from this location, particularly from upper storeys in the new development.

11.4.86 In summer, the view towards the site would be largely unchanged.

Recreational

11.4.87 Recreational receptors (apart from those engaged in active sports) generally have a high sensitivity to change, as attention is focused on enjoyment of the townscape. Tourists engaged in activities whereby attention is focused on the surrounding townscape also have a high sensitivity to change. The visual baseline in respect of recreational receptors, including tourists, is discussed below.

Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge

11.4.88 This viewpoint is representative of the typical view from pedestrians crossing Vauxhall Bridge, towards the northern end of the bridge.

Vol 15 Plate 11.4.21 Viewpoint 2.1: winter view towards Heathwall Pumping Station and Kirtling Street

Date taken: 9 December 2011 year. 35mm lens.

11.4.89 The linear view (illustrated in Vol 15 Plate 11.4.21) up the river towards Battersea Power Station to the west is characterised by industrial buildings along the south bank of the river, alongside residences along Nine Elms Lane. Residential premises along the frontage of the north bank form the foreground of the view. The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the sites, partially located on the foreshore, are unobstructed from this viewpoint.

Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge

11.4.90 This viewpoint is representative of the typical view from pedestrians crossing Vauxhall Bridge, from the centre of the bridge.

Vol 15 Plate 11.4.22 Viewpoint 2.2: winter view towards Heathwall Pumping Station and Kirtling Street

Date taken: 9 December 2011. 35mm lens.

11.4.91 The linear view (illustrated in Vol 15 Plate 11.4.22) up the river towards Battersea Power Station is characterised by industrial buildings along the south bank of the river, and residences along Nine Elms Lane. The existing Heathwall pumping station is visible, set amongst other industrial buildings similar in character. Views of the sites, partially located on the foreshore, are unobstructed from this viewpoint.

Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge

11.4.92 This viewpoint is representative of the typical view from pedestrians crossing Vauxhall Bridge, towards the southern end of the bridge.

Vol 15 Plate 11.4.23 Viewpoint 2.3: winter view towards Heathwall Pumping Station and Kirtling Street

Date taken: 9 December 2011. 35mm lens.

11.4.93 The linear view (illustrated in Vol 15 Plate 11.4.23) up the river towards Battersea Power Station is characterised by industrial buildings along the south bank of the river and residences along Nine Elms Lane. The power station forms a key component of the background of the view, dominating the skyline. The existing Heathwall pumping station is visible set amongst other industrial buildings that are similar in character. Views of the sites, partially located on the foreshore, are partially obstructed by a river pier in the foreground.

Viewpoint 2.4: View southwest and northeast from the Thames Path in front of the St George's Wharf development

11.4.94 This viewpoint is representative of the typical view for recreational users of the Thames Path and open spaces in front of the St George's Wharf residential development.

Vol 15 Plate 11.4.24 Viewpoint 2.4: winter view towards Heathwall Pumping Station and Kirtling Street (southwest)

Date taken: 9 December 2011. 35mm lens.

11.4.95 The view (illustrated in Vol 15 Plate 11.4.24) is an open panorama over the river, focused on Battersea Power Station in the background. The view is also focused on residential properties along Nine Elms Lane which are set beyond the foreground of the river frontage of St George's Wharf. The existing Heathwall pumping station is visible set amongst other industrial buildings similar in character. Views of the Heathwall Pumping Station and Kirtling Street sites are partially obscured, although views of the foreshore parts of the sites are largely unobstructed.

Vol 15 Plate 11.4.25 Viewpoint 2.4: winter view towards Albert Embankment Foreshore (northeast)

Date taken: 21 November 2011. 18mm lens.

11.4.96 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Albert Embankment Foreshore (refer to para. 11.3.12). The view (illustrated in Vol 15 Plate 11.4.25) is characterised by an open panorama over the river towards Vauxhall Bridge, visible in the middle ground of the view. The view towards the Albert Embankment Foreshore site is framed by the St George's Wharf development, Vauxhall Cross and Camelford House. Views towards the site are largely obscured by Vauxhall Bridge.

Viewpoint 2.5: View southeast and west from the Thames Path opposite the King William IV public house

11.4.97 This viewpoint is representative of the typical view from recreational users of the Thames Path on the north bank of the river opposite Lupus Street.

Vol 15 Plate 11.4.26 Viewpoint 2.7: winter view towards Heathwall Pumping Station and Kirtling Street

Date taken: 15 February 2012. 18mm lens.

11.4.98 The view (illustrated in Vol 15 Plate 11.4.26) is an open panorama over the river, focused on industrial and commercial premises along the south bank of the river, including Heathwall pumping station. Views of the Heathwall Pumping Station and Kirtling Street sites, partially located on the foreshore, are unobstructed from this location.

Vol 15 Plate 11.4.27 Viewpoint 2.7: winter view towards Chelsea Embankment Foreshore (west)

Date taken: 5 January 2012. 18mm lens.

11.4.99 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Chelsea Embankment Foreshore (refer to para. 11.3.12). The foreground of the view (illustrated in Vol 15 Plate 11.4.27) is dominated by Grosvenor Road and the avenue of mature London plane trees along the river frontage. Grosvenor Bridge is visible in the background of the view, largely obscuring views towards the Chelsea Embankment Foreshore site.

Transport

11.4.100 Travel through an area is often the means by which the greatest numbers of people view the townscape. Such receptors generally have a medium sensitivity to change.

Viewpoint 3.1: View west from the westbound carriageway of Nine Elms Lane

11.4.101 This viewpoint is representative of the typical view from people travelling west towards the site along Nine Elms Lane.

Vol 15 Plate 11.4.28 Viewpoint 3.1: winter view

Date taken: 25 January 2012. 18mm lens.

11.4.102 The linear view (illustrated in Vol 15 Plate 11.4.28) along Nine Elms Lane is contained on both sides by industrial and commercial premises. The boundary wall to Middle Wharf and Heathwall pumping station forms the foreground to the view, obscuring views to the remainder of the site.

Vol 15 Plate 11.4.29 Viewpoint 3.1: summer view

Date taken: 8 August 2011. 18mm lens.

11.4.103 In summer, the view towards the site (illustrated in Vol 15 Plate 11.4.29) is partially obscured by mature trees in the middle ground of the view.

Viewpoint 3.2: View northeast and west from the westbound carriageway of Nine Elms Lane

11.4.104 This viewpoint is representative of the typical view from people travelling west towards the site along Nine Elms Lane.

Vol 15 Plate 11.4.30 Viewpoint 3.2: winter view towards Heathwall Pumping Station (northeast)

Date taken: 25 January 2012. 18mm lens.

11.4.105 The linear view (illustrated in Vol 15 Plate 11.4.31) along Nine Elms Lane is contained on both sides by industrial and commercial premises and hoardings to the Riverlight development site. The boundary wall to Middle Wharf and Heathwall pumping station forms part of the background to the view, obscuring views to the remainder of the Heathwall Pumping Station site.

Vol 15 Plate 11.4.31 Viewpoint 3.2: winter view towards Kirtling Street (west)

Date taken: 9 December 2011. 18mm lens.

11.4.106 This viewpoint is also located within the ZTV of the proposed Thames Tideway Tunnel project site at Kirtling Street. The linear view (illustrated in Vol 15 Plate 11.4.30) along Nine Elms Lane is contained on both sides by industrial and commercial premises and hoardings on the boundary of the Riverlight development site. The southern extent of the Kirtling Street site is highly visible in the foreground of the view. There are also glimpsed views through to the site between industrial buildings on Cringle Street and Tideway Walk.

Construction base case

11.4.107 The base case in Site Year 1 of construction taking into account the schemes described in para. 11.3.13 would change the following character areas:

a. River Thames – Nine Elms Reach TCA - By Site Year 1 of construction, the conversion of a number of industrial units and disused plots of land into new residential and mixed use developments would alter the setting of this stretch of the river. However, as there would be no changes to character within the area, the sensitivity would remain medium as described in para. 11.4.33.

b. Nine Elms Lane Commercial TCA – The character of this area would be substantially altered by the assumed completion of the following developments:

   i part of the New Covent Garden Market development

   ii the US Embassy development, 290m east of the site iii part of the Embassy Gardens mixed use development

   iv Vauxhall Sky Gardens mixed use development

   v Market Towers mixed use development

c. The setting of this area would also be substantially altered, due to the assumed completion of the developments listed within the adjacent Battersea Industrial TCA, described below. The character of the area would be dominated by new high quality residential and mixed uses, as opposed to the existing industrial and commercial character of the area. The area would therefore be likely to have a moderate level of tranquillity and be locally valued by residents within the area, suggesting a medium sensitivity to change.

d. Battersea Industrial TCA – The character of this area would be substantially altered by the assumed completion of the following developments:

   i Riverlight residential led mixed use development

   ii part of the Battersea Power Station redevelopment

e. The setting of this area would also be substantially altered, due to the assumed completion of the developments listed within the adjacent Nine Elms Lane Commercial TCA, described above. The character of the area would be dominated by new high quality residential and mixed uses, as opposed to the existing industrial and commercial character of the area. The area would therefore be likely to have a moderate level of tranquillity and be locally valued by residents within the area, suggesting a medium sensitivity to change.

11.4.108 The assumed changes in base case would also alter the nature of the views towards Heathwall Pumping Station and Kirtling Street from the following viewpoints:

a. Viewpoints 1.1, 1.2, 1.6, 1.7, 2.1, 2.2, 2.3, 2.4, 2.5, - Views across the river would encompass a number of the new mixed use developments, altering the character of the views. However, the site, Cemex operations and waste transfer station would still represent industrial/commercial elements of the views.

b. Viewpoints 1.3, 1.4, - The background of views up the river would encompass a number of new mixed use developments, most notably the Riverlight development adjacent to the Kirtling Street site. However, the site, Cemex operations and waste transfer station would still represent industrial/commercial elements of the views.

c. Viewpoint 3.2 – The foreground of the view would be altered by the assumed completion of the Riverlight development, adjacent to the Kirtling Street site. The view, currently characterised by a line of hoardings, would encompass new mixed use blocks with surrounding landscaping.

11.4.109 In addition, the assumed completion of the Riverlight development would introduce additional visual receptors, represented by viewpoint 1.8.

11.4.110 All other receptors would remain as described in the baseline.

Operational base case

11.4.111 The base case in Year 1 of operation taking into account the schemes described in para. 11.3.21 would further alter the character of Nine Elms Commercial TCA and Battersea Industrial TCA, and the setting of River Thames – Nine Elms Reach TCA through further regeneration of industrial and commercial plots into new mixed use developments. However, it is considered that the sensitivity of the areas would remain medium, as described in para. 11.4.107.

11.4.112 The changes in the base case would also further alter the character of the views from the viewpoints described in para. 11.4.108, although the Cemex site and the waste transfer station would remain industrial components of the view on the river frontage.

11.4.113 All other receptors would remain as described in the baseline.

11.5 Construction effects assessment

11.5.1 The following section describes the likely significant effects arising from construction at Heathwall Pumping Station taking account of Kirtling Street, Albert Embankment Foreshore and Chelsea Embankment Foreshore (as detailed in Section 11.3).

11.5.2 Due to the scale of the construction activities proposed across what are, in many cases, prominent locations in London, construction works would be highly visible. In policy terms, the NPS for waste water (Defra, 2012)[6] recognises that nationally significant infrastructure projects are likely to take place in mature urban environments, with adverse construction effects on townscape and visual receptors likely to arise. In addition, construction works are a commonplace feature across London, and therefore the following assessment should be viewed in this context. It should also be noted that construction effects are temporary in nature and relate to the peak construction year defined in Section 11.3. Effects during other phases of works are likely to be less due to fewer construction plant being required at the time and a reduced intensity of construction activity.

11.5.3 Illustrative plans of the possible layout of the site during construction are contained in a separate volume (see Construction phase plans in separate volume of figures – Section 1). Where photomontages have been prepared to assist the assessment of effects, these are referenced in the appropriate viewpoint below.

Site character assessment

11.5.4 Effects on the character of the site would arise from partial removal of the river wall and other structures, clearance of some vegetation, installation of hoardings and construction activity associated with the construction of the cofferdam, shaft and ventilation equipment, and secondary lining of the tunnel. The impacts on specific components of the site are described in Vol 15 Table 11.5.1 below.

Vol 15 Table 11.5.1 Townscape – impacts on existing site components during construction

ID	Component	Impacts
01	River wall	Parts of the existing river wall would be removed to facilitate construction of the site cofferdam into the river and the construction of permanent infrastructure within the cofferdam.
02	Boundary planting	Vegetation within the eastern and western site boundary would be pruned during construction.
03	Heathwall Pumping Station	This building would be retained during construction, and would remain operational throughout.
04	Middle Wharf	The hardstanding of Middle Wharf would be used as the location for the shaft at this site, largely maintaining its existing character.
05	Middle Wharf jetty	This would remain unaffected during construction.
06	Electrical substation	This would remain unaffected during construction.
07	Battersea Barge	The barge would be relocated during construction.

11.5.5 The existing site has a low level of tranquillity, which would be affected to a limited extent due to the clearance required to form the construction site, including formation of the cofferdam in the river, and the level of activity during construction.

11.5.6 Due to the clearance required to form the construction site and the intense levels of activity, including formation of the temporary cofferdam in the river, the magnitude of change is considered to be high.

11.5.7 The high magnitude of change, assessed alongside the low sensitivity of the site, would result in **minor adverse** effects.

Townscape character areas assessment

River Thames – Nine Elms Reach TCA

11.5.8 The proposed Heathwall Pumping Station site is adjacent to this reach of the river, introducing high levels of construction activity within the river corridor, including a temporary cofferdam and intense construction activity.

11.5.9 The proposed Kirtling Street site is also adjacent to this reach of the river, introducing high levels of construction activity into the river including an industrial jetty, construction plant and 24 hour loading of barges (although contiguous with the safeguarded nature of the wharf). However, the construction activity at both these sites would be typical of other operations in the area such as the waste transfer station adjacent to the Kirtling Street site.

11.5.10 The wider setting of this character area would be affected, although to a limited extent, by the construction works at the proposed Albert Embankment Foreshore and Chelsea Embankment Foreshore sites.

11.5.11 The area has a moderate level of tranquillity at present, which would be affected through the introduction of construction activity at these sites, including piling, demolition and river and road based traffic.

11.5.12 Due to construction activity at all four sites, set against an existing presence of industrial activities, the magnitude of change is considered to be medium.

11.5.13 The medium magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **moderate adverse** effects.

Nine Elms Lane Residential TCA

11.5.14 The proposed Heathwall Pumping Station site is set directly west of this character area. The setting of the area would be affected, although to a limited extent by the presence of construction activity, traffic and construction plant.

11.5.15 The wider riverside setting of this area would be affected to a limited extent by construction activity on the river frontage at Kirtling Street, including 24 hour loading of barges, and the cofferdam and construction activity at Albert Embankment Foreshore. However, the majority of the riverside setting would be largely unaffected.

11.5.16 The area has a moderate level of tranquillity at present, which would be affected through the introduction of construction activity, including piling, demolition and river and road based traffic in the wider area.

11.5.17 Therefore, the magnitude of change arising from the presence of construction activity at all three sites is considered to be medium.

11.5.18 The medium magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **moderate adverse** effects.

St George's Wharf Residential TCA

11.5.19 The proposed Heathwall Pumping Station site forms part of the wider setting of this character area. The setting would be affected to a limited extent by the presence of construction activity and construction plant.

11.5.20 The wider setting of this area would also be affected, although to a limited extent, by construction activity along the river frontage at Kirtling Street, including 24 hour loading of barges.

11.5.21 The proposed Albert Embankment Foreshore site forms part of the immediate setting of this character area, just beyond Vauxhall Bridge. The presence of the temporary cofferdam, construction activity and construction plant at this site would affect the riverside setting of the character area, forming a key component of the setting for the duration of construction.

11.5.22 The area has a moderate level of tranquillity at present, which would be affected through the introduction of construction activity, including piling, demolition and river and road based traffic in the wider area.

11.5.23 Due to the immediate change in setting arising from construction activity at Albert Embankment Foreshore, and the wider changes in setting arising from activities at Heathwall Pumping Station and Kirtling Street, the magnitude of change is considered to be high.

11.5.24 The high magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **moderate adverse** effects.

Nine Elms Lane Commercial TCA; and Battersea Industrial TCA

11.5.25 The proposed Heathwall Pumping Station and Kirtling Street sites are set directly north of these character areas. The setting of the areas would be affected by the presence of construction activity, construction plant, demolition of existing buildings and structures, 24 hour loading of barges at Kirtling Street and the temporary cofferdam at Heathwall Pumping Station. However, the construction activity at both sites would be set against existing industrial uses, including the waste transfer station and Cemex concrete batching plant immediately west of the Kirtling Street site.

11.5.26 The areas have a moderate level of tranquillity, which would be affected by the intensity of construction activity at Heathwall Pumping Station and Kirtling Street, including demolition, road transport and 24 hour loading of barges.

11.5.27 Due to the intensity of construction at both the Heathwall Pumping Station and Kirtling Street sites, set against the industrial context of the Cemex operations and waste transfer station, the magnitude of change is considered to be medium.

11.5.28 The medium magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **moderate adverse** effects.

11.5.29 The assessment of specific effects on the setting of the Grade II* listed Battersea Power Station as a heritage asset is set out in Section 7 of this volume. The historic environment assessment identifies a minor adverse effect on the setting of this asset due to much of the setting being largely unaffected by the proposed development.

Pimlico Residential TCA

11.5.30 The proposed Heathwall Pumping Station and Kirtling Street sites form a direct part of the riverside setting of this character area. The presence of construction activity and construction plant at both sites, demolition, the river jetty and 24 hour loading of barges at Kirtling Street, and the site cofferdam at Heathwall Pumping Station, would affect the riverside setting of this character area. However, the construction activity would be set against existing industrial uses, including the waste transfer station and Cemex concrete batching plant immediately west of the Kirtling Street site, which includes industrial barging operations.

11.5.31 The area has a moderate level of tranquillity at present, which would be largely unaffected by construction activities at the sites.

11.5.32 Due to the substantial changes to the immediate riverside setting of this area, set against the presence of other industrial operations, the magnitude of change is considered to be medium.

11.5.33 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, would result in **moderate adverse** effects.

11.5.34 The assessment of specific effects on the setting of Churchill Gardens, Dolphin Square and Pimlico Conservation Areas as heritage assets is set out in Section 7 of this volume. The historic environment assessment identifies minor adverse effects on the setting of these assets due to much of the historic setting being largely unaffected by the proposed development.

Townscape – sensitivity test for programme delay

11.5.35 For the assessment of townscape effects during construction, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely materially to change the assessment findings reported above (paras. 11.5.4 to 11.5.34). The Nine Elms Regeneration area is subject to ongoing and long term change, and a delay to the Thames Tideway Tunnel project is not likely to change the sensitivity to change of the townscape character areas already presented (paras. 11.4.2 to 11.4.60).

Visual assessment

11.5.36 The visual assessment for the construction phase has been undertaken during winter, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities may be reduced during summer when vegetation, if present in a view, would be in leaf.

Residential

Viewpoint 1.1: View southwest and northeast from residences on Grosvenor Road opposite St George's Square; and Viewpoint 1.2: View southwest and northeast from residences on Grosvenor Road near Balvaird Place

11.5.37 Views towards the Heathwall Pumping Station and Kirtling Street sites would be affected by the presence of construction activity, construction plant, welfare facilities, the river jetty at Kirtling Street and the site cofferdam at Heathwall Pumping Station. The majority of the immediate views across the river would remain unaffected, and the construction would appear alongside other existing industrial uses.

11.5.38 Views from these locations towards the Albert Embankment Foreshore site would be affected by the background visibility of the site cofferdam, construction activity, tall construction plant and welfare facilities, partially obscured by Vauxhall Bridge. The combined sewer overflow (CSO) interception works upstream of the bridge would be directly visible in the middle ground of the views.

11.5.39 Due to the wider visibility of construction activity at all three sites and the direct visibility of the CSO interception works at Albert Embankment Foreshore, the magnitude of change is considered to be medium.

11.5.40 The medium magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **moderate adverse** effects.

Viewpoint 1.3: View southwest and northeast from residences along Nine Elms Lane

11.5.41 The view towards the Heathwall Pumping Station and Kirtling Street sites would be affected by the presence of construction activity, construction plant, the river jetty and 24 hour loading of barges at Kirtling Street and the site cofferdam at Heathwall Pumping Station, in the background of the view. The majority of the wider panoramic view across the river would be largely unaffected.

11.5.42 The wider panoramic views of the river would however be affected by the presence of construction activity and construction plant at the Albert Embankment Foreshore site, although they would be partially obscured by Vauxhall Bridge. CSO interception works would be highly visible set in front of Vauxhall Bridge.

11.5.43 Due to the wider visibility of construction activity at all three sites and the visibility of the interception works at Albert Embankment Foreshore in front of Vauxhall Bridge, the magnitude of change is considered to be medium.

11.5.44 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

Viewpoint 1.4: View southwest from residences along Nine Elms Lane, close to the site

11.5.45 Oblique views from residences towards the Heathwall Pumping Station and Kirtling Street sites would be affected during construction. Views along the river would be affected by the foreground presence of the temporary cofferdam, construction activity and construction plant at Heathwall Pumping Station, and the background visibility of the river jetty and 24 hour loading of barges at Kirtling Street. However, the construction activities would be set against existing industrial uses, including the waste transfer station and Cemex concrete batching plant immediately west of the Kirtling Street site, which includes industrial barging operations. Construction activities further inland from the foreshore structures and river frontage, would be obscured by intervening buildings. Therefore, the magnitude of change is considered to be medium.

11.5.46 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

Viewpoint 1.5: View northeast from residences along Battersea Park Road

11.5.47 Construction activity at the Heathwall Pumping Station site would be barely perceptible from this location, due to the intervening buildings and structures along Nine Elms Lane and mature trees further obscuring the view towards this site.

11.5.48 Construction activity, tall construction plant, demolition, welfare facilities, site hoardings and road traffic at the southern end of the Kirtling Street site would be visible in the foreground of the view. The construction activity at this site would be set against existing industrial and commercial uses.

11.5.49 Therefore, principally due to the visibility of construction activities at the Kirtling Street site, the magnitude of change is considered to be medium.

11.5.50 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

Viewpoint 1.6: View southeast from residences along Grosvenor Road, close to Telford Terrace

11.5.51 Views from residences towards the Heathwall Pumping Station and Kirtling Street sites would be affected, although to a limited extent during construction. The panoramic views over the river would be affected by the background presence of construction activity, construction plant, the river jetty and 24 hour loading of barges at Kirtling Street and the site cofferdam at Heathwall Pumping Station. However, the foreground of the view would remain unaffected and wider views towards the site would be partially screened by mature trees along the river frontage. The construction activity would be set against existing industrial uses, including the waste transfer station and Cemex concrete batching plant immediately west of the Kirtling Street site, which includes industrial barging operations. Therefore, the magnitude of change is considered to be low.

11.5.52 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor adverse** effects.

Viewpoint 1.7: View southeast and south from residences along Grosvenor Road, close to Churchill Gardens Estate

11.5.53 Views from residences towards the Heathwall Pumping Station and Kirtling Street sites would be affected during construction. The panoramic views over the river would be affected by the presence of construction activity, construction plant, the river jetty and 24 hour loading of barges at Kirtling Street and the site cofferdam at Heathwall Pumping Station. However, the construction activities would be set against existing industrial uses, including the waste transfer station immediately west of the Kirtling Street site, which includes industrial barging operations. Therefore, the magnitude of change is considered to be medium.

11.5.54 The view of the proposed development from this viewpoint is illustrated in Vol 15 Plate 11.5.1 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 15 Figure 11.5.1 (see separate volume of figures). The verifiable photomontage shows an illustration of how the construction site may be set up during phase 1 (site setup, shaft construction and tunnelling). The layout of the construction activities may change within the maximum extent of working area (see Construction phase 1 plan – site setup, shaft construction and tunnelling – in separate volume of figures]).

Vol 15 Plate 11.5.1 Viewpoint 1.7 – illustrative construction phase photomontage

Date taken: 6 May 2011. 50mm lens.

11.5.55 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

Viewpoint 1.8: View east from newly built residences in the Riverlight development (base case scheme)

11.5.56 Views from new residences towards the site would be affected during construction by the foreground visibility of construction activity, construction plant and the site cofferdam at the Heathwall Pumping Station site. Views from ground level would be characterised by site hoardings, while from upper storeys construction activity across the whole site would be directly visible. Therefore, the magnitude of change is considered to be high.

11.5.57 The high magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **major adverse** effects.

Recreational

Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge; Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge; and Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge

11.5.58 Views from these locations up the river would be affected by the background presence of construction activity, construction plant, the river jetty at Kirtling Street and the site cofferdam at Heathwall Pumping Station. Construction activity inland from the river frontage would be largely obscured at both sites. In addition, the foreground of the views would be unchanged and the overall character of the views would remain largely unaltered, with the construction activity set against other industrial uses, including the waste transfer station and Cemex concrete batching plant adjacent to the Kirtling Street site. Therefore, the magnitude of change is considered to be low.

11.5.59 The low magnitude of change, assessed alongside the high sensitivity of these receptors, would result in **minor adverse** effects.

Viewpoint 2.4: View southwest and northeast from the Thames Path in front of the St George's Wharf development

11.5.60 Views from this location towards the Heathwall Pumping Station and Kirtling Street sites would be affected by the presence of construction activity, construction plant, the river jetty at Kirtling Street and the site cofferdam at Heathwall Pumping Station. The construction activities would be set against other industrial uses, including the waste transfer station and Cemex concrete batching plant adjacent to the Kirtling Street site.

11.5.61 Wider panoramic views of the river would be affected by the presence of construction activity and construction plant at the Albert Embankment Foreshore site, partially obscured by Vauxhall Bridge. CSO interception works would be highly visible set in front of Vauxhall Bridge in the middle ground of the view. The remainder of the panoramic view across the river would remain unaffected.

11.5.62 Due to the wider visibility of construction activity at all three sites and the direct visibility of the CSO interception works at Albert Embankment Foreshore, the magnitude of change is considered to be medium.

11.5.63 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

Viewpoint 2.5: View southeast and west from the Thames Path opposite the King William IV public house

11.5.64 Views from this location towards Heathwall Pumping Station and Kirtling Street would be affected by the presence of construction activity, construction plant, the river jetty at Kirtling Street and the site cofferdam at Heathwall Pumping Station. However, the construction activities would be set against other industrial uses, including the waste transfer station and Cemex concrete batching plant adjacent to the Kirtling Street site.

11.5.65 Views from this location would also be affected to a limited extent by construction activity at the Chelsea Embankment Foreshore site. The site cofferdam, tall construction plant and cranes at the site would be visible in the background of the view, largely obscured by Grosvenor Bridge and Chelsea Bridge. The foreground of the view west would be unaffected.

11.5.66 Therefore, the magnitude of change arising from construction at all three sites is considered to be medium.

11.5.67 The medium magnitude of change assessed alongside the high sensitivity of the receptor, would result in **moderate adverse** effects.

Transport

Viewpoint 3.1: View west from the westbound carriageway of Nine Elms Lane

11.5.68 Views from this location towards the site would be affected to a limited extent during construction due to the presence of tall construction plant and cranes visible beyond the boundary wall to Middle Wharf and

Heathwall Pumping Station, and construction traffic along Nine Elms Lane. However, the road traffic would be typical of normal levels of traffic along Nine Elms Lane, which includes substantial numbers of HGVs. In addition, components of the existing view, including Heathwall pumping station and the boundary walling, would remain largely unchanged. Therefore, the magnitude of change is considered to be low.

11.5.69 The low magnitude of change, assessed alongside the medium sensitivity of the receptor, would result in **minor adverse** effects.

Viewpoint 3.2: View northeast and west from the eastbound carriageway of Nine Elms Lane

11.5.70 Views from this location towards Heathwall Pumping Station would be affected to a limited extent by the background presence of tall construction plant, cranes and construction traffic along Nine Elms Lane. Other construction activities at this site would be obscured by intervening buildings and structures, including those within the newly built Riverlight development which would be assumed to be complete by Site Year 1 of construction (refer to para. 11.4.107).

11.5.71 Construction activity at Kirtling Street would also be visible from this viewpoint. The view would be affected by the wider presence of tall construction plant, the noise shed and cranes, and the foreground visibility of demolition, construction activity, welfare facilities and site hoardings in the southern part of the site. Views of other parts of the site would be partially obscured by buildings within the newly built Riverlight development, which would be assumed to be complete by Site Year 1 of construction (refer to para. 11.4.107).

11.5.72 Due to the background visibility of some construction activity at Heathwall Pumping Station and the foreground visibility of construction activity in the southern extent of Kirtling Street, with wider views obscured by intervening buildings, the magnitude of change is considered to be medium.

11.5.73 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, would result in **moderate adverse** effects.

Visual effects – sensitivity test for programme delay

11.5.74 Para. 11.3.14 describes other developments assumed to be under construction at the same time as construction takes place at the Heathwall Pumping Station site. These are assessed cumulatively (Section 11.7). In the event that there is a programme delay of approximately one year for the Thames Tideway Tunnel project, this would result in a re-categorisation of phases of these other developments from the cumulative assessment into base case, that is more phases would be assumed to be built and occupied with a delayed start to construction at the Heathwalll Pumping Station site. While this would result in an increase in the number of visual receptors, the assessment already factors in these viewpoints and therefore the outcome of the assessment would remain unchanged.

11.6 Operational effects assessment

11.6.1 The following section describes the likely significant effects arising during the operational phase at Heathwall Pumping Station taking account of the Kirtling Street and Albert Embankment Foreshore sites (as detailed in Section 11.3).

11.6.2 Effect on tranquillity is one factor which informs the overall assessment of effects on townscape character. Since the operation of the proposed development would have little above-ground activity associated with it, apart from infrequent maintenance visits, it is considered that the proposed development would have a negligible effect on tranquillity for all townscape character areas. This conclusion is not repeated for each character area discussed below.

11.6.3 For the site, all surrounding townscape character areas and all viewpoints, adverse effects would be avoided by the commitment to a high quality design as detailed in the design principles, summarised in para. 11.2.6. Furthermore, the elements of the design, including a new publicly accessible river frontage, improved river wall incorporating timber fendering, improvements to the boundary walling of Middle Wharf and Heathwall Pumping Station and new tree planting along Nine Elms Lane, are considered to be an enhancement of the existing site. Where specific measures are of particular relevance to the effect on a receptor, these are described under each townscape character area and viewpoint.

11.6.4 Illustrative plans of the proposed development during operation are contained in a separate volume (Vol 15 Heathwall Pumping Station Figures – Section 1) and design principles describing environmental design measures are set out in Vol 1 Appendix B. Where photomontages have been prepared to assist the assessment of effects, these are referenced in the appropriate viewpoint below.

Operational effects Year 1

Site character assessment

11.6.5 The proposed development would constitute a permanent improvement to the character of the site. The permanent works layout would result in a new area of public realm in front of Heathwall pumping station, projecting into the river by approximately 18m, forming a continuation of the public river frontage. This projection would introduce a new structure into the river beyond the line of the river wall in a stretch of river characterised by numerous incursions and insets including the existing pier structure at Middle Wharf (immediately adjacent to the site). The river wall surrounding the foreshore structure would be clad in concrete panels typical of the character of surrounding river walls. The wall would incorporate horizontal bands to mark river levels and vertical timber fenders. The design intent for the river wall is illustrated on the Proposed river wall design intent figure (see separate volume of figures – Section 1).

11.6.6 The ventilation columns serving the shaft and South West Storm Relief Sewer (4-8m high) and the narrow ventilation column serving the Heathwall Pumping Station CSO interception chamber (6m high) would be located within the Heathwall pumping station compound and would be typical of the character of this part of the site. The design intent for the ventilation columns (which would be the project signature design) is illustrated on the Ventilation columns design intent figure – type B and C (see separate volume of figures – Section 1). The main electrical and control equipment would be located within Heathwall Pumping Station.

11.6.7 New gates and fencing would be provided along the Thames Path and around the Heathwall Pumping Station compound, comprising low level fair faced concrete walls, high quality architectural steel fencing coloured to integrate with the adjacent Riverlight development and sliding steel dates. Ivy would be planted on the fencing to the eastern boundary of Middle Wharf. The design intent for the fencing and gates is illustrated on the Proposed fencing and gate elevations figure (see separate volume of figures – Section 1). Three new semi-mature trees would be planted along Nine Elms Lane in front of the Heathwall Pumping Station compound and Middle Wharf. The facades of Heathwall Pumping Station would be cleaned and painted.

11.6.8 The remainder of the construction phase working area would be returned to its original condition, or improved with new surfacing as part of the extension of the public river frontage around the pumping station. It is considered that the works would result in an improvement to the public realm and river walls around Heathwall pumping station and Middle Wharf. The impacts on specific components of the site are described in Vol 15 Table 11.6.1 below.

Vol 15 Table 11.6.1 Townscape – impacts on baseline components in Year 1 of operation

ID	Component	Impacts
01	River wall	A new river wall would form the flood defence line around the cofferdam forming the site.
02	Boundary planting	No operational impacts.
03	Heathwall Pumping Station	No operational impacts.
04	Middle Wharf	No operational impacts.
05	Middle Wharf jetty	No operational impacts.
06	Electrical substation	No operational impacts.
07	Battersea Barge	The barge would be relocated back to approximately same location as existing.

11.6.9 Due to the improvements to the site, including creation of a publicly accessible river frontage, broadly in keeping with the existing character, the magnitude of change is considered to be medium.

11.6.10 The medium magnitude of change, assessed alongside the low sensitivity of the site, would result in **minor beneficial** effects.

Townscape character areas assessment

11.6.11 This section describes effects arising from the proposed development in operation on townscape character areas surrounding the site. No assessment of townscape effects has been made for the following character areas, as the components of the operational scheme would not alter their setting:

a. Nine Elms Lane Residential

b. St George's Wharf Residential.

River Thames – Nine Elms Reach TCA

11.6.12 The proposed development at Heathwall Pumping Station would locally improve the setting of this character area by creating a public pedestrian frontage along the river and by partially screening the existing pumping station through new planting and well designed structures. The Kirtling Street site would also locally improve the setting of this character area through the demolition of existing dilapidated buildings and structures.

11.6.13 The proposed development at Albert Embankment Foreshore would not substantially alter the setting of this character area. However, the CSO interception chamber on either side of Vauxhall Bridge would affect the setting of the reach to a limited extent by slightly altering the appearance of Vauxhall Bridge, an important part of this area's character. The change would be minimised through terracing to blend the interception chamber on the west side of the bridge into the surrounding foreshore, representing an improvement to the existing CSO outfalls which are highly visible adjacent to the bridge. The majority of the areas setting would be largely unaffected.

11.6.14 Due to the improvements in setting introduced by components of the proposed development at all three sites, the magnitude of change is considered to be low.

11.6.15 The low magnitude of change, assessed alongside the medium sensitivity of this character area, would result in **minor beneficial** effects.

Nine Elms Lane Commercial TCA; and Battersea Industrial TCA

11.6.16 The proposed development at Heathwall Pumping Station would locally alter the setting of these character areas through improving the boundary to Middle Wharf, partially screening the pumping station and creating public access along the wharf and in front of the pumping station.

11.6.17 The setting of the areas would also be affected by the demolition of dilapidated buildings at the Kirtling Street site. However, the majority of the setting of both character areas would be largely unaffected. Therefore, the magnitude of change is considered to be low.

11.6.18 The low magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **minor beneficial** effects.

11.6.19 The assessment of specific effects on the setting of the Grade II* listed Battersea Power Station as a heritage asset is set out in Section 7. The historic environment assessment identifies a minor adverse effect on the setting of this asset due to slight changes in views of the power station.

Pimlico Residential TCA

11.6.20 The proposed development at Heathwall Pumping Station would result in changes to the riverside setting of this character area, due to the creation of a new area of public realm in front of Heathwall pumping station, partially screening the existing pumping station through new planting and structures and providing a new, well designed river wall.

11.6.21 The riverside setting of the area would also be affected by the demolition of dilapidated buildings at the Kirtling Street site. However, the majority of the setting would be largely unaffected. Therefore, the magnitude of change is considered to be low.

11.6.22 The low magnitude of change, assessed alongside the medium sensitivity of these character areas, would result in **minor beneficial** effects.

Townscape – sensitivity test for programme delay

11.6.23 For the assessment of townscape effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely to materially change the assessment findings reported above (paras. 11.6.5 to 11.6.22). This is on the basis that there are no known schemes that would change the sensitivity to change of the townscape character areas already presented (paras. 11.4.2 to 11.4.60).

Visual assessment

11.6.24 For each viewpoint, an assessment of the visual effects during Year 1 of operation has been made. In each instance, the first part of the assessment relates to visual effects during winter, while the second part relates to visual effects during summer.

11.6.25 No assessment of visual effects has been made for the following viewpoints, as the components of the operational scheme would not be visible or would be barely perceptible in the background of the view:

a. Viewpoint 1.1: View southwest and northeast from residences on Grosvenor Road opposite St George's Square

b. Viewpoint 1.2: View southwest and northeast from residences on Grosvenor Road near Balvaird Place

c. Viewpoint 1.3: View southwest and northeast from residences along Nine Elms Lane

d. Viewpoint 1.5: View northeast from residences along Battersea Park Road

e. Viewpoint 1.6: View southeast from residences along Grosvenor Road close to Telford Terrace

f. Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge

g. Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge

h. Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge

i. Viewpoint 2.4: View southwest and northeast from the Thames Path in front of the St George's Wharf development

j. Viewpoint 2.5: View southeast and west from the Thames Path opposite the King William IV public house

k. Viewpoint 3.2: View northeast and west from the eastbound carriageway of Nine Elms Lane.

Residential

Viewpoint 1.4: View southwest from residences along Nine Elms Lane, close to the site

11.6.26 Oblique views from residences towards the site would be affected to a limited extent by the design of the new river wall, public realm and site boundaries. The site would form an indistinct component in the background of the panoramic view, set against the context of the surrounding redevelopment which would be similar in character, comprising a public river frontage. In addition, the majority of the river panorama would be unaffected. Therefore, the magnitude of change is considered to be low.

11.6.27 The view of the proposed development from this viewpoint is illustrated in Vol 15 Plate 11.6.1 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 15 Figure 11.6.1 (see separate volume of figures). The layout of the proposed development illustrated in this photomontage may change within the zones shown on the Site works parameter plan (see separate volume of figures – Section 1), however the assessment of effects would be no worse than that described here.

Vol 15 Plate 11.6.1 Viewpoint 1.4 – illustrative operational phase photomontage

Date taken: 23 March 2011. 50mm lens.

11.6.28 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor beneficial** effects.

11.6.29 There would be no change to the assessment during summer.

Viewpoint 1.7: View southeast and south from residences along Grosvenor Road, close to Churchill Gardens Estate

11.6.30 Views from residences towards the Heathwall Pumping Station site would be affected to a limited extent by the design of the new river wall around the foreshore structure. The site would form an indistinct component in the panoramic view, set against the context of the surrounding redevelopment which would be similar in character, comprising a public river frontage. The view of the existing pumping station would also be partially screened.

11.6.31 The view south towards the Kirtling Street site would be affected by the demolition of existing dilapidated buildings. However, the views of the site would remain typical of the surrounding industrial uses, including the neighbouring waste transfer station. Therefore, the magnitude of change arising from the operation of the proposed development at both sites is considered to be low.

11.6.32 The view of the proposed development from this viewpoint is illustrated in Vol 15 Plate 11.6.2 below. A larger scale print of the photomontage, including the wider context and annotations, is provided in Vol 15 Figure 11.6.2 (see separate volume of figures). The layout of the proposed development illustrated in this photomontage may change within the zones shown on the Site works parameter plan (see separate volume of figures – Section 1), however the assessment of effects would be no worse than that described here.

Vol 15 Plate 11.6.2 Viewpoint 1.7 – illustrative operational phase photomontage

Date taken: 6 May 2011. 50mm lens.

11.6.33 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor beneficial** effects.

11.6.34 There would be no change to the assessment during summer.

Viewpoint 1.8: View east from newly built residences in the Riverlight development (base case scheme)

11.6.35 Views from newly built residences towards the site would be affected by the foreground visibility of the new high quality area of public realm, river wall and boundary treatments. Views of the existing Heathwall pumping station and compound would be partially obscured by new structures including the new gates along the river frontage, improving the view. The new tree planting along Nine Elms Lane would also be visible from this location. However, the overall character of the view would remain largely unchanged. Therefore, the magnitude of change is considered to be low.

11.6.36 The low magnitude of change, assessed alongside the high sensitivity of the receptor, would result in **minor beneficial** effects.

11.6.37 There would be no change to the assessment during summer.

Transport

Viewpoint 3.1: View west from the westbound carriageway of Nine Elms Lane

11.6.38 Views from residences towards the majority of the proposed development would be largely obscured by intervening buildings and the boundary walls to Heathwall pumping station and Middle Wharf, which would remain unaltered by the proposed works. However, new tree planting along Nine Elms Lane would be visible in the middle ground of the view, continuing the line of trees visible in the foreground and filtering views towards Heathwall pumping station. Therefore, the magnitude of change is considered to be low.

11.6.39 The low magnitude of change, assessed alongside the medium sensitivity of the receptor, would result in **minor beneficial** effects

11.6.40 In summer, the trees along Nine Elms Lane would strengthen the green frontage along the street and further obscure views of the Heathwall pumping station building. Therefore, the magnitude of change is considered to be medium, resulting in **moderate beneficial** effects during summer.

Visual effects – sensitivity test for programme delay

11.6.41 For the assessment of visual effects during operation, a delay to the Thames Tideway Tunnel project of approximately one year would not be likely materially to change the assessment findings reported above (paras. 11.6.25 to 11.6.40). This is on the basis that there are no known schemes within the assessment area that would introduce new visual receptors, or alter visibility of the proposed development from the viewpoints described in paras. 11.4.62 to 11.4.106.

Operational effects Year 15

11.6.42 Operational effects for all townscape and visual receptors identified would remain unchanged in Year 15 compared to Year 1, due to the limited effect any maturing vegetation would have on the visibility of the site and the limited changes anticipated in the surrounding area in the Year 15 base case. This would also apply in the event of a programme delay to the Thames Tideway Tunnel project of approximately one year.

11.7 Cumulative effects assessment

Construction effects

11.7.1 As described in para. 11.3.14, a number of other schemes within the assessment area would be under construction during Site Year 1 of construction at the Heathwall Pumping Station site.

11.7.2 Cumulatively, construction activity at the Thames Tideway Tunnel project sites (Heathwall Pumping Station, Kirtling Street and Albert Embankment Foreshore) and all the developments described above, and construction traffic arising from all these sites, would elevate effects on the setting of all townscape character areas surrounding the site and visual assessment viewpoints within the assessment area.

11.7.3 Significant effects on receptors arising from the proposed Thames Tideway Tunnel project would remain significant when considered with non-Thames Tideway Tunnel project developments. Effects during daytime on the following visual receptors (which are not significant from the Thames Tideway Tunnel project alone) would be significant when taking into account construction at the developments described in para.11.3.14:

a. Viewpoint 1.6: View southeast from residences along Grosvenor Road, close to Telford Terrace

b. Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge

c. Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge

d. Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge

e. Viewpoint 3.1: View west from the westbound carriageway of Nine Elms Lane.

11.7.4 In the event that the programme for the Thames Tideway Tunnel project is delayed by approximately a year, a greater proportion of the schemes listed above would be built and occupied with a corresponding reduced level of cumulative activity. In terms of townscape, there would remain a high level of cumulative construction and effects on townscape character areas would remain unchanged from those assessed. Similarly, while a programme delay would increase the number of visual receptors, the associated viewpoints are already factored into the assessment and again, findings for the visual assessment would be unlikely to change.

Operational effects

11.7.5 There would be no cumulative effects during Year 1 or Year 15 of operation (the assessment years) because no schemes relevant to the assessment of effects on townscape and visual receptors have been identified. Therefore, operational effects remain as described in Section 11.6. This would also apply in the event of a programme delay to the Thames Tideway Tunnel project of approximately one year.

11.8 Mitigation

11.8.1 All measures embedded in the proposed scheme and *CoCP* of relevance to the townscape and visual assessment are summarised in Section 11.2. No further mitigation is possible for residual effects due to the highly visible nature of the construction activities.

11.8.2 No mitigation is required during operation as all effects are assessed to be negligible or beneficial.

11.9 Residual effects assessment

Construction effects

11.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 11.5. All residual effects are presented in Section 11.10.

Operational effects

11.9.2 As no mitigation measures are proposed, the residual operational effects remain as described in Section 11.6. All residual effects are presented in Section 11.10.

11.10 Assessment summary

Vol 15 Table 11.10.1 Townscape – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
The site	Change to character due to demolition of structures, construction of the site cofferdam and intensity of construction activity.	Minor adverse	None	Minor adverse
River Thames – Nine Elms Reach TCA	Change to setting due to construction activity at Heathwall Pumping Station and Kirtling Street, and the wider presence of construction activity at Albert Embankment Foreshore and Chelsea Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Nine Elms Lane Residential TCA	Change to riverside setting due to construction activity, traffic and construction plant at Heathwall Pumping Station, the river jetty at Kirtling Street and the cofferdam and construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
St George's Wharf Residential TCA	Wider change to setting due to construction activity at Heathwall Pumping Station and Kirtling Street. Change to immediate setting due to construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Nine Elms Lane Commercial TCA	Change to setting due to construction activity, construction plant and road transport and demolition of existing structures at Heathwall Pumping Station and Kirtling Street.	Moderate adverse	No mitigation possible	Moderate adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Battersea Industrial TCA	Change to setting due to construction activity, construction plant and road transport and demolition of existing structures at Heathwall Pumping Station and Kirtling Street.	Moderate adverse	No mitigation possible	Moderate adverse
Pimlico Residential TCA	Change to riverside setting due to construction activity and construction plant at both sites, the river jetty at Kirtling Street and the cofferdam at Heathwall Pumping Station.	Moderate adverse	No mitigation possible	Moderate adverse

Vol 15 Table 11.10.2 Visual – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential				
Viewpoint 1.1: View southwest and northeast from residences on Grosvenor Road opposite St George's Square	Visibility of construction activity, construction plant, the river jetty at Kirtling Street and the cofferdam at Heathwall Pumping Station. Background visibility of construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Viewpoint 1.2: View southwest and northeast from residences on Grosvenor Road near Balvaird Place	Visibility of construction activity, construction plant, the river jetty at Kirtling Street and the cofferdam at Heathwall Pumping Station. Background visibility of construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Viewpoint 1.3: View southwest and northeast from residences along Nine Elms Lane	Visibility of construction activity, construction plant, the river jetty at Kirtling Street and the cofferdam at Heathwall Pumping Station. Background visibility of construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Viewpoint 1.4: View southwest from residences along Nine Elms Lane, close to the site	Oblique visibility of construction activity at Heathwall Pumping Station in the foreground and the river jetty at Kirtling Street in the background.	Moderate adverse	No mitigation possible	Moderate adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Viewpoint 1.5: View northeast from residences along Battersea Park Road	Foreground visibility of construction activity, construction plant, demolition and road traffic at Kirtling Street. Background visibility of construction activity at Heathwall Pumping Station.	Moderate adverse	No mitigation possible	Moderate adverse
Viewpoint 1.6: View southeast from residences along Grosvenor Road, close to Telford Terrace	Wider visibility of construction activity at Kirtling Street and Heathwall Pumping Station.	Minor adverse	None	Minor adverse
Viewpoint 1.7: View southeast and south from residences along Grosvenor Road, close to Churchill Gardens Estate	Visibility of construction activity at Heathwall Pumping Station and Kirtling Street across the river.	Moderate adverse	No mitigation possible	Moderate adverse
Viewpoint 1.8: View east from newly built residences in the Riverlight development (base case scheme)	Foreground visibility of construction activity, construction plant and the cofferdam at Heathwall Pumping Station.	Major adverse	No mitigation possible	Major adverse
Recreational				
Viewpoint 2.1: View southwest from the northern end of Vauxhall Bridge	Background visibility of construction activity at Heathwall Pumping Station and Kirtling Street.	Minor adverse	None	Minor adverse
Viewpoint 2.2: View southwest from the centre of Vauxhall Bridge	Background visibility of construction activity at Heathwall Pumping Station and Kirtling Street.	Minor adverse	None	Minor adverse
Viewpoint 2.3: View southwest from the southern end of Vauxhall Bridge	Background visibility of construction activity at Heathwall Pumping Station and Kirtling Street.	Minor adverse	None	Minor adverse

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Viewpoint 2.4: View southwest and northeast from the Thames Path in front of the St George's Wharf development	Visibility of construction activity at Heathwall Pumping Station and Kirtling Street. Wider visibility of construction activity at Albert Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Viewpoint 2.5: View southeast and west from the Thames Path opposite the King William IV public house	Visibility of construction activity at Heathwall Pumping Station and Kirtling Street. Wider visibility of the cofferdam, tall construction plant and cranes at Chelsea Embankment Foreshore.	Moderate adverse	No mitigation possible	Moderate adverse
Transport				
Viewpoint 3.1: View west from the westbound carriageway of Nine Elms Lane	Visibility of tall construction plant, cranes and road traffic at Heathwall Pumping Station.	Minor adverse	None	Minor adverse
Viewpoint 3.2: View northeast and west from the eastbound carriageway of Nine Elms Lane	Background visibility of construction at Heathwall Pumping Station. Foreground visibility of construction activity at Kirtling Street.	Moderate adverse	No mitigation possible	Moderate adverse

Vol 15 Table 11.10.3 Townscape – summary of Year 1 and Year 15 operational assessment[ii]

Receptor[iii]	Effect	Significance of effect	Mitigation	Significance of residual effect
The site	Change in character through creation of new public realm and an improved river wall.	Minor beneficial	None	Minor beneficial
River Thames – Nine Elms Reach TCA	Slight change to setting due to creation of riverside public realm and screening of some existing structures at Heathwall Pumping Station, and the demolition of dilapidated buildings at Kirtling Street.	Minor beneficial	None	Minor beneficial
Nine Elms Lane Commercial TCA	Slight change to setting due to the improvement to boundaries at Heathwall Pumping Station and the demolition of dilapidated buildings at Kirtling Street.	Minor beneficial	None	Minor beneficial
Battersea Industrial TCA	Slight change to setting due to the improvement to boundaries at Heathwall Pumping Station and the demolition of dilapidated buildings at Kirtling Street.	Minor beneficial	None	Minor beneficial
Pimlico Residential TCA	Change to riverside setting due to the creation of new public realm and screening of some existing structures at Heathwall Pumping Station, and the demolition of dilapidated buildings at Kirtling Street.	Minor beneficial	None	Minor beneficial

[ii] Operational effects have been assessed to be the same in both Year 1 and Year 15 of operation

[iii] Townscape character areas not assessed during operation (refer to para. 11.6.11) are not included in the summary table

Vol 15 Table 11.10.4 Visual – summary of Year 1 and Year 15 operational assessment[iv]

Receptor[v]	Effect	Significance of effect	Mitigation	Significance of residual effect
Residential				
Viewpoint 1.4: View southwest from residences along Nine Elms Lane, close to the site	Visibility of the new river wall, public realm and site boundaries at Heathwall Pumping Station	Winter – Minor beneficial	Winter – None	Winter – Minor beneficial
		Summer – Minor beneficial	Summer – None	Summer – Minor beneficial
Viewpoint 1.7: View southeast and south from residences along Grosvenor Road, close to Churchill Gardens Estate	Visibility of the new river wall at Heathwall Pumping Station and the demolition of dilapidated buildings at Kirtling Street.	Winter – Minor beneficial	Winter – None	Winter – Minor beneficial
		Summer – Minor beneficial	Summer – None	Summer – Minor beneficial
Additional viewpoint 1.8: View east from newly built residences in the Riverlight development	Foreground visibility of the area of high quality public realm, river wall, boundary treatments and also new tree planting along Nine Elms Lane.	Winter – Minor beneficial	Winter – None	Winter – Minor beneficial
		Summer – Minor beneficial	Summer – None	Summer – Minor beneficial
Transport				
Viewpoint 3.1: View west from the westbound carriageway of Nine Elms Lane	Visibility of new tree planting along Nine Elms Lane, obscuring views of Heathwall pumping station.	Winter – Minor beneficial	Winter – None	Winter – Minor beneficial
		Summer – Moderate beneficial	Summer – None	Summer – Moderate beneficial

[iv] Operational effects have been assessed to be the same in both Year 1 and Year 15 of operation

[v] Viewpoints not assessed during operation (refer to para. 11.6.25) are not included in the summary table

References

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

[2] LB of Wandsworth. *LDF Core Strategy* (October 2010).

[3] LB 0f Lambeth. *LDF Core Strategy* (January 2011).

[4] City of Westminster. *LDF Core Strategy* (January 2011).

[5] City of Westminster. *Conservation Area Information Leaflets* (May 2004).

[6] Department of Environment, Food and Rural Affairs (2012). See citation above.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 12: Transport

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Creating a cleaner, healthier River Thames

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Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 12: Transport

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12 Transport

12.1 Introduction

12.1.1 This section presents the findings of the assessment of the likely significant transport effects of the proposed development at the Heathwall Pumping Station site. The project-wide transport effects are described in Volume 3 Project-wide effects assessment.

12.1.2 Construction of the proposed development at the site has the potential to affect the following transport elements:

a. pedestrian routes

b. cycle routes

c. bus routes and patronage

d. London Underground and National Rail services

e. river passenger services and river navigation

f. highway layout, operation and capacity.

12.1.3 The assessment considers the effects on each of these elements during construction, as well as effects on specific receptors including residents of adjacent houseboats and users/occupiers of nearby businesses.

12.1.4 The operation of the Heathwall Pumping Station site has the potential to affect highway layout and operation and therefore effects on these are considered within the operational assessment.

12.1.5 The assessment of transport presented in this section has considered the requirements of the National Policy Statement for Waste Water (Defra, 2012)[1] section 4.13. Further details of these requirements can be found in Vol 2 Section 12.3.

12.1.6 Additionally, a separate *Transport Assessment* has been produced which provides an assessment of the effects on the transport network as a result of the construction and operational phases at the Heathwall Pumping Station site. The *Transport Assessment* is included and will accompany the application.

12.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station figures).

12.1.8 The separate but related assessments of effects of transport on air quality and noise and vibration are contained in Vol 15 Sections 4 and 9 respectively.

12.2 Proposed development relevant to transport

12.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to transport are set out below.

Construction

12.2.2 The construction site would be located on an existing industrial area south of the River Thames. Construction vehicles would route to and from the site via Nine Elms Lane (A3205).

12.2.3 During construction it is anticipated that the elements listed under paragraph 12.1.2 may be affected as a result of the additional construction traffic associated with Heathwall Pumping Station site and other construction sites with construction routes along Nine Elms Lane (A3205) and changes to cycle lanes.

12.2.4 Details of the peak year of construction, anticipated lorry and barge movements and the activities which would generate these movements are provided in Vol 15 Table 12.2.1.

Vol 15 Table 12.2.1 Transport – construction details

Description	Assumption
Assumed peak period of construction lorry movements	Site Year 1 of construction
Assumed average peak daily construction lorry vehicle movements (in peak month of Site Year 1 of construction)	36 movements per day (18 vehicle trips)
Assumed average peak period of construction barge movements	Site Year 1 of construction
Assumed average peak daily construction barge movements (in peak month of Site Year 1 of construction)	4 movements per day (2 barge trips)
Types of lorry requiring access (comprising rigid-bodied, flatbed and articulated vehicles)	Excavation lorries Temporary construction material lorries Concrete lorries Plant and equipment lorries Rebar lorries Imported fill lorries Cement tanker lorries Aggregate lorries Office lorries Pipe/track/oils lorries Tunnel precast concrete linings lorries

Note: a movement represents a one way trip. A Site Year is a 12 month period, one in a series of Site Years; Site Year 1 commences at the start of construction

12.2.5 During construction cofferdam fill (both import and export) would be transported by barge. For the transport assessment it has been assumed that 90% of these materials are taken by river. This allows for periods that the river is unavailable and material unsuitable for river transport. All other material would be transported by road.

12.2.6 Vehicle movements would take place during the standard day shift of ten hours on weekdays (08:00 to 18:00) and five hours on Saturdays (08:00 to 13:00). While construction at this site may involve continuous 24 hour working for the duration of the connection tunnel construction, construction vehicle movements would be limited to the hours set out above. It would only be in exceptional circumstances that HGV and abnormal load movements could occur up to 22:00 on weekdays for large concrete pours and later at night on agreement with the LB of Wandsworth.

Construction traffic routing

12.2.7 The access plan and highway layout during construction plan (see separate volume of figures – Section 1) present the highway layout during construction.

12.2.8 The construction routing at Heathwall Pumping Station would use the TLRN to access the site (Nine Elms Lane (A3205). Vehicles would access the site on a left-turn in, left-turn out basis. All of the vehicles would arrive at the site from the direction of the Battersea Park Road (A3205) / Queenstown Road (A3216) junction. Vehicles leaving the site would travel east towards the Vauxhall Cross roundabout. Vehicles would then route along South Lambeth Road (A203) and Wandsworth Road (A3036) to the south, Kennington Lane (A3204) and Harleyford Road (A202) to the east, Albert Embankment (A3036) to the north and Vauxhall Bridge Road (A202) to the northwest.

12.2.9 Vol 15 Figure 12.2.1 (see separate volume of figures) shows the construction traffic routes for access to / from the Heathwall Pumping Station site. Construction routes have been discussed with both Transport for London (TfL) and the Local Highway Authority (LHA), LB of Wandsworth, for the purposes of the assessment.

12.2.10 Existing accesses to the Heathwall Pumping Station would be used to gain access to the Heathwall Pumping Station site at two access points. At the eastern access point it would be necessary to remove a section of footway (approximately 5m) and suspend a section of cycle lane along Nine Elms Lane (A3205) between two existing access points to form a single access that is wide enough to accommodate construction vehicles accessing the site. It is noted that no pedestrian route diversions would be required with pedestrians able to crossover the site access point. There would also be a western access point at which no widening/reconfiguration works would be required. The area available for vehicles within the site would be limited and therefore each access point would only be able to accommodate one construction vehicle entering/exiting at a time.

Construction workers

12.2.11 The construction site is expected to require a maximum workforce of approximately 40 workers at any one time. The number and type of workers is shown in Vol 15 Table 12.2.2.

Vol 15 Table 12.2.2 Transport – construction worker numbers

Contractor		Client
Staff*	**Labour****	**Staff*****
08:00-18:00	**08:00-18:00**	**08:00-18:00**
15	20	5

** Contractor Staff – engineering and support staff to direct and project manage the engineering work and site.*
***Labour – those working on site doing engineering, construction and manual work.*
****Client Staff – engineering and support staff managing the project and supervising the Contractor*

12.2.12 At the Heathwall Pumping Station site there would be no parking provided within the site boundary for workers. As parking on surrounding streets would also be restricted as part of the traffic management works necessary to provide access to the Kirtling Street site, and measures to reduce car use would be incorporated into the site-specific Travel Plan (prepared by the contractor in accordance with the overall aims and objectives of the *Draft Project Framework Travel Plan*), it is highly unlikely that workers would travel by car. It is therefore assumed that construction workers would access the site by other modes of transport, further details of which are provided in Vol 15 Table 12.5.1.

Code of Construction Practice

12.2.13 Measures incorporated into the *Code of Construction Practice (CoCP)*[i] *Part A* (Section 5) to reduce transport effects include:

a. site specific *Traffic Management Plans (TMP)*: to set out how vehicular access to the site would be managed so as to minimise impact on the local area and communicate this with the local borough and other stakeholders. This includes any works on the highway, diversion or temporary closure of the highway or public right of way

b. HGV management and control: to ensure construction vehicles use appropriate routes to the sites and the vehicle fleet and/or drivers meet current safety and environmental standards

c. site specific *River Transport Management Plans (RTMP)* are to be produced for each relevant worksite. As with the *TMP's* this would set out how river access to site would be managed so as to minimise impact on the river and communicate this with the PLA, local borough and other stakeholders.

[i] The Code of Construction Practice (CoCP) is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

12.2.14 In addition to the general transport measures within the *CoCP Part A*, the following transport measures have been incorporated into the *CoCP Part B* (Section 5) relating to the Heathwall Pumping Station site:

a. the site access would be located at the existing access to the pumping station and one of the existing accesses to the adjacent Middle Wharf

b. for general construction vehicle access, no reversing to/from the site onto Nine Elms Lane would be allowed

c. Thames Water operations require ‘business as usual’ access to the pumping station

d. Pedestrian access would be maintained to and from Battersea Barge during construction, including during its temporary relocation

e. access to the site would be from the west with left turn into the site from Nine Elms Lane (A3035). Egress from the site would be left turn out travelling east towards Vauxhall

f. the contractor is required to put measures in place to prevent vehicles halting on Nine Elms Lane when entering the site. This may include the vehicle notifying the site in advance to ensure the entrance gate is open, locating the security barrier at a distance within the site and use of a traffic marshal

g. due to the site being constrained, the contractor may need to consider the use of a turntable, or restrict lorry size to meet the requirement to prevent reversing operations to/from Nine Elms Lane

h. signage, safe crossing points and other required measures would be provided for pedestrians and cyclists at site accesses to address the potential hazards.

12.2.15 The effective implementation of the *CoCP Part A* and *Part B* measures is assumed within the assessment.

12.2.16 Based on current travel planning guidance including TfL’s ‘Travel planning for new development in London (TfL, 2011)[2], this development lies within the threshold for producing a Strategic Framework Travel Plan. A *Draft Project Framework Travel Plan* has been prepared based on the TfL ATTrBuTE guidance[3]; this will accompany the application. The *Draft Project Framework Travel Plan* addresses project-wide travel planning measures, including the need for a project-wide Travel Plan Manager, initial travel surveys during construction and a monitoring framework. It also contains requirements and guidelines for the site-specific travel plans to be prepared by the site contractors. The site specific travel-planning measures of relevance to the *Draft Project Framework Travel Plan* are as follows:

a. information on existing transport networks and travel initiatives for the Heathwall Pumping Station site including shuttle bus services for staff and labour

b. a mode split established for the Heathwall Pumping Station site construction workers to establish and monitor travel patterns

c. site-specific targets and interim targets would be established based on the mode share which would link to objectives based on local, regional and national policy

d. a nominated person would be assigned to manage the monitoring, action plan and budget for the Travel Plan measures.

Other measures during construction

12.2.17 Embedded design measures which are not outlined in the *CoCP* but are of relevance to the transport assessment at the Heathwall Pumping Station site include the following:

a. suspension of part of the eastbound cycle lane at the crossover of the easterly site access

b. removal of the footway at the crossover of the easterly site access on Nine Elms Lane

Operation

12.2.18 During operation, maintenance vehicles would enter the site via the existing access to the Heathwall Pumping Station site from Nine Elms Lane (A3205) eastbound, as set out in the Heathwall Pumping Station design principles report Section 4.12 (see Vol 1 Appendix B). Access would be required for a light commercial vehicle on a three to six monthly maintenance schedule. Additionally there would be more substantive maintenance visits at approximately ten year intervals which would require access to enable two cranes and associated support vehicles to be brought to the site.

12.3 Assessment methodology

Engagement

12.3.1 Vol 2 Section 12 documents the overall engagement which has been undertaken in preparing the *Environment Statement*. Specific comments relevant to the assessment for transport are presented here (see Vol 15 Table 12.3.1).

12.3.2 It is noted that it was reported in the *Scoping Report* that operational traffic effects for the project as a whole were scoped out of the *Environmental Statement*. However, while the environmental effects associated with transport for the operational phase are not expected to be significant or adverse, the assessment of transport effects in the *Environmental Statement* examines relevant aspects of the operational phase in order to satisfy the relevant stakeholders that technical issues have been addressed.

Vol 15 Table 12.3.1 Transport – stakeholder engagement

Organisation	Comment	Response
LB of Wandsworth, phase two consultation, January 2012	The Borough prefer the use of barge wherever possible. Any movement of materials into and out of the site should be minimised.	The *Transport Strategy* sets out that the river would be used for the movement of materials at the Heathwall Pumping Station site. For the purposes of the assessment it is assumed that 90% of cofferdam import and export materials are transported by barge. This 90% assumption is believed to be a realistic maximum to account for the periods that the river is unavailable or material is unsuitable for river transport.
LB of Wandsworth, phase two consultation, January 2012	Details of traffic generation during operational and construction phases should be provided.	The assessment considers the expected vehicular traffic generation and the associated transport effects during the construction and operational phases at the Heathwall Pumping Station site. These are reported in Section 12.5 and 0.
LB of Wandsworth, phase two consultation, January 2012	To minimise disruption in relation to the proposed temporary extension of the cofferdam engagement with the owners of Battersea Barge restaurant would be required.	The proposals for the site have been discussed with the owners of Battersea Barge.
LB of Wandsworth, targeted consultation, January 2012	It was questioned whether off-site storage would be needed for Heathwall Pumping Station. The opportunity to use Kirtling Street for this purpose was discussed as it has a greater site area.	The Kirtling Street site would not be used as a storage location for materials to/from Heathwall Pumping Station. There would therefore not be any vehicle movements between the two sites.
LB of Wandsworth, targeted consultation, January 2012	The re-alignment of Ponton Road should be taken into consideration in the assessment.	The Ponton Road re-alignment and upgrade has been included in this assessment.

Organisation	Comment	Response
LB of Wandsworth, targeted consultation, January 2012	Based on the regeneration proposals of the site opportunities to relocate, build above or around the pumping station building should be considered.	A site selection process has been followed and the site is considered the most appropriate location to link the Heathwall Pumping Station CSO and the Southwest Storm Relief CSO to a drop shaft connected to the Thames Tideway Tunnel.
Transport for London, phase two consultation, February 2012	Ensure that the construction impact does not impede the operation of the Strategic Road Network (SRN)/TLRN.	TfL have been fully consulted with regard to traffic modelling and analysis. Local modelling outcomes are outlined in Sections 12.4 (baseline) and 12.5 (construction effects assessment). A project-wide assessment is contained in Volume 3 of the ES.
Transport for London, phase two consultation, February 2012	The number of vehicle movements between sites must be determined and assessed if Kirtling Street is used as a hub site for Heathwall.	Offices and welfare facilities would be located at the Kirtling Street site. However, this would not generate vehicle movements between the Heathwall Pumping Station and Kirtling Street sites.
Transport for London, phase two consultation, February 2012	Investigate whether all movements for vehicles is feasible at the site entrances on Nine Elms Lane.	There would be just under 900 vehicles routing along Nine Elms Lane (A3205) in each direction in the base case, which equates to 15 vehicles per minute. To enable vehicles to right-turn out of the site the accesses are likely to need to be part of a signal controlled junction with Nine Elms Lane (A3205). For the purposes of the assessment it is therefore assumed the site accesses operate on a ‘left-in, left-out’ basis.
Transport for London, consultation workshop, June 2011	The gates at the site accesses must be set back from the highway to a distance that would allow a construction vehicle to wait off the highway if the gate is closed when they	It has been possible to set the western access gate back from the highway. Due to site layout constraints it has not been possible to set back the eastern access gate. However, suitable

Organisation	Comment	Response
	arrive.	management measures, as described in the *CoCP Part B* would be in operation to prevent vehicles waiting on the highway.
LB of Wandsworth consultation workshop, April 2011	Consideration should be given to vehicle type and CO_2 emissions (eg, Euro iV etc).	This is addressed as part of measures included within the *CoCP Part A*.
LB of Wandsworth, consultation workshop, April 2011	The EIA should consider noise, pollution, access and working times related to the transport arrangements.	This has been taken into consideration within the assessment where required and addressed within other relevant topic assessments and the *CoCP*.

Baseline

12.3.3 The baseline methodology follows the methodology described in Vol 2 Section 12. It is noted that site specific baseline modelling on the highway network has not been undertaken for this site. Results from the nearby Kirtling Street assessment have been used which covers a network appropriate to both the Kirtling Street and Heathwall Pumping Station sites.

Construction

12.3.4 The assessment methodology for the construction phase follows that described in Vol 2 Section 12 with the exception of the method of local capacity modelling. Due to the number of committed developments in the Nine Elms area the base case traffic flows in the TfL HAMs are lower than the expected flows. Background traffic flows have therefore been calculated using information available for each committed development site and manually adding these into the models as described further in para. 12.3.10 below.

12.3.5 The effect of all other Thames Tideway Tunnel project sites on the area surrounding Heathwall Pumping Station has been taken into account within the assessment of the peak year of construction at this site.

12.3.6 There are a number of developments identified within 1km of the Heathwall Pumping Station site that would be complete and operational by Site Year 1 of construction (see site development schedule in Vol 15 Appendix N) meaning that they would form part of the base case (unless the information has not been available). However, in the Kirtling Street site assessment (see Vol 14 Section 12), it is acknowledged that Site Year 3 of construction would produce higher traffic flows. Therefore, Site Year 3 traffic flows for the developments have been used to produce reasonable worst case scenario for the base case. The developments that would be complete and operational by Site Year 3 of construction are:

a. Northern Line Extension

b. US Embassy

c. Market Towers

d. Island Site Vauxhall Gyratory

e. Nine Elms Sainsbury's

f. Spring Mews, Vauxhall[ii]

g. Vauxhall Sky Gardens

h. Riverlight development

i. St George's Wharf (Vauxhall Tower)

j. Marco Polo House (Phase 1a and 1b)

k. Battersea Power Station (Phase 1- 3)

l. Embassy Gardens (Buildings A02, A05,and A09- A11)

m. New Covent Garden Market (Buildings B4- B6)

n. 10 Pascal Street

o. Riverwalk House, Millbank

p. 1-9 Bondway and 4-6 South Lambeth Place

12.3.7 There are also some developments that would be under construction at the same time as construction works at the Heathwall Pumping Station site. These are:

a. 81 Black Prince Road (Parliament Road)[ii]

b. 10 Albert Embankment (Hampton House)[ii]

c. 20 Albert Embankment (Wah Kwong House)[ii]

d. Chelsea Barracks

e. Marco Polo House (Phase 2)

f. Battersea Power Station (Phase 4-6)

g. Nine Elms Parkside (Plots B-D)

h. Embassy Gardens (Buildings A01, A03, A04 and A07)

i. New Covent Garden Market (Buildings B1- B3 and site entrance)

12.3.8 Vauxhall Square Cap Gemini This means that there are also cumulative effects to consider.

12.3.9 The TfL Highway Assignment Models (HAMs) have been developed using GLA employment and population forecasts, which are based on the employment and housing projections set out in the London Plan[4]. As a result the assessment inherently takes into account a level of future growth and development across London.

[ii] These sites have been identified in liaison with TfL and LB of Wandsworth, which are in addition to those indicated in the site development schedule (see Vol 15 Appendix N)

12.3.10 However, it is expected that because of the scale and rate of change in the wider Nine Elms area, trips associated with the committed developments in the vicinity of the Heathwall Pumping Station site could significantly alter the operation of the highway network in the future. From inspection of the TfL HAM for this area, it is not clear whether the changes associated with committed development are fully represented at the detailed local level and therefore in assessing the transport effects of this site, it has been discussed with TfL and LB of Wandsworth that specific allowance should be made in the local highway models for trips associated with the above listed developments in addition to the growth factors derived from the HAMs.

12.3.11 The assessment of transport effects is based on the Battersea Power Station development being partially completed and partially under construction by Site Year 3 of construction, this includes a new highway layout at the Kirtling Street / Battersea Park Road (A3205) / Nine Elms Lane (A3205) / New Covent Garden access road junction. However, as there are some uncertainties around the timescale for implementation of the Battersea Power Station development a sensitivity test has been undertaken in which the construction base and development cases assume that Battersea Power Station development is not progressed within a timescale that coincides with the Thames Tideway Tunnel project, and hence the highway layout would be as existing. This sensitivity test is presented in the *Transport Assessment*.

Construction assessment area

12.3.12 As stated above, the Kirtling Street modelling has been used as a basis of the Heathwall Pumping Station assessment. The assessment area for the Kirtling Street site (and therefore the Heathwall Pumping Station site) includes the local roads off Nine Elms Lane/ Battersea Park Road (A3205) as well as the junctions of Kirtling St / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road and Cringle Street / Nine Elms Lane (A3205). In addition, the site access points to the Heathwall Pumping Station site have been modelled as a single access to provide a robust assessment.

12.3.13 These roads and junctions have been assessed for highway, cycle and pedestrian impacts. The Thames Path has been included within the assessment due to its proximity to the development site. Effects on local bus services within 640m of the site and rail services within 960m of the site have also been assessed[iii].

Construction assessment years

12.3.14 A site-specific peak construction assessment year has been identified. The histograms in Vol 15 Plate 12.3.1 and Vol 15 Plate 12.3.2 show that the peak site-specific activity at the Heathwall Pumping Station site would occur in Site Year 1 of construction for both construction lorries and construction barges. As detailed in Vol 15 Table 12.2.1 there would be an estimated 36 average peak daily construction lorry vehicle movements

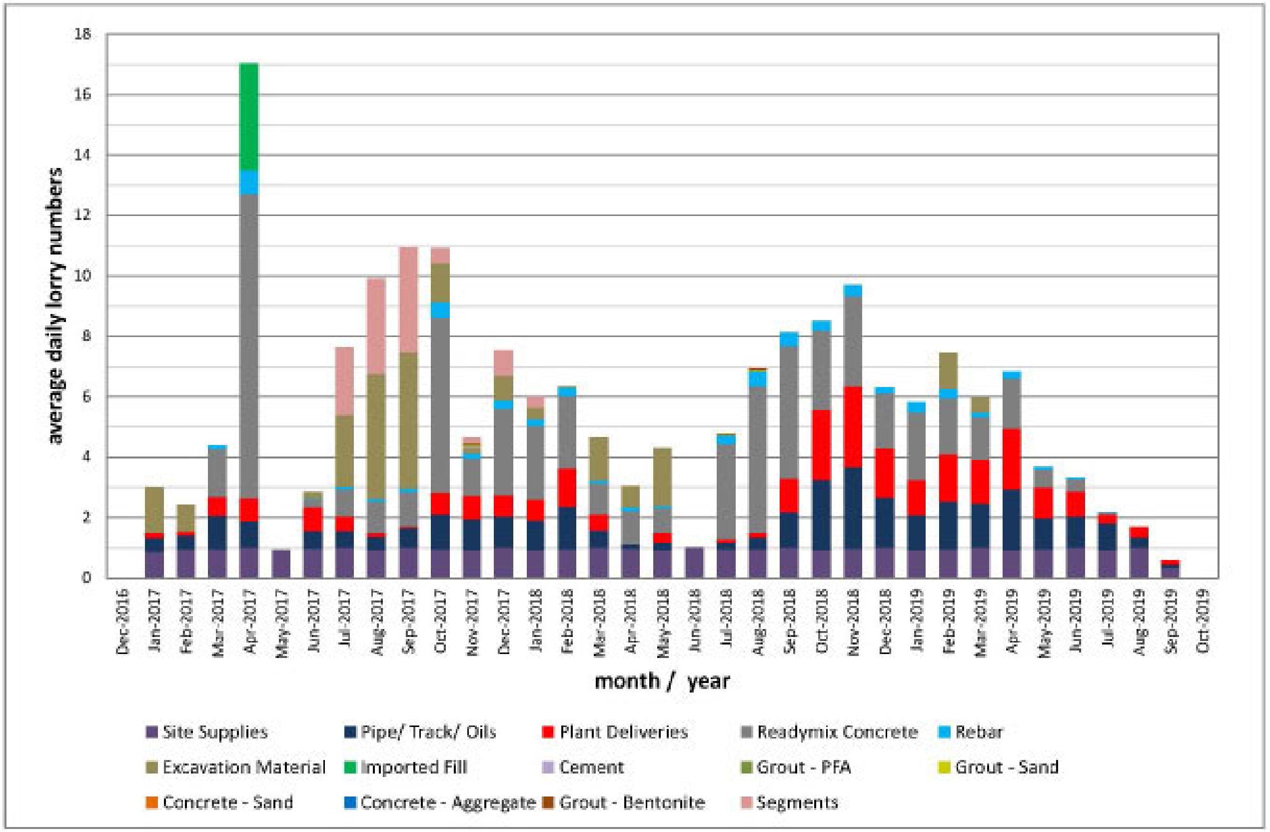
[iii] Distances derived from the Public Transport Accessibility Level (PTAL) methodology described in Volume 2.

and an estimated four peak daily construction barge movements generated by the Heathwall Pumping Station site.

12.3.15 This volume of the *Environmental Statement* assesses the construction vehicles from Heathwall Pumping Station in the site-specific peak construction year (Site Year 1 of construction) combined with the vehicular trips generated for the committed developments at Site Year 3 at Kirtling Street (for modelling purposes). As mentioned previously, the committed development traffic in Site Year 3 at Kirtling Street is greater than the committed development traffic in Site Year 1 for Heathwall Pumping Station, therefore this represents a robust assessment.

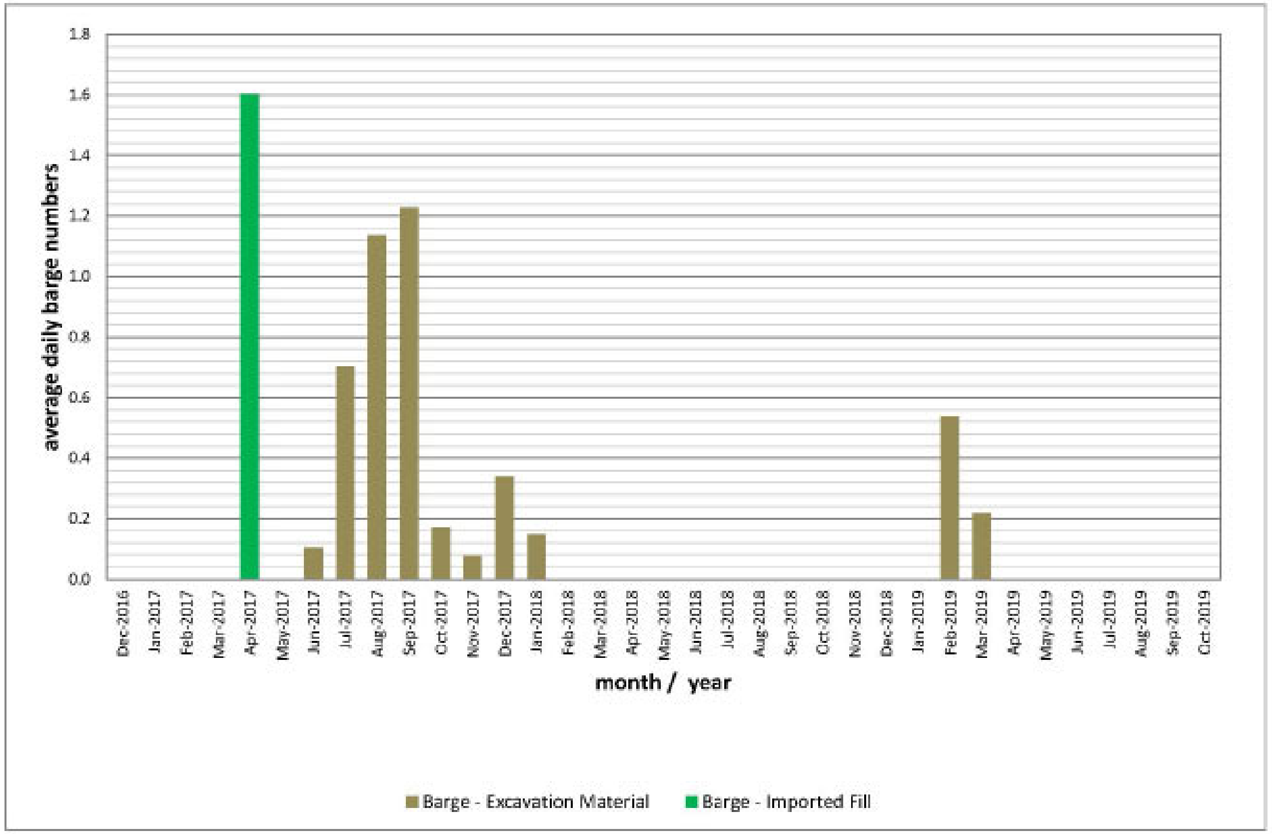
12.3.16 The assessment of construction effects also considers the extent to which the assessment findings would be likely to be materially different should the programme for the Thames Tideway Tunnel project be delayed by approximately one year.

Vol 15 Plate 12.3.1 Transport – estimated construction lorry profile



Note: Plate shows approximate volumes and number of lorry trips based upon assumed timings for the works. It is not a programme and remains subject to change.

Vol 15 Plate 12.3.2 Transport – estimated construction barge profile



Note: Plate shows approximate volumes and number of barge trips based upon assumed timings for the works. It is not a programme and remains subject to change.

Operation

12.3.17 The assessment methodology for the operational phase follows that described in Vol 2 Section 12. There are no site-specific variations for undertaking the operational assessment of this site.

12.3.18 Once the Thames Tideway Tunnel project is operational it is not expected that there would be any significant effects on the transport infrastructure and operation within the local area because maintenance trips to the site would be infrequent and short-term. On this basis it is not necessary to assess the effects on all the elements listed at paragraph 12.1.2. The only element considered is the effects on the highway layout and operation.

12.3.19 These elements are considered qualitatively (as described in Vol 2 Section 12) because the minimal effect on the highway network means that a quantitative assessment is not required. The scope of this analysis has been discussed with the LB of Wandsworth and TfL

12.3.20 Also, given the local impact of the transport activity associated with the Thames Tideway Tunnel project during the operational phase impacts from other Thames Tideway Tunnel project sites including the Kirtling Street site would be localised and would not have operational impacts on the Heathwall Pumping Station. Therefore only the localised transport effects around the site are assessed (ie, other Thames Tideway Tunnel project sites are not considered).

12.3.21 With regard to other developments in the vicinity of the Heathwall Pumping Station site (as detailed in the site development schedule, Vol 14 Appendix N) and as identified in liaison with TfL and LB of Wandsworth, the following developments would be complete and operational by Year 1 of operation:

a. Northern Line Extension
b. US Embassy
c. New Covent Garden Market (Buildings B1- B6 and site entrance)
d. Market Towers
e. Island Site Vauxhall Gyratory
f. Vauxhall Square Cap Gemini
g. Nine Elms Sainsbury's
h. 81 Black Prince Road (Parliament House)[iv]
i. Spring Mews[iv]
j. Riverlight development
k. Chelsea Barracks [iv]

[iv] These sites have been identified in liaison with TfL and LB of Wandsworth, which are in addition to those indicated in the site development schedule (see Vol 15 Appendix N)

l. Embassy Gardens

m. Vauxhall Sky Gardens

n. Marco Polo House

o. Battersea Power Station (Phases 1-4, part of phase 5, phase 6)

p. St George's Wharf (Vauxhall Tower)

q. Nine Elms Parkside (Plots A-D)

r. 10 Albert Embankment (Wah Kwong House) [iv]

s. 20 Albert Embankment (Hampton House) [iv]

t. 10 Pascal Street

u. Riverwalk House, Millbank

v. 30-60 South Lambeth Road

w. 1-9 Bondway and 4-6 South Lambeth Place

12.3.22 There will also be some developments that would still be under construction in Year 1 of operation of the Heathwall Pumping Station site. These are:

a. Battersea Power Station (Phase 7 and part of phase 5)

b. Nine Elms Parkside (Plots E-G)

c. New Covent Garden Market (Buildings T1-T3)

12.3.23 As a result these developments have been included within the operational base case which takes into consideration the effects on highway layout and operation

Operational assessment area

12.3.24 The assessment area for the operational assessment remains the same as for the construction assessment as set out in paragraphs 12.3.12 and 12.3.13.

Operational assessment year

12.3.25 As outlined in Vol 2 Section 12 the operational assessment year has been taken as Year 1 of operation. As the number of vehicle movements associated with the operational phase is low there is no requirement to assess any other year beyond that date.

12.3.26 As with construction, the assessment of operational effects also considers the extent to which the assessment findings would be likely to be materially different should the programme for the Thames Tideway Tunnel project (and hence opening year) be delayed by approximately one year.

Assumptions and limitations

12.3.27 The general assumptions and limitations associated with this assessment are presented in Vol 2 Section 12.

Assumptions

12.3.28 As mentioned in paragraph 12.3.11, this assessment assumes that the Battersea Power Station development proposals are implemented. Sensitivity testing has been undertaken to determine what the effects would be should the Battersea Power Station site be developed after the Heathwall Pumping Station site is operational. The results of the sensitivity test are contained within the *Transport Assessment*.

12.3.29 Local junction modelling for the construction base and development cases at this site has incorporated traffic signal optimisation on the basis that this would be implemented as necessary by TfL (as part of routine management) to ensure the effective operation of the highway network and respond to changes in traffic conditions.

12.3.30 There would be deliveries of fuel for construction plant at this site and a number of construction products may be classified as hazardous. For the Heathwall Pumping Station site, it is assumed that there would be one hazardous load per fortnight generated by the site.

12.3.31 With regard to construction workers travelling to the site, it is assumed that no construction workers would drive to the site, as set out in para. 12.5.3.

Limitations

12.3.32 There are no site-specific limitations of the transport assessment undertaken for this site.

12.4 Baseline conditions

12.4.1 The following section sets out the baseline conditions for transport within and around the site. Future baseline conditions (base case) are also described.

Current baseline

12.4.2 The site location is shown in Vol 15 Figure 12.4.1 (see separate volume of figures).

12.4.3 The site can be accessed directly from Nine Elms Lane (A3205), which forms part of the TLRN. There are four existing access points to the site.

Pedestrian routes

12.4.4 The existing pedestrian network and facilities in the vicinity of the site are shown in Vol 15 Figure 12.4.2 (see separate volume of figures).

12.4.5 Nine Elms Lane (A3205) provides a continuous southwest-northeast link for pedestrians along the southern side of the River Thames. Nine Elms Lane (A3205) starts at Vauxhall Cross roundabout and then routes parallel to the course of the River Thames to Battersea Park Rail Station.

12.4.6 The footways on both sides of Nine Elms Lane (A3205) vary in width between 1.5m and 4m.

12.4.7 Signalised pedestrian crossings are available on all three arms of the junction of Nine Elms Lane (A3205) with Ponton Road, approximately 120m to the east of the site. These crossing points include tactile paving and dropped kerbs. There is also a signalised pedestrian crossing facility on all arms of the junction of Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road approximately 450m to the southwest of the site. These crossing points again include tactile paving and dropped kerbs.

12.4.8 Additional signalised pedestrian crossing facilities are provided at the junctions of Nine Elms Lane (A3205) with St George's Wharf and Wandsworth Road (A3036) to the east of the site and at the junctions of Battersea Park Road (A3205) with Prince of Wales Drive to the west of the site.

12.4.9 At the junction of Cringle Street and Nine Elms Lane (A3205) no formal crossing points are provided. However dropped kerbs and tactile paving are provided on the Cringle Street arm of the junction.

12.4.10 There are no formal crossing points located at the existing access points to Heathwall Pumping Station or the vacant land to the east of the pumping station which would form part of the construction site. The carriageway is raised to footway level at these crossing points and there is no tactile paving in place.

12.4.11 The Thames Path routes along the riverside north of Battersea Park before routing south to connect with Battersea Park Road (A3205) via The Queen's Circus junction. The path continues east routing down Kirtling Street to return to the riverside. The path meets Nine Elms Lane (A3205) for a short distance around the Heathwall Pumping Station site before it returns to the riverside routing towards Vauxhall Bridge. There is an alternative Thames Path route past the Heathwall Pumping Station site along the river front but this section is gated and is only opened on a permissive basis.

Cycle facilities and routes

12.4.12 The existing cycle network and facilities in the vicinity of the site are shown in Vol 15 Figure 12.4.2 (see separate volume of figures).

12.4.13 The main cycle route within the area is National Cycle Network Route 4 (off road) which routes northeastwards and southwestwards along Nine Elms Lane (A3205). The cycle path is shared with the footway. Road markings and signage are in place to alert people to the presence of the cycle path.

12.4.14 Advanced stop lines for cyclists are in place at the junctions of Nine Elms Lane (A3205) with Ponton Road and with Kirtling Street/New Covent Garden access road.

12.4.15 The closest Cycle Superhighway (CS) to the site is CS8 which routes between Wandsworth and Westminster. The closest point on the CS8 from the Heathwall Pumping Station site is at Queenstown Road approximately 1.1km walking distance to the southwest of the site.

12.4.16 The closest cycle hire docking station is at Vauxhall Cross approximately 900m walking distance or 11 minutes walking time to the east of the site. The docking station accommodates 16 bicycles.

12.4.17 There are no on-street cycle parking areas within the vicinity of the site. The closest cycle parking facilities are provided at the Battersea Park National Rail station on Battersea Park Road (A3205) within the western footway approximately 1km walking distance southwest of the site; where there are two style parking stands provided.

Public Transport Accessibility Level

12.4.18 The Public Transport Accessibility Level (PTAL) of the site has been calculated using TfL's approved PTAL methodology[5] and assumes a walking speed of 4.8km/h and considers rail stations within a 12 minute walk (960m) of the site and bus stops within an eight minute walk (640m).

12.4.19 Using this methodology the site has a PTAL rating of between 3 and 4, rated as 'moderate' (with 1a being the lowest accessibility and 6b being the highest accessibility).

12.4.20 Vol 15 Figure 12.4.3 (see separate volume of figures) shows the public transport network around the Heathwall Pumping Station site.

Bus routes

12.4.21 As shown in Vol 15 Figure 12.4.3 (see separate volume of figures) two daytime bus routes operate within 640m walking distance of the site.

12.4.22 These bus routes operate from the following bus stops:

a. Cringle Street bus stop on Nine Elms Lane (A3205) – eastbound and westbound - 160m walking distance southwest of the site

b. Elm Quay Court bus stop on Nine Elms Lane (A3205) – eastbound and westbound – 190m walking distance northeast of the site

c. Sleaford Street bus stop on Nine Elms Lane (A3205) - eastbound and westbound– 450m walking distance southwest of the site

d. Wandsworth Road bus stop on Nine Elms Lane (A3205) – eastbound and westbound. – 600m walking distance northeast of the site

12.4.23 On average there are 17 daytime bus services in total per hour in the AM and PM peaks within a 640m walking distance of the site in each direction.

12.4.24 There is one night time bus route within a 640m walking distance of the site, Route 344, which stops at Cringle Street (approximately 160m to the southwest of the site) and is a 24 hour service with two to four buses per hour during the night.

12.4.25 A bus stand is located on Cringle Street that allows TfL buses to park when not in operation. As far as it can be established this stand is not regularly used.

12.4.26 Additionally, Vauxhall bus station is located approximately 950m walking distance to the northeast of the Heathwall Pumping Station site. This bus station serves a large number of bus services. On average there are approximately 146 daytime bus services per hour in the AM and PM peak hours and approximately six night-time bus services per hour Monday to Friday between 00:00 and 06:00 and nine bus services per hour on Saturdays between 00:00 and 06:00.

London Underground

12.4.27 As shown on Vol 15 Figure 12.4.3 (see separate volume of figures) Vauxhall Underground station, which is served by the Victoria line is located approximately 950m walking distance or 12 minutes walking time to the northeast of the site.

12.4.28 Victoria line trains serving this station travel north to Green Park, King's Cross, Tottenham Hale and Walthamstow Central and south to Brixton. The frequency of the Victoria line trains from Vauxhall Underground station is approximately every two to five minutes, providing up to 21 services per hour in each direction.

National Rail

12.4.29 The closest National Rail station to the site is Vauxhall, approximately 950m walking distance or 12 minutes walking time to the northeast of the site.

12.4.30 Vauxhall station provides access to Southwest train services to and from Guildford, Woking, Clapham Junction, Chessington South, Hampton Court and Shepperton in the south and London Waterloo to the north.

12.4.31 In the AM and PM peak hours there are approximately 90 and 82 services respectively calling at Vauxhall station.

12.4.32 Furthermore, Queenstown Road and Battersea Park National Rail stations are in the vicinity of the site. Queenstown Road station is located approximately 1.3km walking distance or 16 minutes walking time to the southwest of the site and Battersea Park Station is located 1km walking distance or 13 minutes walking time southwest of the site.

12.4.33 Queenstown Road provides access to Southwest train services and provides northbound services to London Waterloo and southbound services to Weybridge. In the AM and PM peak hours there are approximately 16 services which call at Queenstown Road.

12.4.34 Battersea Park Station provides access to Southern Railway train services and provides northbound services to London Victoria and southbound services to Sutton (Surrey), London Bridge and Caterham. In the AM peak hour there are approximately 28 services. In the PM peak hour there are approximately 25 services.

River passenger services

12.4.35 The St George Wharf Pier is within walking distance, approximately 750m northeast of the site, and provides river passenger services. This river service is shown on Vol 15 Figure 12.4.3 (see separate volume of figures).

12.4.36 River passenger services at St George Wharf Pier provide a route to Blackfriars Millennium Pier in the AM and PM peak hours with two services in each direction. Outside of peak hours the service routes from St George Wharf to Bankside via Millbank and Embankment.

River navigation

12.4.37 The site is located approximately 370m east of Cringle Dock, which is a waste transfer station for the Western Riverside Waste Authority. Waste arriving at this facility is containerised and transported by barge to the new Belvedere energy from waste plant. This is a daily operation and comprises arriving and departing tugs towing up to three barges.

12.4.38 The Heathwall Pumping Station site is also located approximately 355m east of Kirtling Wharf, which is a concrete batching facility for Cemex. Aggregates arriving at this facility from either Cemex's Dagenham Terminal or Angerstein Wharf in Charlton is batched and delivered to construction sites via concrete lorries. This is a weekly operation with two to four barges per week depending on demand, arriving at the site.

12.4.39 Although there are no stopping services in the area of the site other vessels pass the site as they navigate up and downstream. It is estimated that the peak hour for such traffic is between 14:00 and 15:00, Monday to Friday. During this hour approximately 11 vessels are estimated to pass the site (plus the additional vessels servicing Cringle Dock and Metro Greenham Wharf described above). This figure however, is not constant as freight vessel transit patterns, which are included in the traffic, are influenced by the rising and falling tide. Therefore, such a peak will only occur every 10 to 12 days when the tide is at its highest[v].

Parking

12.4.40 Vol 15 Figure 12.4.4 (see separate volume of figures) shows the locations of the existing car parks and car club spaces within the vicinity of the site.

Existing on-street car parking

12.4.41 There is on-street parking in place along Kirtling Street and Cringle Street which are approximately 200m walking distance or three minutes walking time from the Heathwall Pumping Station site. Parking in this area is unrestricted and not subject to a controlled parking zone (CPZ).

12.4.42 No on-street parking is permitted along Nine Elms Lane or Battersea Park Road (A3205), which form part of the TLRN.

Existing off-street/private car parking

12.4.43 The nearest private car park to the site is approximately 1km walking distance or 13 minutes walking time to the east on Wandsworth Road (A3036). This car park is operated by Sainsbury's and has 450 parking bays intended for customers' use only. The car park is operational Monday to Friday between 07:00 and 23:00, Saturday between 07:00 and 22:00 and Sunday 12:00 to 18:00.

12.4.44 The Nine Elms Pier riverboat community has 14 parking spaces within the 'Riverlight' development that is adjacent to the Kirtling Street site.

Coach parking

12.4.45 The nearest coach parking is New Covent Garden Market coach park which is immediately southwest of the site at the junction between Kirtling

[v] The estimates are derived from study team calculations that use the arrival and departure times for piers published in TfL River Bus and Tour timetables (http://www.tfl.gov.uk/modalpages/2648.aspx) and information on barge movements obtained from barge operators and commercial users.

Street and Battersea Park Road (A3205). There are 25 bays available which are intended for customer use only.

Car clubs

12.4.46 Car clubs provide members with easy access to cars for short-term use. Cars are available as and when needed and allow members to access a car without purchase, storage and operational costs associated with owning a private car.

12.4.47 The nearest car club space to Heathwall Pumping Station is operated by ZipCar and is at St Georges Wharf approximately 850m to the northeast of Heathwall Pumping Station site where three car spaces are provided.

Servicing and deliveries

12.4.48 Off-street loading bays used to service the Nine Elms Pier houseboats are located southwest of the site. Deliveries to these houseboats are made via Kirtling Street. These bays are temporary until the Riverlight development has been completed, after which the houseboat resident servicing will take place from within the Riverlight development.

12.4.49 There are no on-street loading bays available near to the Heathwall Pumping Station site. Nine Elms Lane (A3205) is a Red Route and no stopping is permitted along this road at any time. There, are however, a number of unrestricted parking areas along Cringle Street and Kirtling Street which could be used for on-street servicing and deliveries.

Taxis

12.4.50 There are no taxi rank facilities within 960m of the site.

Highway network and operation

12.4.51 Nine Elms Lane (A3205) forms part of the TLRN and is a four lane single carriageway of which one lane on each side of the road is a bus lane. A 30mph speed limit applies and the road is suitable for HGVs and long vehicles. The road links to Vauxhall Cross in the east and Queenstown Road (A3216) in the west.

12.4.52 Vauxhall Gyratory (A3036) is part of the TLRN and is a six lane one-way gyratory system including a bus lane that circulates around Vauxhall Rail, Underground and Bus stations at Vauxhall. This gyratory is immediately east of Vauxhall Bridge.

12.4.53 Queenstown Road (A3216) is a three lane carriageway routing in a north-south direction including a northbound bus lane providing access to Battersea Park and Central London. Queenstown Road forms part of the SRN.

12.4.54 There are a number of signalised junctions along Nine Elms Lane (A3205) to the west of Heathwall Pumping Station including those at Kirtling Street/New Covent Garden access road, Prince of Wales Drive and Queenstown Road (A3216). There are also a number of signalised junctions on Nine Elms Lane (A3205) to the east of the Heathwall Pumping Station site, including Ponton Road, St George's Wharf and Wandsworth Road (A3036).

Data from third party sources

Description of data

12.4.55 Data in relation to accidents has been sourced from TfL. Five years of accident data on roads within the vicinity of the site have been collected.

Accident analysis

12.4.56 A total of 16 accidents have been recorded in the Heathwall Pumping Station site assessment area over the five years of accident data analysed which included three serious accidents and 13 slight accidents. There were no fatal accidents.

12.4.57 Two of the serious accidents occurred along Nine Elms Lane (A3205) while one serious accident occurred at the junction of Nine Elms Lane (A3205) with Ponton Road.

12.4.58 Of the total accidents, three involved light goods vehicles (LGVs). Of these, two of the accidents were slight in severity and one accident was recorded as serious. None of the accidents involved pedestrians or HGVs.

12.4.59 Of the five years of accident data analysed none of the accidents happened as a result of the road geometry.

Survey data

Description of surveys

12.4.60 Baseline survey data were collected in May, July, August and September 2011 to establish the existing transport movements and usage of parking in the area. Volume 15 Figure 12.4.5 (see separate volume of figures) shows the survey locations in the vicinity of the site.

12.4.61 The surveys included manual and automated traffic surveys undertaken to establish specific traffic, pedestrian and cycle movements including turning volumes, queue lengths, saturation flows, degree of saturation and traffic signal timings. Parking surveys were undertaken to establish the parking restrictions and associated demand and spare capacity within the vicinity of the site.

Results of the surveys

12.4.62 The surveys inform the analysis of the baseline situation in the area surrounding the site.

Pedestrians and cyclists

12.4.63 The pedestrian surveys show that there is a higher volume of pedestrian and cycle movements along Nine Elms Lane / Battersea Park Road (A3205) than along the Thames Path.

12.4.64 The pedestrian surveys show that there is a low flow of pedestrians during the AM peak hour along the Thames Path footway adjacent to the Battersea Barge restaurant of approximately 21 pedestrians in total. During the PM peak hour the flow is similar with approximately 11 pedestrians in total on the Thames Path. There was no notable variation between the May and September surveys.

12.4.65 A survey along Battersea Park Road (A3025) between Thessaly Road and Sleaford Street indicated a higher volume of pedestrian movements during the AM peak hour of approximately 205 pedestrians in total. During the PM peak hour the flow is slightly lower with approximately 170 pedestrians in total on this section of road.

12.4.66 Pedestrian flows between Kirtling Street and the Thames Path link to the north of Cringle Street were recorded as less than 45 two-way movements in the AM peak and less than 63 in the PM peak.

12.4.67 The junction survey counts at the Nine Elms Lane (A3205) / Cringle Street junction suggest a large number of cyclists travelling northeastbound along Battersea Park Road (A3205) and Nine Elms Lane (A3205) with up to 279 cyclists in the AM peak hour. In the PM peak hour, this reduced to less than 55. In the opposite direction, cyclist movements amounted to 34 southwestbound in the AM peak hour and 84 in the PM peak hour.

Traffic flows

12.4.68 The ATC data have been analysed to identify the existing traffic flows along Nine Elms Lane (A3205) at its junction with Ponton Road. The weekday vehicle and HGV flows for a 12-hour period (07:00-19:00) are reported as this is when the greatest impacts from the project are likely to be experienced.

12.4.69 The data shows that the PM peak hour for Nine Elms Lane (A3205) is the busiest westbound hour with a maximum of approximately 270 vehicles every 15 minutes. Similar flows are experienced in the busiest eastbound hour which occurs in the AM peak hour.

12.4.70 The traffic flows for the busiest periods (weekday AM and PM peak hours) within the area are shown in Vol 15 Figure 12.4.6 and Vol 15 Figure 12.4.7 (see separate volume of figures).

Parking

12.4.71 The results of the parking surveys indicate that usage of the on-street parking along Kirtling Street and Cringle Street is moderate but that there is spare capacity available on both weekdays and weekends during the peak and off-peak periods.

12.4.72 The parking surveys suggested that about 60% of all available spaces were used throughout the day. The utilisation is lower in the Saturday peak when compared to the weekday.

Local highway modelling

12.4.73 It was discussed with TfL and the LB of Wandsworth that the baseline Kirtling Street model output would provide the baseline for the Heathwall Pumping Station site. The scope discussed with TfL and the LB of Wandsworth for the Kirtling Street site was to model the signalised Kirtling Street / Nine Elms Lane (A3025) / Battersea Park Road (A3205) / New Covent Garden access road junction in LinSig and the Nine Elms Lane (A3205) / Cringle Street priority junction in PICADY. Additionally, modelling has been undertaken for the Heathwall Pumping Station site access point from Nine Elms Lane (A3205) although modelling has been undertaken for the development case only (ie, no baseline / base case modelling).

12.4.74 The baseline modelling incorporates the current traffic and transport conditions within the vicinity of the site and followed the methodology outlined in Vol 2 Section 12.

12.4.75 The weekday AM and PM baseline model flows for Nine Elms Lane (A3205) were compared against observed queue lengths for the peak periods using junction survey data to validate the LinSig and PICADY models and ensure reasonable representation of existing conditions.

12.4.76 Vol 15 Table 12.4.1 shows the PICADY modelling outputs which demonstrate that the Cringle Street / Nine Elms Lane (A3205) junction is currently operating within capacity. The validated model indicates that the PM peak hour is the busiest period and that the traffic turning out of Cringle Street is operating at 19% capacity in that period with no queues generated. The delay to vehicles is most significant during the AM peak hour for the same movement, which currently experiences an average of 16 seconds of delay per vehicle.

12.4.77 Vol 15 Table 12.4.2 shows the LinSig modelling outputs which demonstrate that the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction is currently operating within capacity. The model indicates that the AM peak hour is the busiest period and that the left ahead movement of Nine Elms Lane (A3205) is operating at 50% level of saturation in that period, with maximum queues of seven PCUs. The delay to vehicles is most significant in both the AM and PM peak hours for the right ahead movement from the New Covent Garden Market access road, which currently experiences an average of 33 seconds of delay per PCU.

Vol 15 Table 12.4.1 Transport – baseline PICADY model outputs

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (vehs)	RFC	Max. Queue (vehs)	Delay (seconds per veh)	Flow (vehs)	RFC	Max. Queue (vehs)	Delay (seconds per veh)
Cringle Street	Left / ahead / right	18	8%	0	16	62	19%	0	14
Nine Elms Lane (E) (A3205)	Right	25	8%	0	13	25	7%	0	10

Notes: 1. RFC represents Ratio of Flow to Capacity. Queue represents number of vehicles in queue. Delay represents the mean delay per vehicle.
2. Nine Elms Lane (A3205) westbound is not included in table as PICADY model only considers movements where vehicles have to give way.

Vol 15 Table 12.4.2 Transport – baseline LinSig model outputs

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (PCU)	DoS	MMQ	Delay (seconds per PCU)	Flow (PCU)	DoS	MMQ	Delay (seconds per PCU)
Kirtling Street	Left / ahead / right	27	9%	1	32	33	10%	1	32
Nine Elms Lane (A3205)	Left / ahead	467	50%	7	19	448	48%	7	19
	Ahead / right	418	46%	7	20	412	46%	7	20
New Covent Garden Market access road	Left	67	10%	1	18	68	10%	1	18
	Right / ahead	27	8%	1	33	22	7%	0	33
Battersea Park Road (A3205)	Left / ahead	377	41%	6	16	380	41%	6	17
	Right	484	44%	6	19	419	40%	6	17
		PRC		Total delay (PCU hours)		PRC		Total delay (PCU hours)	
Overall junction performance		79.7%		10		85.9%		9	

Notes: DoS represents Degree of Saturation; the ratio of flow to capacity. MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. Delay represents the mean delay per PCU. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs.

Transport receptors and sensitivity

12.4.78 Vol 15 Table 12.4.3 indicates the receptors and their sensitivities for the Heathwall Pumping Station site. The transport receptor sensitivity is defined as high, medium or low using the criteria detailed in Vol 2 Section 12.

12.4.79 The transport effects identified in this assessment are directly related to changes to the operation of transport networks which may occur as a result of physical changes to transport networks or of additional vessel or vehicle movements or additional public transport patronage. These changes in operation could lead to effects which would be experienced by people using those transport networks, whether as pedestrians, cyclists, public transport or private vehicle users. The assessment identifies several 'generic' groups of transport users in the list of transport receptors.

12.4.80 Receptors who are occupiers and users of or visitors to existing or committed developments in the vicinity of each of the project sites may experience transport effects on their journeys to and from those developments. In many cases those effects would be similar (or identical) to the effects identified for the 'generic' groups of transport users. However, the assessment specifically includes these receptors to ensure that any particular effects that they would be likely to experience (for instance because they make use of particular routes or transport facilities) have been identified.

Vol 15 Table 12.4.3 Transport – receptors and sensitivity

Receptors (relating to all identified transport effects)	Phase at which receptor is sensitive to identified impacts	Value/sensitivity and justification
Pedestrians and cyclists (including sensitive pedestrians[vi]) using the Thames Path and the local highway network.	Construction	High sensitivity to changes to journey patterns and environment resulting in increases to journey times.
Private vehicle users (including taxis) in the area using the local highways or on-street parking.	Construction Operation	Medium sensitivity to increases in HGV traffic and road network changes leading to journey time change.
Emergency vehicles travelling on Nine	Construction Operation	High sensitivity to journey time delays due to time constraints on journey

[vi] Sensitive pedestrians include those with mobility impairments, including wheelchair users.

Receptors (relating to all identified transport effects)	Phase at which receptor is sensitive to identified impacts	Value/sensitivity and justification
Elms Lane (A3205).		purposes.
Marine emergency services	Construction	High sensitivity to changes in vessel movements/moorings
Bus user (passengers) travelling along Nine Elms Lane (A3205) / Battersea Park Road (A3205)and through the Vauxhall Gyratory.	Construction	Medium sensitivity to journey time delays as a result of increases to traffic flows.
Public transport users using rail or river services within the area.	Construction	Medium sensitivity due to distance from the site and the low patronage change.
River vessel operators including river passenger services.	Construction	Medium sensitivity to increases in barge movements
Residents of the houseboats at Tideway Village, 120m west of the site. Residents of the Nine Elms Pier houseboats, adjacent to site Users of Battersea Barge Restaurant	Construction	Medium sensitivity to changes to access regime for pedestrians, vehicles and river navigation
Users and operators of Cemex concrete batching works, 340m west of the site	Construction	Medium sensitivity to changes to access regime for vehicles

Receptors (relating to all identified transport effects)	Phase at which receptor is sensitive to identified impacts	Value/sensitivity and justification
Users and operators of Cringle Dock Waste Transfer Station 375m west of the site		

Construction base case

12.4.81 As described in Section 12.3, the construction assessment year for transport effects in relation to this site is Site Year 1 of construction.

12.4.82 As described in para. 12.3.6, there are a number of committed developments within the LB of Wandsworth in the vicinity of the Heathwall Pumping Station site which are expected to be complete and operational by Site Year 1 of the Heathwall Pumping Station site construction which have been considered in the assessment.

12.4.83 Changes to the pedestrian and cycle network by Site Year 1 of construction would occur as a result of the developments at Battersea Power Station, the US Embassy, Embassy Gardens, Nine Elms Parkside and Vauxhall Sky Gardens. The changes include providing signalised pedestrian crossing facilities on all arms of the Nine Elms Lane (A3205) / Battersea Park Road (A3205) / Kirtling Street / New Covent Garden Market access junction, re-routing of the Thames Path to Cringle Street via the new Battersea Power Station development, improved public realm surrounding Nine Elms Parkside and Vauxhall Sky Gardens and realignment of Ponton Road inclusive of pedestrian refuge islands at the junction.

12.4.84 It is anticipated that patronage on public transport services may change between the baseline situation and Site Year 1 of construction. Future patronage changes on underground networks will be driven by a range of complex factors and there are inherent uncertainties in setting a patronage level for a future year. There are further capacity improvements anticipated on the Bakerloo, Piccadilly and Central lines however the best way of delivering these improvements, including the timescales, are currently being investigated by TfL. At this stage, it is not possible to estimate how much of these upgrades will have been completed by the construction base case or how much will be remaining.

12.4.85 Therefore, in order to ensure that a busiest base case scenario is used in assessing the result of additional construction worker journeys by public transport the capacity for public transport services in the construction base case has been assumed to remain the same as capacity in the baseline situation. This ensures a robust assessment as outlined in Vol 2 Section 12.

12.4.86 There are no known proposals to alter river passenger services or river navigation patterns from the current baseline conditions and therefore the construction base case in Site Year 1 of construction remains similar to the baseline position.

12.4.87 Baseline traffic flows (from the junction surveys) have been used and forecasting carried out to understand the capacity on the highway network in the vicinity of the Heathwall Pumping Station site in Site Year 1 of construction without the Thames Tideway Tunnel project. The construction base case traffic flows (derived from the survey data) are shown on Vol 15 Figure 12.4.6 and Figure 12.4.7 (see separate volume of figures).

12.4.88 As explained in para.12.3.10, for the local highway modelling at this site consideration has been given to the traffic flows that may be generated by the surrounding committed developments, which are outlined in para. 12.3.6.

12.4.89 In line with the approach used for local modelling at all sites, growth factors from the TfL HAMs for the LB of Wandsworth have been applied to the baseline traffic flows. In addition, because of the scale of development change in the area, information on traffic associated with each of the committed developments has been sourced and compiled, and this traffic has also been added to the baseline traffic flows to produce construction base case flows for the local modelling.

12.4.90 Transport network changes associated with the committed developments, where known, have also been included in the construction base case local models. These changes, by Site Year 1 of construction at the Heathwall Pumping Station site, include:

a. suspension of parking on Kirtling Street and Cringle Street (as a result of the Battersea Power Station development proposals)

b. provision of a dedicated right-turn land from Nine Elms Lane (A3205) into Kirtling Street

c. provision of two lanes on the Kirtling Street arm of the Nine Elms Lane (A3205) / Battersea Park Road (A3205) / Kirtling Street / New Convent Garden Market access junction

d. realignment of Ponton Road (as a result of the US Embassy development proposals)

e. upgrade of the Ponton Road / Nine Elms Lane (A3205) junction and potentially two new junctions along Nine Elms Lane (A3205) (as a result of the US Embassy development proposals)

f. conversion of Cringle Street / Nine Elms Lane (A3205) junction from T-junction to a crossroad (as a result of the Nine Elms Parkside redevelopment proposals)

12.4.91 The assessment is based on the programmed implementation of the Battersea Power Station development. However as there are uncertainties surrounding the actual timescales for implementation, a sensitivity test has been undertaken within the highway modelling and public transport assessments to determine whether if the Battersea Power

Station development were excluded from the base case, the assessment would produce any different outcomes. This sensitivity test is reported in the *Transport Assessment*.

12.4.92 The construction base case LinSig and PICADY models for the Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction and the Nine Elms Lane (A3205) / Cringle Street priority junction indicate that the local network will continue to operate within capacity, when taking into account the construction base case traffic flows.

12.4.93 Developments within 250m of the site are considered to present potential receptors to transport effects, as described in Vol 2 Section 12. For the Heathwall Pumping Station site, the committed developments within 250m of the site have been identified from the site development schedule (Vol 14 Appendix N) and these have been included as receptors in the assessment of construction effects as detailed in Vol 15 Table 12.4.4 .

Vol 15 Table 12.4.4 Transport – construction base case additional receptors

Receptors (relating to all identified transport effects)	Phase at which receptor is sensitive to identified impacts	Value/sensitivity and justification
Occupiers of Riverlight, Embassy Gardens, Nine Elms Parkside and US Embassy developments	Construction Operation	High sensitivity as pedestrians and cyclists Low sensitivity as highway users Medium sensitivity as parking users following occupation of these developments which is expected prior to completion of construction at Heathwall Pumping Station site

Operational base case

12.4.94 The operational assessment year for transport is Year 1 of operation.

12.4.95 As explained in para. 12.3.18 the elements of the transport network considered in the operational assessment are highway layout and operation. For the purposes of the operational base case it is anticipated that the highway layout will be as indicated in the construction base case.

12.4.96 The operational base case, Year 1 of operation, takes into account the developments described in the site development schedule (see Vol 14 Appendix N) as described in paras. 12.3.21 and 12.3.22. Given that the effects in the operational phase would be limited to effects on highway operation in the immediate vicinity of the Heathwall Pumping Station site it is not necessary to consider additional receptors beyond those identified for the construction base case in Vol 15 Table 12.4.4 above.

12.5 Construction effects assessment

12.5.1 This section summarises the findings of the assessment undertaken for the peak year of construction at the Heathwall Pumping Station site (Site Year 1 of construction).

12.5.2 The anticipated mode split of worker trips (covering all types of construction worker described in Vol 15 Table 12.2.2) for Heathwall Pumping Station is detailed in Vol 15 Table 12.5.1 and has been derived by considering the availability of parking on the Heathwall Pumping Station site and in the surrounding streets and the 2001 Census data for journeys to workplaces within the vicinity of the Heathwall Pumping Station site[vii].

12.5.3 At this site there would be no parking provided within the site boundary for workers. The availability of parking on surrounding streets would be restricted as part of the traffic management works necessary to provide access to the Kirtling Street site, and measures to reduce car use would be incorporated into site-specific Travel Plan requirements, and therefore it is highly unlikely that workers would travel by car. The Census mode shares have therefore been adjusted in Vol 15 Table 12.5.1 to reflect increased levels of non-car use by workers at this site. This forms the basis of the assessment.

Vol 15 Table 12.5.1 Transport – mode split

Mode	Percentage of trips to site	Equivalent number of worker trips (based on 40 worker trips)	
		AM peak hour (07:00-8:00)	PM peak hour (18:00-19:00)
Bus	20%	8	8
National Rail	33%	13	13
Underground	29%	12	12
Car driver	<1%*	0	0
Car passenger	<1%*	0	0
Cycle	4%	1	1
Walk	9%	4	4
River	0.3%	0	0
Other (taxi/	5%	2	2

[vii] Based on 2001 Census as this type of data had not been released from the 2011 Census at the time of assessment.

Mode	Percentage of trips to site	Equivalent number of worker trips (based on 40 worker trips)	
		AM peak hour (07:00-8:00)	PM peak hour (18:00-19:00)
motorcycle)			
Total	**100%**	**40**	**40**

* *Assumed to be zero for the purposes of the assessment.*

Pedestrian routes

12.5.4 The construction phase layout (phase 1-4) plans (see separate volume of figures – Section 1) show the layout of pedestrian footways during construction.

12.5.5 To facilitate the reconfiguration of two existing accesses to form a single access at the eastern side of the site it would be necessary to remove a section of footway (approximately 1.3m). This removal of footway would ensure that the access would be wide enough for construction traffic to access and egress the site safely. However, no pedestrian route diversions would be required with pedestrians still able to cross the widened site access point.

12.5.6 There would be no diversions or changes to the Thames Path.

12.5.7 To assess a busiest case scenario it has been anticipated that all workers would finish their journeys to the site by foot. As a result the 40 worker trips generated by the site have been added to the construction base case pedestrian flows during the AM and PM peak hours.

12.5.8 It is likely that the majority of trips made by foot would route along Nine Elms Lane (A3205).

12.5.9 In determining the magnitude of impacts on pedestrian routes the relevant impact criteria are pedestrian delay, pedestrian amenity and accidents and safety (as set out in Vol 2 Section 12).

12.5.10 Given that there are no pedestrian diversions the impact on pedestrian delay would be negligible.

12.5.11 With regard to pedestrian amenity; there is increased potential for conflict between HGVs and pedestrians created by the eastern site access widening that would require HGVs to cross the footway on Nine Elms Lane (A3205). Safe crossing points and signage would therefore be provided on the pedestrian route at the site accesses. On this basis the impact magnitude for pedestrian amenity would be classified as low adverse.

12.5.12 In terms of accidents and safety for pedestrians the need for pedestrians to cross the proposed widened eastern site access coupled with the anticipated construction vehicle flow of between four and 20 two way HGV movements per hour suggest a low adverse impact, using the criteria set out in Vol 2 Section 12. However, consideration has been given to the implication of the site access being directly onto the TLRN in assessing the accident and safety impacts for the highway network, set out in para. 12.5.43 and the impact magnitude for pedestrian accidents and safety would be classified as medium adverse.

Cycle facilities and routes

12.5.13 The relevant impact criteria for determining the magnitude of impacts on cycle facilities and routes are; cycle delay and accidents and safety (as set out in Vol 2 Section 12).

12.5.14 Cyclists using the off-road cycle route along Nine Elms Lane (A3205) would not experience additional delay to journey time because there would be no route diversions. As a result there is minimal change to cyclist delay anticipated.

12.5.15 Cyclists using the shared footway / cycleway would experience similar changes at the site accesses to those encountered by pedestrians on the same route. This could result in a small increase in risk to cyclists within the area, which would be addressed through appropriate management measures at the site accesses.

12.5.16 Cyclists using the highway could experience delay to their journey time as a result of the construction works at the Heathwall Pumping Station site. The effect on journey times on this route is detailed in the construction highway network assessment (see paras. 12.5.46-12.5.49) and the results show that there would be a maximum increase in delay for cyclists using Nine Elms Lane (A3205) of two seconds over the construction base case. This represents a negligible impact on cycle delay.

12.5.17 With regard to accidents and safety, cyclists using the shared footway / cycleway on Nine Elms Lane (A3205) would experience similar impacts to pedestrians on the same route. This would result in a medium adverse impact.

Bus routes and patronage

12.5.18 There are two bus services which operate along Nine Elms Lane (A3205). Additional construction vehicles serving the site may affect bus journey times of these services along Nine Elms Lane (A3205) and within the wider area. The effect on journey times is detailed in the highway operation and network assessment (paras.12.5.46 to 12.5.49) and would be an increase of a maximum of approximately two seconds over the construction base case. This represents a negligible impact.

12.5.19 It is expected that approximately eight additional two-way worker trips would be made by bus during the AM and PM peak hours, which would result in less than one worker trip per bus (based on a service of 17 buses within a 640m walking distance during the AM and PM peak hours).

12.5.20 Based on the impact criteria outlined in Vol 2 Section 12 the additional worker trips made by bus in peak hours would have a negligible impact on bus patronage.

London Underground and National Rail services and patronage

12.5.21 No underground or rail stations are directly adjacent to the site and therefore none would be directly affected by the construction works and the Heathwall Pumping Station site. It is anticipated that approximately 25 construction workers and labourers would use London Underground or National Rail services to access the site which would result in 13 additional person trips on National Rail services and 12 additional person trips on London Underground services in each of the AM and PM peak hours.

12.5.22 On London Underground services this equates to less than one person per train during the AM and PM peak hours based on a frequency of 42 trains during the peaks.

12.5.23 On National Rail services there would be approximately one additional passenger per train based on the AM peak service of over 100 trains serving the site.

12.5.24 Based on the quantitative assessment of patronage and the impact criteria on rail patronage in Volume 2 this would result in a negligible impact on London Underground and National Rail patronage.

River passenger services and patronage

12.5.25 There are river passenger services passing the Heathwall Pumping Station site on their way to Putney, but these are limited to three in the morning and three in the evening Monday to Friday. Generally their presence is not expected to be affected by the barges associated with the Heathwall Pumping Station site, but there might be a minor effect on days when high tides occur at these times as this when Heathwall Pumping Station barges are most likely to be accessing the site.

12.5.26 During construction it is anticipated that 0.3% of construction workers and labourers would use the river services to access the construction site. As this represents less than one additional journey per river service in the AM peak hour calling at St George Wharf Pier, based on the criteria for river passenger service patronage in Vol 2 Section 12 the impact on river passenger services would be negligible.

River navigation

12.5.27 This section addresses the effects on river navigation and access in the vicinity of the Kirtling Street site. The wider effects of transporting construction materials by river from a number of sites within the project are dealt with in Volume 3.

12.5.28 During construction it is intended that the cofferdam import and export would be transported by barge. For the assessment it is taken as 90% of these materials are by river to take into account periods where river transport is unavailable or the material is unsuitable. The peak number of barge movements is within Site Year 1 of construction with a daily average of four barge movements a day.

12.5.29 As the number of barge movements at the Heathwall Pumping Station is between one and two per day, the impact on river navigation in the vicinity of the site as a result of the barges arriving at Heathwall Pumping Station would be negligible according to the criteria set out in Vol 2 Section 12.

12.5.30 However, it is anticipated that 350T barges would be used at this site. Barges would be hauled by tugs which may be capable of hauling two 350T barges together. The number of transit movements required on the river may therefore be lower than the number of individual barge movements.

12.5.31 The temporary jetty would also affect access to Cringle Dock which is used by the Western Riverside Waste Authority to transport containers from the waste transfer station. The presence of the temporary jetty to the northeast of the dock could cause minor delays to barges as they may need to undertake additional manoeuvres to access the dock and may have to wait if other barges are docking at or leaving the temporary jetty.

12.5.32 Given the potential delays to other vessels, the overall impact has been assessed as low adverse.

12.5.33 A separate *Navigational Issues and Preliminary Risk Assessment* has been undertaken for the temporary construction works and barges to be used at the Heathwall Pumping Station site. This is reported separately outside of the *Environmental Statement* and *Transport Assessment* will accompany the application.

Parking

12.5.34 There are no proposals to remove any on-street parking or loading bays in association with the construction works at the Heathwall Pumping Station site.

12.5.35 There would be no effect on the Sainsbury's car park on Wandsworth Road or the coach parking bays in the New Covent Garden Market coach car park.

12.5.36 In determining the magnitude of impacts on parking the relevant criterion is vehicle parking and loading changes (as set out in Vol 2 Section 12). Given that there are no changes to the parking and loading operation at this site the impact on parking and loading changes would be negligible.

Highway network and operation

12.5.37 The highway layout during construction plan (see separate volume of figures – Section 1) shows that the site would be accessed via Nine Elms Lane (A3205) on a 'left in, left out' basis. The highway layout during construction vehicle swept path analysis (see Heathwall Pumping Station *Transport Assessment* figures) demonstrates that the construction vehicles would be able to safely enter and leave the site.

12.5.38 Construction lorry movements would be generally limited to the day shift only (08:00 to 18:00 Monday to Friday and 08:00 to 13:00 Saturday). Vol 15 Table 12.5.2 show the construction lorry movement assumptions for the local peak traffic periods. These are based on the peak months of construction activity at this site, which occurs during Site Year 1 of construction. The table also shows the other construction vehicle and construction worker vehicle movements expected to be generated by the Heathwall Pumping Station site.

12.5.39 The assessment is based on 10% of the daily number of lorry journeys occurring in the peak hours, which has been discussed with TfL as a reasonable approach. It is recognised that it may be desirable to reduce the number of construction lorry movements in peak hours and the mechanisms for addressing this would form part of the *Traffic Management Plans* which are required as part of the *CoCP*.

Vol 15 Table 12.5.2 Transport – peak construction works vehicle movements

Vehicle type	**Vehicle movements per time period**				
	Total daily	**07:00 to 08:00**	**08:00 to 09:00**	**17:00 to 18:00**	**18:00 to 19:00**
Construction lorry vehicle movements 10%*	36	0	4	4	0
Other construction vehicle movements**	36	4	4	4	4
Worker vehicle movements***	nominal	0	0	0	0
Total	**72**	**4**	**8**	**8**	**4**

** The assessment is based on 10% of the daily construction lorry movements associated with materials taking place in each of the peak hours.*
*** Other construction vehicle movements includes cars and light goods vehicles associated with site operations and contractor activity.*
**** Worker vehicle numbers based on less than 1% of workers driving, on the basis that there would be no worker parking on site; on-street parking in the area is restricted; and Travel Plan measures would discourage workers from driving. In practical terms, this would be close to zero.*

12.5.40 To ensure the assessment of the highway network is robust it has been based on a combination of the peak hour of movements for construction lorries and other construction vehicles between 07:00 and 09:00 and 17:00 and 19:00. These have been combined and applied to the peak hour to take into account the highest number of movements generated by the site.

12.5.41 An average peak flow of 72 vehicle movements a day is expected during the months of greatest activity during Site Year 1 of construction at this site. At other times in the construction period vehicle movements would be lower than this average peak figure.

12.5.42 The relevant impact criteria for determining the magnitude of impacts on the highway network and operation are; accidents and safety, road network delay and hazardous loads (as set out in Vol 2 Section 12).

12.5.43 There are no proposals to alter the layout of the existing highway network during the construction of the Heathwall Pumping Station site. However, given that the site access would be directly from the TLRN the criteria in Vol 2 Section 12 indicate that this represents a medium adverse impact in relation to accidents and safety for highway users.

12.5.44 It is assessed that potentially one vehicle every fortnight would be transporting hazardous loads to and from this site during construction and therefore the impact on the highway network in relation to hazardous loads would be low adverse, based on the criteria set out in Vol 2 Section 12.

12.5.45 Validated PICADY and LinSig models have been used to apply the construction traffic demands and local junction modifications to the construction base case to determine the changes in the highway network operation due to the project (ie, comparison of base and development cases). The development case traffic flows (providing input to the LinSig and PICADY models) are shown on Vol 14 Figure 12.4.6 and Figure 12.4.7 (see separate volume of figures).

12.5.46 A summary of the construction assessment results for the site access point for the weekday AM and PM peak hours is presented in Vol 15 Table 12.5.3. The results suggest that it would take a maximum of 18 seconds and 16 seconds for site traffic to gain access onto Nine Elms Lane (A3205) in the AM and PM peak hours respectively. This would result in a negligible impact, based on the impact criteria identified in Vol 2 Section 12.

12.5.47 A summary of the construction assessment results for the Cringle Street/ Nine Elms Lane (A3205) junction in the weekday AM and PM peak hours is presented in Vol 15 Table 12.5.4 and Vol 15 Table 12.5.5. The model results suggest that the junction would operate within capacity and that the maximum increase in delay would be ten seconds occurring in the PM peak hour for vehicles turning out of Cringle Street causing an increase of one vehicle in the queue length. This would result in a negligible impact, based on the impact criteria identified in Vol 2 Section 12.

12.5.48 A summary of the construction assessment results for the Kirtling Street/ Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden access road junction in the weekday AM and PM peak hours is presented in Vol 15 Table 12.5.6 and Vol 15 Table 12.5.7.

12.5.49 The model results suggest that the junction would continue to operate within capacity. The maximum increase in capacity level would occur in the AM peak hour for vehicles turning right on Nine Elms Lane (A3205) (3% increase). The increase in queue length for this movement would be one additional PCU and the increase in delay would be an additional one second per PCU. Based on the criteria set out in Vol 2 Section 12, the model results suggest that the impact of construction traffic on road network delay at this junction would be negligible both peak periods.

Vol 15 Table 12.5.3 Transport – construction PICADY model outputs – site access points from Nine Elms Lane (A3205)

Approach	Movement	Weekday							
		AM peak hour (08:00-09:00)				PM peak hour (17:00-18:00)			
		Flow (vehs)	RFC	Max. Queue (vehs)	Delay (seconds per veh)	Flow (vehs)	RFC	Max. Queue (vehs)	Delay (seconds per veh)
Site access	Left onto Nine Elms Lane (A3205)	4	2%	0	18	5	2%	0	16

Notes: 1. RFC represents Ratio of Flow to Capacity. Queue represents number of vehicles in queue. Delay represents the mean delay per vehicle.
2. Nine Elms Lane (A3205) westbound is not included in table as PICADY model only considers movements where vehicles have to give way.

Vol 15 Table 12.5.4 Transport – construction PICADY model outputs, AM peak hour – Nine Elms Lane (A3205) / Cringle Street junction

Approach	Movement	Flow	Weekday								
			AM peak hour (08:00-09:00)								
			RFC			Max. Queue (vehs)			Delay (seconds per veh)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Cringle Street	Left . ahead / right	83	36%	43%	+7%	1	1	0	29	34	+5
Nine Elms Lane (W) (A3205)	Right	2	1%	1%	0	0	0	0	19	19	0
Nine Elms Parkside	Left	5	2%	2%	0	0	0	0	17	17	0
Nine Elms Parkside	Right	3	4%	4%	0	0	0	0	50	52	+2
Nine Elms Lane (E) (A3205)	Right	81	37%	37%	0	1	1	0	26	26	0

Notes: RFC represents Ratio of Flow to Capacity. Queue represents number of vehicles in queue. Delay represents the mean delay per vehicle.

Vol 15 Table 12.5.5 Transport – construction PICADY model outputs, PM peak hour – Nine Elms Lane (A3205) / Cringle Street junction

Approach	Movement	Flow (vehs)	Weekday								
			AM peak hour (17:00-18:00)								
			RFC			Max. Queue (vehs)			Delay (seconds per veh)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Cringle Street	Left / ahead /right	139	58%	66%	+8%	1	2	+1	39	49	+10
Nine Elms Lane (W) (A3205)	Right	3	2%	2%	0	0	0	0	20	20	0
Nine Elms Parkside	Left	4	2%	2%	0	0	0	0	18	18	0
Nine Elms Parkside	Right	2	3%	3%	0	0	0	0	60	64	+4
Nine Elms Lane (E) (A3205)	Right	78	33%	33%	0	0	0	0	23	23	0

Notes: RFC represents Ratio of Flow to Capacity. Queue represents number of vehicles in queue. Delay represents the mean delay per vehicle.

Vol 15 Table 12.5.6 Transport – construction LinSig model outputs, AM peak hour – Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden Market access road junction

Approach	Movement	Flow (PCU)	Weekday								
			AM peak hour (08:00-09:00)								
			DoS			MMQ (PCU)			Delay (seconds per PCU)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Kirtling Street	Left	4	3%	3%	0%	0	0	0	58	58	0
	Right	52	37%	37%	0%	2	2	0	64	64	0
Nine Elms Lane (A3205)	Left / ahead	576	75%	75%	0%	14	15	+1	36	36	0
	Right / ahead	540	70%	73%	+3%	13	14	+1	36	37	+1
New Covent Garden Market	Left	96	72%	72%	0%	4	4	0	91	91	0
	Right / ahead	40	29%	29%	0%	1	1	0	62	62	0
Battersea Park Road (A3205)	Left / ahead	484	75%	76%	+1%	13	14	+1	41	42	+1
	Right / ahead	607	79%	80%	+1%	15	15	0	43	44	+1
			PRC						Total delay (PCU hours)		
Overall junction performance			13.3%	12.5%	-0.8%				28	28	0

Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity. MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. Delay represents the mean delay per PCU. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUs.

Thames Tideway Tunnel project construction vehicles would be a mixture of three- and four-axle vehicles and have therefore been given a PCU value of two.
2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in para. 12.3.29.

Vol 15 Table 12.5.7 Transport – construction LinSig model outputs, PM peak hour – Kirtling Street / Nine Elms Lane (A3205) / Battersea Park Road (A3205) / New Covent Garden Market access road junction

Approach	Movement	Flow (PCU)	Weekday								
			PM peak hour (17:00-18:00)								
			DoS			MMQ (PCU)			Delay (seconds per PCU)		
			Base case	Devt case	Change	Base case	Devt case	Change	Base case	Devt case	Change
Kirtling Street	Left	6	5%	5%	0%	0	0	0	59	59	0
	Right	43	31%	31%	0%	1	1	0	62	62	0
Nine Elms Lane (A3205)	Left / ahead	598	78%	79%	+1%	16	16	0	38	38	0
	Right / ahead	572	75%	77%	+2%	15	15	0	37	39	+2
New Covent Garden Market access road	Left	93	70%	70%	0	4	4	0	88	88	0
	Right / ahead	33	24%	24%	0	1	1	0	60	60	0
Battersea Park Road (A3205)	Left / ahead	521	81%	82%	+1%	15	15	0	45	46	+1
	Right / ahead	579	80%	80%	0	15	16	+1	43	43	0
			PRC						Total delay (PCU hours)		
Overall junction performance			10.8%	10.0%	-0.8%				29	30	+1

Notes: 1. DoS represents Degree of Saturation; the ratio of flow to capacity. MMQ represents Mean Maximum Queue for the busiest-case 15 minute modelled period (in vehicle lengths). Delay represents the mean delay per PCU. PRC represents Practical Reserve Capacity; measure of how much additional traffic could pass through a junction whilst maintaining a maximum DoS of 90% on all lanes. PCU value for a car is one PCU. Vans and three-axle vehicles are 1.5 PCUs, vehicles with four or more axles are 2.3 PCUs. Buses and coaches are two PCUs. Motorcycles are 0.4 PCUs and pedal cycles are 0.2 PCUsThames Tideway Tunnel project construction vehicles would be a mixture of three- and four-axle vehicles and have therefore been given a PCU value of *two.*

2. Assessment has assumed that traffic signal optimisation has been undertaken as detailed in para. 12.3.29

Significance of effects

12.5.50 The significance of the effects has been determined by considering the transport impacts described above in the context of the sensitivity of the receptors identified in Vol 15 Table 12.4.3 and Vol 15 Table 12.4.4.

12.5.51 Vol 15 Table 12.5.8 sets out the effects on each receptor in the vicinity of the site.

Vol 15 Table 12.5.8 Transport – significance of effects during construction

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
Pedestrians and cyclists (including sensitive pedestrians) using the Thames Path and the local highway network.	Minor adverse effect on pedestrians Minor adverse effect on cyclists	**Pedestrians:** • High sensitivity • Negligible impact on pedestrian delay • Low adverse impact on pedestrian amenity • Medium adverse impact on accidents and safety • Due to impacts of negligible, low and medium adverse magnitude, equates to minor adverse effect. **Cyclists:** • High sensitivity • Negligible impact on cyclist delay • Medium adverse impact on accidents and safety • Due to impacts being medium adverse or negligible magnitude equates to minor adverse.

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
Private vehicle users (including taxis) in the area using the local highways or on-street parking.	Minor adverse effect on highway users Negligible effect on parking users	**Highway users:** • Medium sensitivity • Negligible impact on road network delay • Medium adverse impact on accidents and safety • Low adverse impact from hazardous loads • Due to the combination of impact magnitudes, and the sensitivity of the receptor, this equates to a minor adverse effect. **Parking users:** • Medium sensitivity • No impact on on-street parking • Due to no impact, this equates to negligible effect.
Emergency vehicles travelling on Nine Elms Lane (A3205)	Minor adverse effect	• High sensitivity • Negligible impact on road network delay • Medium adverse impact on accidents and safety • Low adverse impact from hazardous loads • Due to the combination of impact magnitudes, equates to a minor adverse effect.
Marine emergency services	Minor adverse effect	• High sensitivity • Low adverse impact on river navigation /moorings • Low adverse impact equates to minor adverse effect
Bus users (passengers) travelling along Nine Elms Lane (A3205) / Battersea Park Road	Negligible effect	• Medium sensitivity • Negligible impact on network delay and patronage

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
(A3205) and through the Vauxhall Gyratory.		• Due to negligible impacts, equates to a negligible effect.
Public transport users using rail or river services within the area.	Negligible effect	• Medium sensitivity • Negligible impact on patronage • Equates to negligible effect.
River vessel operators including river passenger services.	Minor adverse effect	• Medium sensitivity • Negligible impact on patronage • Low adverse impact on river navigation • Negligible and low adverse impacts results in minor adverse effect.
Occupiers of Riverlight, Embassy Gardens, Nine Elms Parkside and US Embassy developments Residents of the houseboats at Tideway Village Residents of the Nine Elms Pier houseboats Users of Battersea Barge Restaurant	Minor adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect highway users Negligible effect on parking users	**Pedestrians:** • High sensitivity • Negligible impact on pedestrian delay • Low adverse impact on pedestrian amenity • Medium adverse impact on accidents and safety • Given the sensitivity of the receptor, overall effect is considered to be minor adverse. **Cyclists:** • High sensitivity • Negligible impact on cyclist delay • Medium adverse impact on accidents and safety • Given the sensitivity of the receptor, overall effect is considered to be minor adverse.

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		Highway users: • Low sensitivity • Negligible impact on road network delay • Medium adverse impact on accidents and safety • Low adverse impact from hazardous loads • Overall minor adverse effect on highway users. **Parking users:** • Medium sensitivity • No impact on on-street parking • Due to no impact, this equates to negligible effect.
Users of the Cringle Dock Waste Transfer Station and the Metro Greenham Wharf Cemex concrete batching site	Minor adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Negligible effect on parking users	**Pedestrians:** • Medium sensitivity • Negligible impact on pedestrian delay • Low adverse impact on pedestrian amenity • Medium adverse impact on accidents and safety • Overall effect is considered to be minor adverse. **Cyclists:** • Medium sensitivity • Negligible impact on cyclist delay • Medium adverse impact on accidents and safety • Overall effect is considered to be minor adverse. **Highway users:** • Medium sensitivity • Negligible impact on road network delay

Receptors (relating to all identified transport effects)	Significance of effect	Justification (receptor sensitivity and impacts)
		• Medium adverse impact on accidents and safety • Low adverse impact from hazardous loads • Overall minor adverse effect on highway users **Parking users:** • Medium sensitivity • No impact on on-street parking • Due to no impact, this equates to negligible effect.

Sensitivity test for programme delay

12.5.52 The assessment has been based on an estimated programme for the construction of the Thames Tideway Tunnel project. That programme has been used to derive construction vehicle numbers and to understand the relationships between the project and other developments in the vicinity of project sites, in order to allow appropriate receptors to be identified.

12.5.53 If the overall programme were to be delayed by approximately a year, the implications in relation to the transport effects would be as follows:

a. It is unlikely that the effects on pedestrians and cyclists would change. Over the course of one year, it is unlikely that pedestrian or cycle traffic in the vicinity of the project site would increase by a sufficient amount to change the magnitude of impacts or the significance of effects reported

b. Effects on public transport are unlikely to change as the rate of public transport patronage growth is relatively low and over the course of one year, any reduction in spare capacity on existing public transport networks would be small. Additionally, there is a general trend towards the enhancement of the public transport network through the provision of additional bus, rail and river services in order to meet future demand and accommodate future patronage growth. The transport assessment typically indicates that the additional public transport patronage arising from Thames Tideway Tunnel project sites would be small and not significant in the context of the capacity available on the wider networks

c. Effects on river navigation and access would not be significantly different as the rate of change in patterns of river usage is comparatively small

d. Effects on the operation of the highway network are derived from the use of the TfL Highway Assignment Models (HAMs), which have a forecast model year of 2021. To provide consistency within the assessment, it has been agreed with TfL that this is an appropriate approach. Since the local highway capacity models for the base case also use traffic flow information from the HAMs, it follows that both the strategic and local capacity assessments are effectively based on a year of 2021. As the peak months of activity at the Heathwall Pumping Station site fall before 2021 based on the programme that has been assessed, it follows that a delay of up to one year would not alter the outcomes of the highway network modelling and therefore would not alter the effects reported

e. Based on the site development schedule (see Vol 15 Appendix N), it is possible that as a result of a one year delay, some developments which have been assumed to be under construction in the assessment would be partially complete and occupied. However, it is not expected that new receptors would experience any different effects to those receptors which have been assessed above; rather it would be a case of the potential for some additional receptors to experience the same effects that have already been identified.

12.6 Operational effects assessment

12.6.1 This section summarises the findings of the assessment undertaken for Year 1 of operation at the Heathwall Pumping Station site.

12.6.2 The transport demands created by the development in the operational phase would be extremely low and limited to occasional maintenance visits every three to six months and larger cranes and other associated support vehicles required for access to the shaft and tunnel every ten years.

12.6.3 The assessment of the operational phase is therefore limited to the physical issues associated with accessing the site from the base case highway network.

12.6.4 The operational assessment has taken into consideration those elements that would be affected, which comprise the short-term impacts on the highway layout and operation when maintenance visits are made to the site.

Highway layout and operation

12.6.5 The permanent highway layout plan (see separate volume of figures – Section 1) shows the highway layout during the operational phase.

12.6.6 The site would be accessed from the existing access to the Thames Water Pumping Station via Nine Elms Lane (A3205) during the operational phase.

12.6.7 For routine three or six monthly inspections vehicular access would be required for light commercial vehicles, typically a transit van. On occasion there may be a need for flatbed vehicles to access the site.

12.6.8 During ten-yearly inspections an area to locate two large cranes within the site area would be required. The cranes would facilitate lowering and recovery of tunnel inspection vehicles and to provide duty/standby access for personnel. To assess the effect of these on the highway layout, swept path analyses have been undertaken for the largest vehicles expected to access the site; an 11.36m mobile crane, a 10m rigid vehicle and a 10.7m articulated vehicle. The permanent highway layout vehicle swept path analysis plan (see Heathwall Pumping Station *Transport Assessment* figures) demonstrates that operational vehicles would be able to safely enter and leave the site.

12.6.9 When larger vehicles are required to service the site there may also be some temporary, short-term delay to other road users while manoeuvres are made. However it is anticipated that the arrival of large vehicles would normally be scheduled to take place outside of the peak hours to minimise the effect on the local highway network.

12.6.10 Based on the impact magnitude criteria outlined in Vol 2 Section 12 during the routine inspections of the operational site it is anticipated that there would be a negligible impact on road network delay.

12.6.11 Taking into consideration the various sensitivities of the receptors affected during the operational phase (private vehicle users, emergency vehicles and occupiers of Riverlight, Embassy Gardens, Nine Elms Parkside and US Embassy developments) this would result in a **negligible** effect on highway layout and operation.

Sensitivity test for programme delay

12.6.12 If the opening year of the Thames Tideway Tunnel project were to be delayed by approximately one year, the results of the operational assessment would not be materially different to the assessment findings reported above.

12.7 Cumulative effects assessment

Construction effects

12.1.1 As listed in para. 12.3.7, there are a number of developments in the vicinity of the Heathwall Pumping Station site that would be under construction at the same time. This suggests that there are cumulative effects to assess for the construction development case. However, as para. 12.3.9 explains, the TfL HAMs which have been used in the assessment already take account of population and employment growth forecasts in London.

12.1.2 In addition, specific allowance has been made in the local highway modelling for the construction trips generated by the committed developments in paras. 12.3.6 and 12.3.7, where that information is available.

12.1.3 This approach addresses a number of uncertainties around the actual timescale for implementation of each of the committed developments and thus inherently addresses cumulative effects within the assessment of construction effects reported in Section 12.5. The effects on transport would therefore remain as described in that section. This would also be the case if the programme for the Thames Tideway Tunnel project were delayed by approximately one year.

Operational effects

12.1.4 As indicated in the site development schedule (see Vol 14 Appendix N) and as identified in liaison with TfL and LB Wandsworth, the developments stated in paras. 12.3.21-12.3.22 are in the vicinity of the Heathwall Pumping Station site would be under construction or operational by Year 1 of operation.

12.1.5 However, as maintenance trips to the Heathwall Pumping Station site would be low and the trips from the developments identified above are already taken into account within the assessment, there is no need for a cumulative assessment on transport and the effects would remain as described in Section 12.6. This would also be the case if the programme for the Thames Tideway Tunnel project were delayed by approximately one year.

12.8 Mitigation

12.1.6 The project has been designed to limit the effects on transport networks as far as possible and many measures have been embedded directly in the design of the project including the *CoCP* and *Draft Project Framework Travel Plan*. No additional measures are required for transport and therefore there is no mitigation identified for either construction or operation.

12.9 Residual effects assessment

Construction effects

12.1.7 As no mitigation measures are proposed the residual construction effects remain as described in Section 12.5. All residual effects are presented in Section 12.10.

Operational effects

12.1.8 As no mitigation measures are proposed the residual operational effects remain as described in Section 12.6. All residual effects are presented in Section 12.10.

12.10 Assessment summary

Vol 15 Table 12.10.1 Transport – summary of construction assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Pedestrians and cyclists (including sensitive pedestrians) using the Thames Path and the local highway network.	• Loss of cycle lane • Increase in potential conflicts with construction traffic at the site crossovers	Minor adverse effect on pedestrians Minor adverse effect on cyclists	None	Minor adverse effect on pedestrians Minor adverse effect on cyclists
Private vehicle users (including taxis) in the area using the local highways or on-street parking.	• Movement of large construction vehicles • Slight delay to journey time • No effect on on-street parking	Minor adverse effect on highway users Negligible effect on parking users	None	Minor adverse effect on highway users Negligible effect on parking users
Emergency vehicles travelling on Nine Elms Lane (A3205).	• Movement of large construction vehicles • Slight delay to journey time.	Minor adverse effect	None	Minor adverse effect
Marine emergency services	• Additional barge movements on the River Thames	Minor adverse effect	None	Minor adverse effect
Bus user (passengers) travelling along Nine Elms Lane (A3205) / Battersea Park Road (A3205) and through the Vauxhall	• Movement of large construction vehicles • Slight delay to journey time	Negligible effect	None	Negligible effect

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Gyratory.	• Additional patronage from construction workers			
Public transport users using rail or river services within the area.	• Additional patronage from construction workers	Negligible effect	None	Negligible effect
River vessel operators including river passenger services.	• Additional barge movements on River Thames	Minor adverse effect	None	Minor adverse effect
Occupiers of Riverlight, Embassy Gardens, Nine Elms Parkside and US Embassy developments Residents of the houseboats at Tideway Village Residents of the Nine Elms Pier houseboats Users of Battersea Barge Restaurant Users of the Cringle Dock Waste Transfer Station and the Metro Greenham Wharf	• Movement of large construction vehicles • Slight delay to journey time • No effect on on-street parking	Minor adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect highway users Negligible effect on parking users	None	Minor adverse effect on pedestrians Minor adverse effect on cyclists Minor adverse effect on highway users Negligible effect on parking users

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Cemex concrete batching site				

Vol 15 Table 12.10.2 Transport – summary of operational assessment

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Private vehicle users in the area using the local highways	• Occasional delay to road users when large maintenance vehicles accessing site.	Negligible effect	None	Negligible effect
Emergency vehicles travelling on Nine Elms Lane (A3205)	• Occasional maintenance trips resulting in some temporary, short-term road network delay.	Negligible effect	None	Negligible effect
Occupiers of Riverlight, Embassy Gardens, Nine Elms Parkside and US Embassy developments	• Occasional maintenance trips resulting in some temporary, short-term road network delay.	Negligible effect	None	Negligible effect

References

[1] Defra, *National Policy Statement for Waste Water* (2012)

[2] TfL, *Travel Planning for new development in London,* Transport for London (2011)

[3] Transport for London, *Assessment Tool for Travel Plan Building Testing and Evaluation (ATTrBuTE)*, 2011. http://www.attrbute.org.uk/

[4] Greater London Authority, *London Plan*, July 2011.

[5] Transport for London, *Transport Assessment Best Practice Guidance*, April 2010.

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Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 13: Water resources - groundwater

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 13: Water resources – groundwater

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13 Water resources – groundwater

13.1 Introduction

13.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on groundwater at Heathwall Pumping Station site.

13.1.2 The proposed development has the potential to affect groundwater due to:

a. grout/ground treatment to control ingress of water

b. creation of pathways for pollution

c. obstruction to groundwater flows

d. seepage into and out of the combined sewer overflow (CSO) drop shaft during operations.

13.1.3 The groundwater assessment at this site should be read in conjunction with the supporting Volume 15 Appendix K and the land quality assessment (Section 8 Land quality).

13.1.4 The site is underlain by thick layer of relatively impermeable London Clay Formation and construction would extend down a short distance into the variable permeability Lambeth Group. No dewatering of the upper aquifer would be required at the Heathwall Pumping Station site and instead the groundwater in the River Terrace Deposits would be cut off using a jacked caisson[i] and secant piles[ii] into the London Clay. Depressurisation[iii] of the top of the Lambeth Group would be required to avoid minor seepages and inflows of groundwater during the construction of shaft and base slab. There would be no effects from Heathwall Pumping Station site on the lower aquifer because of the separation distance between the base of the shaft and the lower aquifer.

13.1.5 An assessment of project-wide environmental effects on groundwater is presented in Volume 3 Project-wide assessment.

13.1.6 The assessment of groundwater presented in this section has considered the requirements of the National Policy Statement for Waste Water (Defra, 2012)[1] Section 4.2. The physical characteristics of the groundwater environment including groundwater resources and quality are presented and the anticipated effects (including cumulative effects) on these resources addressed in the assessment that follows (further detail can be found in Vol. 2 Section 13.3).

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[i] Caisson – a retaining water-tight structure.

[ii] Secant piles – a sub-surface barrier installed around construction sites in order to control inflows of shallow groundwater typically formed of intersecting concrete or overlapping shafts of concrete.

[iii] Depressurisation – a term used to describe dewatering or lowering of hydraulic pressures in a confined aquifer.

13.1.7 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Vol 15 Heathwall Pumping Station Figures).

13.2 Proposed development relevant to groundwater

13.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to groundwater are set out below.

Construction

13.2.2 The elements of construction at the Heathwall Pumping Station site, relevant to groundwater, would include:

a. A CSO drop shaft of approximately 16m internal diameter (ID), and approximately 46m deep (or 58.23mATD[iv] based on an assumed ground level of 104.4mATD) (excluding a 3m thick base slab once constructed).

b. Interception structures for the Heathwall Pumping Station CSO, including an interception chamber, valve chamber and 10m ID and approximately 18m deep shaft

c. Interception structures for the Southwest Storm Relief (SWSR) CSO, including a valve chamber and modifications to an existing chamber on the SWSR sewer

d. A connection culvert from the Heathwall Pumping Station interception structures to the CSO drop shaft

e. A connection culvert from the SWSR valve chamber to the CSO drop shaft

f. A connection tunnel from the CSO drop shaft to the main tunnel

g. A temporary cofferdam in the foreshore.

13.2.3 The proposed methods of construction for these elements of the site are described in Section 3 of this volume and summarised in Vol 15 Table 13.2.1. Approximate duration of construction and depth are also contained in this table.

Vol 15 Table 13.2.1 Groundwater – methods of construction

Design element	Method of construction	Construction periods (in years)*	Construction depth**
CSO drop shaft	Jacked caisson	<1	Deep

[iv] In general, the measurements of depth are expressed as metres Above Tunnel Datum (mATD). The standard zero point for mATD scale is -100maOD (metres above Ordnance Datum is based on Newlyn datum point for mean sea level). The use of the mATD scale avoids the need for use of negative values, and is widely used for large scale sub-surface projects.

Design element	Method of construction	Construction periods (in years)*	Construction depth**
	with bottom underpinning and depressurisation of Lambeth Group		
Heathwall Pumping Station shaft	Jacked caisson with bottom underpinning	<1	Deep
Heathwall Pumping Station interception structures (excluding shaft)	Secant piles	1-2	Shallow
SWSR interception chambers and connection culverts	Secant piles	1-2	Shallow
Connection tunnel (from base of CSO drop shaft to main tunnel)	Sprayed concrete lining (SCL) with depressurisation of Lambeth Group & ground treatment[v]	1-2	Deep

** The site would be used for construction purposes for up to 3 years*
*** In terms of construction depth – shallow (means <10m) and deep (means >10m).*

Code of Construction Practice

13.2.4 All works would be undertaken in accordance with the *Code of Construction Practice (CoCP)*. Relevant measures included within the *CoCP (Part A)* to ensure adverse effects on groundwater are minimised are as follows:

a. Measures include providing bunded stores for fuel/oils held on site and the settlement of dewatering from excavations to prevent silty water from entering watercourses, surface water drains and onto roads as per Environment Agency guidelines (EA, 2011)[2]. The contractor would have plans and equipment in place to deal with emergency situations as well as ensuring that staff are appropriately trained.

b. A precautionary approach, involving targeted risk-based audits and checks by monitoring water quality, would be applied to abstraction licences thought to be at risk.

[v] Ground treatment – stabilisation of soils/rocks by injection of grouts and or freezing techniques.

c. Monitoring arrangements for dewatering permits and any permits required on change of licensing regulations would be developed in liaison with the EA (see also the groundwater monitoring strategy in Vol 3 Appendix K.1).

d. The use of any materials for ground treatment would be agreed with the EA prior to use.

e. At the end of construction where temporary support does not form part of the operational structure it would be removed, piped through or cut down to avoid the build up of groundwater on the upstream side of underground structures.

13.2.5 There are no site specific groundwater measures contained within the *CoCP Part B*.

Other measures during construction

13.2.6 The depth of CSO drop shaft means that it would extend down into the Laminated Beds (LtB) of the Lambeth Group (see Vol 15 Appendix K.1), with the base slab extending down into the Lower Mottled Beds (LMB), both of which are expected to contain substantial quantities of groundwater under pressure. The depth of the shaft that is part of the Heathwall Pumping Station interception structure means that it would extend down into the London Clay Formation. Groundwater in the London Clay Formation is considered to consist of localised seepages and minor inflows.

13.2.7 For the purposes of this assessment, no dewatering of the upper aquifer is anticipated to be required. Instead a jacked caisson and secant pile into the London Clay Formation would be constructed around the Heathwall Pumping Station site to seal out the River Terrace Deposits (upper aquifer). The dewatering impacts on the upper aquifer have therefore been excluded.

13.2.8 To prevent possible inundation of the CSO drop shaft by groundwater from the Harwich Formation and confined groundwater layers within the Lambeth Group, the construction of the shafts would involve building a concrete lining around the shaft (a jacked caisson). This method would reduce the amount of pumping required from within the caisson. Depressurisation wells would be drilled into the Lambeth Group around the outside of the jacking collar of the shaft and pumped to lower the water pressure in the Lambeth Group. Pumps would be placed in the wells and groundwater would be extracted and discharged directly to the River Thames on site, following any necessary treatment and subject to EA approval. The duration of pumping would be determined by ground conditions and groundwater volumes encountered; however this is likely to be in the order of up to 12 months; the time required to build and excavate the shafts and base slabs.

13.2.9 An estimate of the amount of dewatering which would be needed at Heathwall Pumping Station site is less than $200m^3/d$.

13.2.10 For the purposes of this assessment, no ground treatment is anticipated to be required for construction of the CSO drop shaft but may be required for the advancing connection tunnels and the connection to the main tunnel, both at depth. This ground treatment would be within the Lower Mottled Beds of the Lambeth Group. No other ground treatment is anticipated to be required which could affect the lower aquifer.

13.2.11 The site would extend partly into the River Thames and this part of the site would be protected from inundation by a cofferdam. The cofferdam would be constructed from two sheet pile walls. The toe level of the sheet piles would be approximately 2m into the London Clay Formation at approximately 94mATD. Any small volumes of water entering through the cofferdam would be pumped back to the river following any required treatment. The sheet piles in the river would be removed at the end of the construction period.

Operation

13.2.12 The design of the CSO drop shafts includes a lining, which as well as providing structural integrity, would minimise the possibility of groundwater infiltration into the shaft when empty.

13.2.13 On the occasions when the CSO drop shaft would be full the lining would also ensure sewage would not be able to exfiltrate from the shaft.

13.2.14 A groundwater monitoring strategy is one of the project's environmental design measures (see Vol 3 Appendix K.1). This covers groundwater levels and groundwater quality, and would outline the future monitoring and actions in the event of trigger levels being exceeded.

13.3 Assessment methodology

Engagement

13.3.1 Vol 2 Environmental assessment methodology documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. There were no specific comments relevant to this site for the assessment of groundwater.

Baseline

13.3.2 The baseline methodology follows the methodology described in Vol 2. There are no site specific variations for identifying the baseline conditions for this site.

13.3.3 The baseline describes receptors within a 1km radius of the CSO sites during both construction and operation.

13.3.4 There are unlikely to be any effects on groundwater beyond a kilometre at the Heathwall Pumping Station site given the hydrogeological setting and the method of construction (para. 13.1.4).

Construction

13.3.5 The assessment methodology for the construction phase follows that described in Vol 2. There are no site-specific variations for undertaking the construction assessment of the Heathwall Pumping Station site.

13.3.6 The assessment year applied to the construction assessment is Site Year 1 of construction. In this year, the jacked caisson or secant piling could obstruct groundwater flows with small-scale pumping from within both these structures and towards the end of that year when depressurisation of Lambeth Group would be required. The baseline is not anticipated to change substantially between 2011 and Site Year 1 of construction (2016) and so baseline data from 2011 has formed the basis (base case) for the construction assessment.

13.3.7 A number of proposed developments which are likely to be complete and operational before commencement of construction have formed part of the construction base case.

13.3.8 The developments considered as part of the base case and those included in the cumulative effects assessment are presented in Vol 15 Table 13.3.1. The developments relevant to groundwater are those which would contain basements, and Sustainable Drainage Systems (SuDS).

Vol 15 Table 13.3.1 Groundwater – construction base case and cumulative assessment developments (2016)

Development	Component or receptor relevant to groundwater	Construction base case	Cumulative effect assessment	Comments (if required)
1-9 Bondway and 4-6 South Lambeth Place	*Basement	✓	✗	n/a
30 - 60 South Lambeth Road	*Basement	✗	✓	n/a
Battersea Power Station	*Basement *SuDS	Phase 1 and Phase 2 complete	Phase 3 under construction	Abstraction **28/39/42/0074 not considered as in lower aquifer
Embassy Gardens, Land to the south of Nine Elms Lane comprising DHL Depot and 1-12 Ponton Road and 51 Nine Elms Lane	*Basement	Buildings A09, A10, & A11 complete	Buildings A01, A02, A03, A04, A05 & A07 under construction	n/a
Island Site Vauxhall Gyratory	*Basement	✗	✓	n/a
St Georges Wharf (Vauxhall Tower)	*Basement	✓	✗	**GSHP not considered as in lower aquifer
Marco Polo House, 346 Queenstown Road	*Basement	Phase 1a complete	Phases 1b and 2 under construction	n/a
Market Towers	*Basement	✓	✗	n/a

Development	Component or receptor relevant to groundwater	Construction base case	Cumulative effect assessment	Comments (if required)
New Covent Garden Market	*Basement	✗	B1, B2, B3, B4, B5 & B6 under construction	n/a
Nine Elms Sainsbury's, Wandsworth Road	*Basement	✓	✗	n/a
Northern Line Extension	*Underground Structures	✗	✓	n/a
Nine Elms Parkside	*Basement	✗	Plots C & D under construction	n/a
Riverlight, Tideway Industrial Estate	*Basement	Blocks B, C, D, E & F complete	Block A under construction	**GSHP not considered as in lower aquifer
US Embassy - Land on south side of Nine Elms Lane incorporating Ponton Road	*Basement	✓	✗	n/a
Vauxhall Sky Gardens, 143-161 Wandsworth Road	*Basement	✓	✗	n/a
Vauxhall Square Cap Gemini Site (plot bounded by Parry Street, Bondway, Miles Street and Wandsworth Road)	*Basement	✗	✓	n/a

** Relevant to the upper aquifer*
*** Relevant to the lower aquifer*
Symbols ✓ applies ✗ does not apply

13.3.9 Section 13.5 details the likely significant effects arising from the construction at the Heathwall Pumping Station site. No dewatering of the lower aquifer would be required at the Heathwall Pumping Station site but impacts on the Chalk and licensed abstractions been addressed within project-wide assessment (see Vol 3 Section 13 Water resources – groundwater).

Operation

13.3.10 The assessment methodology for the operational phase follows that described in Vol 2. There are no site-specific variations for undertaking the operational assessment of this site.

13.3.11 The assessment year applied to the operational assessment is Year 1 of operation. The baseline is not anticipated to vary significantly by the start of the operational phase in 2023 and therefore baseline data from 2011 have formed the basis for the operation assessment. In addition, information on proposed development schemes likely to have been complete before commencement of the operation of the Thames Tideway Tunnel has formed part of the operational base case.

13.3.12 The developments considered as part of the operational base case and cumulative effects assessment are included in Vol 15 Table 13.3.2. The developments relevant to groundwater include basements, and SuDS.

Vol 15 Table 13.3.2 Groundwater – operational base case and cumulative assessment developments (2023)

Development	Component or receptor relevant to groundwater	Operational base case	Cumulative effect assessment	Comments (if required)
1-9 Bondway and 4-6 South Lambeth Place	*Basement	✓	✘	n/a
30 - 60 South Lambeth Road	*Basement	✓	✘	n/a
Battersea Power Station	*Basement *SuDS	Phase 1, 2, 3, 4 and 6 complete	Phase 5 and 7 under construction	Abstraction **28/39/42/0074 not considered as in lower aquifer
Embassy Gardens, Land to the south of Nine Elms Lane comprising DHL Depot and 1-12 Ponton Road and 51 Nine Elms Lane	*Basement	✓	✘	n/a
Island Site Vauxhall Gyratory	*Basement	✓	✘	n/a
St Georges Wharf (Vauxhall Tower)	*Basement	✓	✘	**GSHP not considered as in lower aquifer
Marco Polo House, 346 Queenstown Road	*Basement	✓	✘	n/a
Market Towers	*Basement	✓	✘	n/a
New Covent Garden Market	*Basement	Buildings B1, B2, B3, B4, B5, B6 & Site	Buildings T1, T2 and T3 under construction	n/a

Development	Component or receptor relevant to groundwater	Operational base case	Cumulative effect assessment	Comments (if required)
		Entrance complete		
Nine Elms Sainsbury's, Wandsworth Road	*Basement	✓	✘	n/a
Northern Line Extension	*Underground Structures	✓	✘	n/a
Nine Elms Parkside	*Basement	Plots A, B, C & D complete	Plots E, F & G under construction	n/a
Riverlight, Tideway Industrial Estate	*Basement	✓	✘	**GSHP not considered as in lower aquifer
US Embassy - Land on south side of Nine Elms Lane incorporating Ponton Road	*Basement	✓	✘	n/a
Vauxhall Sky Gardens, 143-161 Wandsworth Road	*Basement	✓	✘	n/a
Vauxhall Square Cap Gemini Site (plot bounded by Parry Street, Bondway, Miles Street and Wandsworth Road)	*Basement	✓	✘	n/a

** Relevant to the upper aquifer*
*** Relevant to the lower aquifer*
Symbols ✓ applies ✘ does not apply

13.3.13 Section 13.6 details the likely significant effects arising from the operation at the Heathwall Pumping Station site. There are no other Thames Tideway Tunnel project sites which could give rise to additional effects on groundwater resources within the assessment area for this site during the operational phase and so no other Thames Tideway Tunnel project sites are considered in this assessment.

Assumptions and limitations

Assumptions

13.3.14 The construction assumptions relevant to this site are presented in section 13.2.

13.3.15 The amount of pumping required from outside of the jacked caisson the Heathwall Pumping Station site has been estimated at less than 200m^3/d.

13.3.16 The assessment of obstruction effects in Sections 13.5 and 13.6 is based on an estimated hydraulic gradient[vi] of 0.004 in the upper aquifer across the site.

13.3.17 This assessment has assumed that a lining in the shaft would be in place with a pertinent criterion to limit the rate of seepage of 1l/m^2/d (Vol 2 Appendix K.2).

13.3.18 It has been assumed that the separation distance of approximately 5.2m between the base of the CSO drop shaft and the lower aquifer is sufficient in addition to project-wide dewatering of the lower aquifer at Kirtling Street main tunnel site assisting with the depressurisation of the Lambeth Group by under-draining the Chalk means that dewatering of the lower aquifer would not be required at this site.

13.3.19 The measurements of the depth of shafts are quoted to two decimal places, however these measurements may be altered slightly in the future and are therefore indicative only.

13.3.20 For the purposes of this assessment, deep refers to greater than 10m below ground level (bgl) and shallow refers to less than 10m bgl.

Limitations

13.3.21 No site-specific pumping tests have yet been undertaken as part of the ground investigation. In the absence of site-specific hydrogeological data, published sources of hydrogeological information have been used in this assessment (see Vol 15 Appendix K.2).

13.3.22 Groundwater level data available for this assessment is limited, with monitoring typically available from one borehole (or monitoring horizon) within the upper and lower aquifers. This means that hydraulic gradients could only be estimated across the site. In addition, the range of hydrological conditions experienced during the monitoring period (2010-2012) did not included a prolonged wet winter period when exceptionally high groundwater levels might occur.

13.3.23 Groundwater quality data available locally at this site is also limited.

13.3.24 Despite the limitations identified above, the assessment which uses the best available information is considered robust.

13.4 Baseline conditions

13.4.1 The following section sets out the baseline conditions for groundwater within and around the site. Future baseline conditions (base case) are also described.

13.4.2 This section of the assessment is supported by Vol 15 Appendix K.

[vi] Hydraulic gradient – the slope of the water table which drives groundwater movement.

Current baseline

Hydrogeology

13.4.3 The CSO drop shaft would pass through Made Ground, Alluvium, River Terrace Deposits, London Clay Formation, Harwich Formation and the Lambeth Group (into the Laminated Beds). The base slab would be founded in the Lower Mottled Beds of the Lambeth Group.

13.4.4 The River Terrace Deposits form the upper aquifer and are classified by the EA as a secondary A aquifer[vii]. The Upnor Formation, Thanet Sands and Chalk form the lower aquifer and are classified by the EA as a principal aquifer[viii]. The presence of the London Clay Formation is expected to act as a confining layer between these two aquifers at the Heathwall Pumping Station site. The Harwich Formation is expected to be water-bearing and to contain groundwater under pressure. In addition, the Lambeth Group is expected to contain confined groundwater within several layers, such as in the sand unit, the Laminated Beds and the Upper Mottle Beds.

13.4.5 The depths and thicknesses of the geological layers have been determined by reference to ground investigation boreholes drilled on site: these are boreholes PR1085 and SR1086. Additional ground investigation boreholes, namely PR1081 and SR1083 and overwater boreholes SA2063 and SA2064 have been used to gauge the lateral continuity of strata across the general area. The depths and thicknesses of geological layers encountered are summarised in Vol 15 Table 13.4.1.

Vol 15 Table 13.4.1 Groundwater – anticipated ground conditions/hydrogeology

Formation	Top elevation* (mATD)	Depth (m)	Thickness (m)	Hydrogeology
Made Ground	104.00	0.00	4.90	Confining layer
Alluvium/ River Terrace Deposits	99.10	4.90	5.60	Upper aquifer
London Clay	93.90	10.50	28.70	Aquiclude[ix]
Harwich Formation	65.20	39.20	0.70	Aquitard[x]/ aquifer

[vii] Secondary aquifer – either permeable strata capable of supporting local supplies or low permeability strata with localised features such as fissures (was previously referred to as a minor aquifer)

[viii] Principal aquifer – a geological stratum that exhibits high inter-granular and /or fracture permeability (was previously referred to as a major aquifer)

[ix] Aquiclude – a hydrogeological unit which, although porous and capable of storing water, does not transmit it at rates sufficient to furnish an appreciable supply for a well or spring.

[x] 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.

Formation	Top elevation* (mATD)	Depth (m)	Thickness (m)	Hydrogeology
Lambeth Group				Aquitard/aquifers
USB	64.50	39.90	1.60	
UMB	62.90	41.50	3.40	
LtB	58.50	44.90	2.40	
LSB	56.10	47.30	0.10	
LMB	56.00	47.40	6.00	Lower aquifer
UPN (Gv)	50.00	53.40	1.20	
UPN	45.80	54.60	1.10	

** Based on an assumed ground level of 104.4m*
USB–Upper Shelly Beds; UMB–Upper Mottled Beds; LtB–Laminated Beds; LSB-Lower Shelly Beds; LMB-Lower Mottled Beds; UPN (Gv)-Upnor Formation (Gravel); UPN-Upnor Formation

Groundwater level monitoring

13.4.6 Groundwater level monitoring has been undertaken at a number of boreholes across the assessment area (1km radius of the site). In addition, the EA has a regional network of monitoring boreholes, mainly within the lower aquifer, across London with records available dating back over 50 years.

13.4.7 Information on groundwater levels for this assessment was collected from one ground investigation borehole located at 160m from the Heathwall Pumping Station site (SA1084). This borehole has a response zone[xi] and monitors groundwater levels in the River Terrace Deposits. The location is shown in Vol 15 Figure 13.4.1 (see separate volume of figures).

13.4.8 The recorded water levels in the River Terrace Deposits at SR1084 suggest that the upper aquifer is fully saturated and confined[xii] beneath the overlying Made Ground and Alluvium at this site.

13.4.9 From the one monitoring borehole within the River Terrace Deposits, it is not possible to determine the direction of groundwater flow in these deposits. However it is likely that the direction of groundwater movement can be inferred from the topography to be towards the river to the northwest in these shallow deposits.

13.4.10 Further detail on water level monitoring is provided in Vol 15 Appendix K.3. The average, minimum and maximum recorded water levels are detailed in Vol 15 Table 13.4.2

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

[xii] Confined – a term used to describe an aquifer in which water is held under pressure, such that groundwater in a borehole penetrating a confined aquifer would rise to a level above the top of the aquifer.

Vol 15 Table 13.4.2 Groundwater – water level summary

Borehole ID	Formation	Maximum (mATD)	Minimum (mATD)	Average over the period of record (mATD)
SA1084	River Terrace Deposits	100.55	100.20	100.35

Licensed abstractions

13.4.11 There is no licensed groundwater abstraction from the River Terrace Deposits or upper aquifer within 1km of the Heathwall Pumping Station site.

13.4.12 There are several licensed groundwater abstractions from the Chalk located at between 20m and 700m to the east, west, north and northeast of the Heathwall Pumping Station site. The licensed abstractions from the lower aquifer (Chalk) would be unaffected by the proposed works for Heathwall Pumping station site due to construction taking place entirely within the upper aquifer, the London Clay Formation and the Lambeth Group.

13.4.13 There are no known unlicensed groundwater abstractions from either the upper or lower aquifers within 1km of the Heathwall Pumping Station site.

Groundwater source protection zone

13.4.14 The EA defines Source Protection Zone[xiii] (SPZ) around all major public water supply abstraction sources and large licensed private abstractions in order to safeguard groundwater resources from potentially polluting activities. The Heathwall Pumping Station site is located within the modelled SPZ 1 (50 day time of travel to the source) for the Thames Water Utilities source located approximately 0.3km away to the southwest (see Vol 15 Figure 13.4.2). There is a second modelled SPZ 1, the edge of which lies at 100m to the north-northeast of the Heathwall Pumping Station site; which is designated for the Mantilla Limited source located at 0.3km to the north-northeast of the Heathwall Pumping Station site. These sources both abstract from the lower aquifer (Chalk) and would be unaffected due to construction taking place at Heathwall Pumping Station entirely within the upper aquifer, the London Clay Formation and the Lambeth Group.

Environmental designations

13.4.15 There are no designations relevant to groundwater within 1km of the site.

Groundwater quality and land quality

13.4.16 Historical land use mapping conducted as part of the land quality assessment reviewed as part of the land quality assessment identified

[xiii] Source Protection Zone – which are designed to safeguard groundwater resources from potentially polluting activities.

various potentially contaminative land uses in the local area (see Vol 15 Appendix K.7).

13.4.17 The groundwater quality data presented in Vol 15 Appendix K.7, Vol 15 Table K.8 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 off site and up to 970m away (PR1085, SR1086, SA1084, SA1082, PR1081, SR1083 and PR1088) (for locations see Vol 15 Figure 13.4.1 in separate volume of figures) and within the River Terrace Deposits and Chalk. The data has been compared with the UK drinking water standards (The Water Supply Regulation, 2000)[3] or relevant Environmental Quality Standards (EQS) (River Basin Districts Typology, Standards and Groundwater Threshold Values Direction, 2010)[4].

13.4.18 The data shows exceedances with respect to arsenic, ammonia, chloride, cypermethrin, sodium and turbidity in the River Terrace Deposits within close proximity to the site (at less than 200m). The data also shows exceedances with respect to ammonia, chloride, heavy metals, polycyclic aromatic hydrocarbons (PAHs) and turbidity in the Chalk within 40m of the site. PAHs may be formed during a range of human activities, including incomplete combustion of carbon-based fuels and other industrial processes (EA, 2010)[5]. In addition, PAHs are considered to be Priority Hazardous Substances under the Water Framework Directive (Commission of the European Communities, 2009) [6].

13.4.19 The land quality data from the ground investigation boreholes used in the groundwater quality assessment show no exceedances of the human health screening values (EA, 2009)[7] (soil guideline values designed to be protective of human health) within the River Terrace Deposits but exceedances do occur with respect to heavy metals and hydrocarbons in the overlying Made Ground and Alluvium. Further detail is provided in the land quality assessment (see Vol 15 Appendix F).

Groundwater flood risk

13.4.20 There are no reported incidents of groundwater flooding in the vicinity of the site, based on information from the London Borough (LB) of Wandsworth Strategic Flood Risk Assessment (SFRA) (Scott Wilson Ltd, 2009)[8].

Groundwater receptors

13.4.21 Groundwater receptors which could be affected during construction or operation are summarised in Vol 15 Table 13.4.3 below. It can be seen that the only receptor of relevance to the Heathwall Pumping Station site and which has therefore been assessed, is the upper aquifer.

Vol 15 Table 13.4.3 Groundwater – receptors

Receptor	Construction	Operation	Comment	Licence No.
Groundwater body – upper aquifer	✓	✓	Penetrated by CSO drop shaft and interception	-

Receptor	Construction	Operation	Comment	Licence No.
			structures and culverts	
Groundwater body – lower aquifer	✗	✗	CSO drop shaft and base slab into the lower part of Lambeth Group	-
Licensed abstractions – upper aquifer	✗	✗	One abstraction, not impacted as no dewatering of upper aquifer	28/39/39/0225
Licensed abstractions – lower aquifer	✗	✗	Six Chalk abstractions, not impacted as no dewatering of lower aquifer	N/A
Unlicensed abstractions	✗	✗	No known abstractions	-
Planned developments and abstractions	✗	✗	Two planned Chalk Ground Source Heat Pump (GSHPs) not impacted as no Chalk dewatering on site	-

**Symbols ✓ applies ✗ does not apply*

Receptor sensitivity

13.4.22 The upper aquifer is classified by the EA as a secondary A aquifer and is allocated a medium value in terms of both quantity and quality in this assessment.

Construction base case

13.4.23 The construction base case in Site Year 1 is as per the current baseline and also includes any developments that are likely to be complete and partially or fully operational during construction at the Heathwall Pumping Station site, and which would have the potential to lead to a change in the setting in respect to groundwater in the upper aquifer.

13.4.24 The basements associated with other developments identified in Vol 15 Table 13.3.1 could cause some disruption to groundwater flow in the upper aquifer. Any substantive changes from the baseline conditions prior to construction would be detected by monitoring of groundwater levels in the upper aquifer.

Operational base case

13.4.25 The operational base case is as per the construction base case. There would be no change to the base case in Year 1 of operation in the case of the upper aquifer.

13.5 Construction effects assessment

Construction impacts

Groundwater quality

13.5.1 The baseline groundwater quality data from nearby ground investigation boreholes shows exceedances of arsenic in the River Terrace Deposits. Other exceedances of ammonia, chloride, cypermethrin, sodium and turbidity in the River Terrace were recorded at 1km from the site. The CSO drop shaft construction involving jacked caissons and the secant piling around the interception chamber/culvert excavations would contain an effective seal with the surrounding ground, thereby ensuring no potential for mobilisation of contamination at this site.

13.5.2 The magnitude of this impact on the upper aquifer has been assessed to be negligible.

Physical obstruction

13.5.3 The CSO drop shaft construction activities, the secant pile walls around the interception chambers and culverts and connection culverts may disrupt groundwater flows and as a result alter groundwater levels within the upper aquifer.

13.5.4 The method for assessing the impact of all below ground activities upon the groundwater levels in the upper aquifer is described in Vol 2 Appendix K.1. It has been estimated that groundwater level would rise during the construction phase at the Heathwall Pumping Station site by approximately 0.2m, based on estimated hydraulic gradient of 0.004.

13.5.5 Groundwater levels in the upper aquifer can reach 100.6mATD and this is approximately 4m below the existing ground surface at Heathwall Pumping Station site of 104.4mATD (see Vol 15 Table 13.4.1). There is a confining layer overlying the upper aquifer, therefore the small predicted rise in water levels (0.2m) on the upstream side of the CSO drop shaft would represent a rise in piezometric head only. The impact on the upper aquifer from a change in groundwater levels as a result of physical obstruction would be negligible.

Construction effects

13.5.6 By combining the impacts with the receptor value as shown in para. 13.4.23, the significance of the effects can be derived using the generic significance matrix (Vol 2 Section 2). The results are described in the following sections.

Groundwater quality

13.5.7 A negligible impact from the mobilisation of contamination on the upper aquifer, a medium value receptor for groundwater quality, would result in a **negligible** effect.

13.5.8 The potential for mobilisation of contamination at Heathwall Pumping Station site by project-wide dewatering is discussed in Vol 3 Section 13.

Physical obstruction

13.5.9 A negligible impact on a medium value receptor for groundwater quantity would result in a **negligible** effect.

13.6 Operational effects assessment

Operational impacts

Physical obstruction

13.6.1 The presence of the operational CSO drop shaft, interception chambers and culverts / connection tunnels in the upper aquifer may disrupt local groundwater flow and alter groundwater levels.

13.6.2 The method for assessing the impact of these elements upon the groundwater levels in the upper aquifer is described in Vol 2 Appendix K.1. It is estimated that the groundwater level rise during the operational phase at Heathwall Pumping Station site would be less than 0.1m.

13.6.3 The predicted rise in water levels (less than 0.1m) would result in increased hydraulic pressure within the confined unit rather than an increase of the water table. The magnitude of impact on the upper aquifer would be negligible.

Seepage from the drop shafts

13.6.4 An estimate of the theoretical seepage volumes from the CSO drop shafts at Heathwall Pumping Station site is included in Vol 2 Appendix K.1. The shaft would be full for only approximately 3% of the year or 11 days per year (see Vol 3 Section 13). The estimated volume of seepage from the CSO drop shaft into the upper aquifer is 1.8m^3/annum (Vol 2 Appendix K, Vol 2 Table K.5). In addition, higher heads outside the drop shaft means that any risk of seepage from the drop shaft into the upper aquifer would be further reduced. The magnitude of impact on the upper aquifer would be negligible.

Seepage into the CSO drop shafts

13.6.5 An estimate of the theoretical seepage volumes into the CSO drop shafts at Heathwall Pumping Station site is included in Vol 2 Appendix K.2. The estimated loss of water resources from the upper aquifer is 61m^3/annum (Vol 2 Appendix K, Vol 2 Table K.4). The magnitude of impact on the upper aquifer would be negligible.

13.6.6 No other operational impacts are envisaged.

Operational effects

13.6.7 By combining the receptor value (para. 13.4.23) with the impacts identified above, the significance of the effects can be derived using the generic significance matrix (Vol 2 Section 2). The results are described in the following sections.

Physical obstruction

13.6.8 A negligible impact on groundwater levels in the upper aquifer has been identified as a result of the presence of the caissons and secant pile walls and the CSO drop shafts construction activities. A negligible impact on the upper aquifer, a medium value receptor for groundwater quantity, would lead to a **negligible** effect.

Seepage from the CSO drop shafts

13.6.9 The CSO drop shaft would be constructed with a secondary lining and would only be full on a few occasions a year. A negligible impact on the upper aquifer, a medium value receptor for groundwater quality, would lead to **negligible** effect.

Seepage into the CSO drop shafts

13.6.10 The seepage into the CSO drop shaft has been determined as a negligible impact on the upper aquifer, which being a medium value receptor for groundwater quantity, would lead to a **negligible** effect.

13.7 Cumulative effects assessment

Construction effects

13.7.1 Ten developments identified in Vol 15 Table 13.3.1 which could potentially give rise to cumulative effects to groundwater in the upper aquifer through the inclusion of basements and SuDS schemes. It is considered that although there may be local impacts on groundwater levels in the upper aquifer due to the vicinity of the developments, these impacts are not expected to be significant. This is because a majority of the developments are located a long distance away from the CSO site and are down hydraulic gradient, within the upper aquifer. The upper aquifer is also confined at this site by an overlying layer of Alluvium and Made Ground, which means that any build up in water would manifest as an increased pressure rather than a physical rise in water levels. Any substantive changes would be detected by monitoring of groundwater levels in the upper aquifer.

Operational effects

13.7.2 Three developments are identified in Vol 15 Table 13.3.2 to be under construction during the operational phase which could potentially give rise to cumulative effects in the upper aquifer through the inclusion of basements and SuDS schemes. It is considered that although there may be some change in groundwater levels in the upper aquifer due to these developments, the impacts are not expected to be significant. This is because a majority of the developments are located a long distance away from the CSO site and are down hydraulic gradient, within the upper aquifer. The upper aquifer is also confined at this site by an overlying layer of Alluvium and Made Ground, which means that any build up in water would manifest as an increased pressure rather than a physical rise in water levels. Any substantive changes would be detected by monitoring of groundwater levels in the upper aquifer.

13.8 Mitigation

13.8.1 There are few impacts from the construction phase and those which have been identified would have negligible effects and therefore no mitigation is required.

13.8.2 For the operational phase, no significant effects are identified and therefore no mitigation is required.

13.8.3 Mitigation of the potential mobilisation of the existing contamination in the lower aquifer at Heathwall Pumping Station site is discussed in Vol 3 Section 13.

13.9 Residual effects assessment

Construction effects

13.9.1 As no mitigation measures are required, the residual construction effects remain as described in Section 13.5. All residual effects are presented in Section 13.10.

Operational effects

13.9.2 As no mitigation measures are required, the residual operational effects remain as described in Section 13.6. All residual effects are presented in Section 13.10.

13.10 Assessment summary

Vol 15 Table 13.10.1 Groundwater – construction assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Upper aquifer (groundwater quality)	Deterioration in groundwater quality caused by creation of a pathway	Negligible	None	Negligible
Upper aquifer	Change in groundwater storage as a result of physical obstruction	Negligible	None	Negligible

Vol 15 Table 13.10.2 Groundwater – operational assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Upper aquifer	Change in groundwater levels as a result of physical obstruction	Negligible	None	Negligible
Upper aquifer	Deterioration in water quality in the upper aquifer from seepage out of drop shafts	Negligible	None	Negligible
Upper aquifer	Seepage into drop shafts affecting groundwater resources	Negligible	None	Negligible

References

[1] Defra. *National Policy Statement for Waste Water* (2012)

[2] Environment Agency. *Introducing pollution prevention: PPG 1 – EA Consultation* (2011).

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

[4] *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/.

[5] 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.

[6] 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.*

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

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

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 14: Water resources - surface water

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 14: Water resources – surface water

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14 Water resources – surface water

14.1 Introduction

14.1.1 This section presents the findings of the assessment of the likely significant effects of the proposed development on surface water at the Heathwall Pumping Station site. The assessment of surface water presented in this section has considered the requirements of the *National Policy Statement for Waste Water*, 2012 (NPS)[1]. The physical characteristics of the surface water environment including surface water resources and quality are presented and the anticipated effects (including cumulative effects) on these resources addressed in the assessment that follows. Further details on how the NPS requirements relevant to surface water resources have been met can be found in Vol 2 Section 14.3.

14.1.2 The proposed development has the potential to affect surface water resources (ie, surface waterbodies including the tidal reaches of the River Thames [tidal Thames]) due to:

a. construction activities

b. operation of the main tunnel.

14.1.3 The assessment of construction and operational effects on surface water includes the following:

a. identification of existing surface water resources baseline conditions

b. determining base case conditions against which the proposed development has been assessed

c. assessment of significant effects of the proposed development during construction and operation

d. identification of mitigation measures and the residual effects both during construction and operation.

14.1.4 The assessment of surface water effects partially overlaps with that for groundwater, land quality, aquatic ecology and flood risk. Effects on groundwater resources are assessed separately in Section 13 of this volume. Land quality is addressed in Section 8 of this volume. Effects on aquatic ecology are assessed in Section 5 of this volume. A Flood Risk Assessment (FRA), which assesses the effects of the proposed development on surface water run-off and considers the use of Sustainable Drainage Systems (SuDS), has been carried out separately and is included in Section 15 of this volume.

14.1.5 This assessment covers the effects of the proposed development at the Heathwall Pumping Station site and in particular in relation to the interception of the South West Storm Relief and Heathwall Pumping Station combined sewer overflows (CSOs). It is however important to recognise that whilst the reduction in spills from the South West Storm Relief CSO and the Heathwall Pumping Station CSO would be important to water quality in the immediate area of the CSO outfalls, the overall water quality benefits in any part of the tidal Thames would accrue as a result of the project as a whole, rather than a single part of it. The catchment-wide effects on the tidal Thames, particularly in relation to the water quality improvements anticipated from the proposed Thames Tideway Tunnel project are assessed separately in Volume 3 Project-wide effects assessment Section 14.

14.1.6 Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station Figures).

14.2 Proposed development relevant to surface water

14.2.1 The proposed development is described in Section 3 of this volume. The elements of the proposed development relevant to surface water are set out below.

Construction

14.2.2 The Heathwall Pumping Station site is partly located within the River Thames channel, which means that some of the proposed working area would be within the river bed (as shown on the Construction plans, see separate volume of figures – Section 1).

14.2.3 Barges would be used to import the majority of the cofferdam fill, although it is assumed that other imported materials would be brought in by road. Barges would also be used to export the majority of the cofferdam fill and excavations from the CSO drop shaft. In order to facilitate the use of barges, campsheds would be constructed adjacent to the working area.

14.2.4 A CSO drop shaft would be constructed at the site. Based on the geology at the site, the construction of the base of the CSO drop shaft and associated infrastructure would require depressurisation (a type of dewatering used to lower hydraulic pressure) of the Lambeth Group. Disposal of dewatering effluent can have an impact on surface water. See Section 13 of this volume for further details on the dewatering requirements.

14.2.5 The Battersea Barge is currently moored within the proposed working area to the west of Heathwall Pumping Station. The Battersea Barge would be temporarily relocated west to new moorings and would be returned to its current location once construction works are complete.

14.2.6 The construction of in-river structures, and in particular the temporary cofferdam, would affect the river regime with the potential that localised increases in flow velocity cause scour of the river bed and foreshore, or deposition of sediments. The scour could occur around the face of the cofferdam (abutment scour) or across the channel width (contraction scour). Any potential scour development during construction would be monitored and if relevant trigger levels are reached, appropriate protection measures would be provided. Further details are provided in the *Scour and Accretion Monitoring and Mitigation Plan for Temporary Works in the Foreshore* (Vol 3 Appendix L.4).

Code of Construction Practice

14.2.7 There is a direct pathway for pollutants to be discharged to the tidal Thames due to the location of part of the construction area within the river channel. The *Code of Construction Practice (CoCP)*[i] Part A (Section 8) includes a number of measures to minimise the potential for impacts to surface waters, including impacts such as discharge of pollutants via surface water drains, and these are summarised below.

14.2.8 Appropriate drainage, sediment and pollution control measures are included in the *CoCP* Part A (Section 8). These are in accordance with the relevant Pollution Prevention Guidelines (PPGs) issued by the Environment Agency (EA) and other Construction Industry Research and Information Association (CIRIA) documents.

14.2.9 All site drainage would be drained and discharged to mains foul or combined sewers. Where this is not practicable, the site would be drained such that accumulating surface water would be directed to holding or settling tanks, separators and other measures prior to discharge to surface water drains. Foul drainage from the site welfare facilities would be connected to the mains foul or combined sewer.

14.2.10 Suitable spill kits would be provided and positioned in vulnerable areas, staff would be trained in their use and a record would be kept of all pollution incidents or near-misses, to ensure appropriate action is taken and lessons are learned from any incidents. Regular ‘toolbox talks’ would be held to raise staff awareness of pollution prevention and share lessons learned from any recorded incidents. There would be written procedures in place for dealing with spillages and pollution (*the Pollution Incident Control Plan* or *PICP*).

14.2.11 There are no site specific measures incorporated in the *CoCP* Part B (Section 8) relevant to the surface water assessment.

Operation

14.2.12 The operation of the main tunnel would enable the interception of combined sewage generated during storms which would otherwise discharge to the tidal Thames at the Heathwall Pumping Station site from the Heathwall Pumping Station and South West Storm Relief CSOs. There would therefore be a reduction in the frequency, duration and volume of spills from these CSOs.

14.2.13 The construction of the new permanent structure in the river would affect the river regime with the potential that localised increases in flow velocity cause scour of the river bed and foreshore, or deposition of sediments. The effect of the permanent works on existing third party structures (ie, bridges and flood defences) would be monitored and if relevant trigger levels are reached, appropriate protection measures would be agreed with the owner of the structure. Further details are provided in the *Engineering Design Statement*.

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[i] The Code of Construction Practice (CoCP) is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

14.3 Assessment methodology

14.3.1 The methodology used for the assessment of effects on surface water and their significance differs from the standard Website Transport Analysis Guidance (WebTAG) (DFT, 2003)[2] environmental impact assessment (EIA) methodology for water resources, in that the requirements of the Water Framework Directive (WFD) have also been taken into account. In the absence of an EIA specific assessment methodology for WFD compliance, an assessment methodology has been derived specifically for the Thames Tideway Tunnel project to assess significance of effects. The methodology also takes into consideration the requirements of the Urban Waste Water Treatment Directive (UWWTD)[3] and is outlined in Volume 2 Environmental assessment methodology Section 14. A WFD assessment for the project as a whole is presented in Vol 3 Section 14.

Engagement

14.3.2 Vol 2 documents the overall engagement which has been undertaken in preparing the *Environmental Statement*. Vol 2 Section 14 summarises the engagement that has been undertaken for the surface water assessment and the consultation responses relevant to surface water.

14.3.3 There are no site-specific engagement comments relevant to the surface water assessment at the Heathwall Pumping Station site.

Baseline

14.3.4 The baseline methodology follows the methodology described in Vol 2 Section 14. There are no site-specific variations for identifying baseline conditions for this site.

Construction

14.3.5 The assessment methodology for the construction phase follows that described in Vol 2 Section 14. There are no site-specific variations for undertaking the construction assessment of this site.

14.3.6 The assessment year for construction impacts is Site Year 1 when construction would commence. No modelled water quality data are available for this year. The water quality conditions for the base case have therefore been derived from available modelled simulation data which uses population projections for 2021. This assumption is considered reasonable as substantial changes in water quality are considered unlikely between 2017 and 2021.

14.3.7 The Lee Tunnel and the sewage works upgrades proposed at Mogden, Beckton, Crossness, Long Reach and Riverside sewage treatment works (STWs) would be operational by the time construction of the Thames Tideway Tunnel project commences, as described in Vol 2 Section 14. Significant improvements in the water quality in the tidal Thames are anticipated as a result of these projects. Both the construction base case and the operational base case would be the water quality in the tidal Thames with the Lee Tunnel and sewage works upgrades in place.

14.3.8 The construction base case has considered the developments that are scheduled to be complete and in operation by Site Year 1 (presented in Vol 15 Appendix N). The developments in Vol 15 Appendix N would not result in additional surface water receptors (ie, waterbodies) and are considered unlikely to result in changes in water quality as the developments are remote from the tidal Thames. The base case would therefore not change from that outlined above.

14.3.9 The developments that would be under construction during Site Year 1 (presented in Vol 15 Appendix N) have been considered in the cumulative effects assessment (Section 14.7).

14.3.10 The assessment area for the assessment of effects of construction activities at the Heathwall Pumping Station site would be limited to two sections of the river, namely the Thames Upper and Middle waterbodies listed below in Vol 15 Table 14.4.1 .

14.3.11 Section 14.5 details the likely significant effects arising from the construction at the Heathwall Pumping Station site. The Kirtling Street site is located west of the Heathwall Pumping Station site. It is considered unlikely that the construction of the Kirtling Street site would give rise to additional effects on surface water within the assessment area for this site therefore the Kirtling Street site is not considered in this assessment. The assessment of effects on surface water from the construction at the nearby Kirtling Street site is contained in Vol 14 Section 14.

Operation

14.3.12 The assessment methodology for the operation phase follows that described in Vol 2 Section 14. There are no site-specific variations for undertaking the operational assessment of this site.

14.3.13 The assessment year for operational effects is Year 1 of operation. As with the construction assessment, the operational assessment also relies on modelled water quality data which uses population projections for 2021. In addition, the influence of climate change on the proposed development has been assessed in 2080.

14.3.14 As noted above, the operational base case would be the water quality in the tidal Thames with the Lee Tunnel and sewage works upgrades in place. The operational base case has considered the developments that are scheduled to be complete and in operation by Year 1 of operation (presented in Vol 15 Appendix N). The developments in Vol 15 Appendix N would not result in additional surface water receptors and are considered unlikely to result in changes in water quality as the majority of these developments are remote from the tidal Thames. The base case would therefore not change from that outlined above.

14.3.15 The developments listed in Vol 15 Appendix N that would be under construction during Year 1 have been considered in the cumulative effects assessment (Section 14.7).

14.3.16 The operational assessment uses the same assessment area identified above for the construction assessment.

14.3.17 Section 14.6 details the likely significant effects arising from the operation at the Heathwall Pumping Station site.

Assumptions and limitations

14.3.18 The assumptions and limitations associated with this assessment are presented in Vol 2 Section 14. Based on the geology at the site, it is assumed that depressurisation of the Lambeth Group would be required. There are no other assumptions and limitations specific to the assessment of this site.

14.4 Baseline conditions

14.4.1 The following section sets out the baseline conditions for surface water within and around the site. Future baseline conditions (base case) are also described.

Current baseline

Water quality

14.4.2 A list of all surface water receptors and their WFD status given in the River Basin Management Plan (EA, 2009)[4] (RBMP), which are either adjacent to the site or downstream of the site and therefore have the potential to be affected by the proposed development, is included in Vol 15 Table 14.4.1 below.

14.4.3 The overall classification of status or potential under the WFD is a detailed process, which includes an assessment of water quality, physico-chemical, and hydromorphological elements. Reference should be made to the United Kingdom Technical Advisory Group (UKTAG)[5] guidance, as given in the RBMP (EA, 2009)[6].

Vol 15 Table 14.4.1 Surface water – receptors

Waterbody name/ID	Hydro-morpho-logical status	Current ecological quality	Current chemical quality	2015 Predicted ecological quality	2015 Predicted chemical quality	2027 target status
Thames Upper GB530603911403	Heavily modified	Moderate potential	Good	Moderate potential	Good	Good
Thames Middle GB530603911402	Heavily modified	Moderate potential	Fail	Moderate potential	Fail	Good

14.4.4 The River Thames and its Tidal Tributaries are designated as a Site of Importance for Nature Conservation (Grade III of Metropolitan importance). The Thames Upper (which stretches from Teddington to Battersea Bridge) and the Thames Middle (which stretches from Battersea Bridge to Mucking Flats) waterbodies are considered to be high value waterbodies as although the current and predicted status in 2015 (target date from RBMP (EA, 2009)[7]) is moderate potential, a status objective of good by 2027 has been set for both. In addition, the tidal Thames is a valuable water resource, habitat, and source of amenity, recreation, and transport route throughout London.

14.4.5 Sediment levels within the tidal Thames are estimated to currently reach a peak of 4,000kg/s in the lower tidal Thames estuary, or more than 40,000t of sediment a day during spring tides (HR Wallingford, 2006)[8].

14.4.6 There are no licensed surface water abstractions within 1km of the Heathwall Pumping Station site.

14.4.7 The Heathwall Pumping Station site is approximately 2km downstream of Cadogan Automatic Quality Monitoring Station (AQMS), as shown on Vol 15 Figure 14.4.1 (see separate volume of figures). 2011 summary data from this AQMS monitoring point, which give 90 percentile values for ammonium (concentration that is exceeded 10% of the time) and 10% percentile values for dissolved oxygen (concentration exceeded 90% of the time), is presented below in Vol 15 Table 14.4.2 .

Vol 15 Table 14.4.2 Surface water – Cadogan Pier AQMS 2011

Month	DO (mg/l) (10%)	Ammonium (mg/l) (90%)
January	11.06	4.15
February	9.18	0.57
March	8.44	0.84
April	5.89	1.54
May	6.15	1.84
June	3.7	1.68
July	3.17	1.90
August	3.04	3.06
September	4.34	4.04
October	5.60	6.24
November	5.22	4.80
December	8.09	4.41

14.4.8 The data presented above demonstrate that the dissolved oxygen (DO) levels in the tidal Thames decrease in the summer months, as there is an inverse relationship between temperature and oxygen saturation ie, warmer water holds less DO than colder water.

14.4.9 The discharges from the South West Storm Relief and Heathwall Pumping Station CSOs have the effect of depleting DO in the tidal Thames as a result of the biological breakdown of organic matter in the discharges. This causes both a localised effect at the Heathwall Pumping Station site and a more widespread effect along the tidal Thames of rapidly dropping dissolved oxygen levels. Vol 3 Section 14 details half-tide plots displaying the changes in DO levels along the tidal Thames.

14.4.10 A review of historical mapping has identified several contaminative activities on site, including a lime works and dock as well as the current combined sewage pumping station. A 250m search radius[ii] has shows the surrounding area to be predominantly industrial and commercial, with an extensive gas works located approximately 15m south of the site.

14.4.11 Foreshore sediment sampling carried out at the Heathwall Pumping Station site has shown contamination of the near surface sediments with levels of certain metals and polycyclic aromatic hydrocarbons (PAH), which were elevated against the Threshold Effect Level (TEL)[iii] and Probable Effect Level (PE) (Canadian Council for the Environment, undated)[9]. An assessment of potential on-site contamination is provided within Section 8 of this volume.

Current CSO operation

14.4.12 The current operation of the Southwest Storm Relief Sewer and Heathwall Pumping Station CSOs has been characterised using the catchment model of the sewer system (See Vol 3 Section 14 for further details of catchment modelling) and the annual average duration, frequency and volume of spill has been defined as follows:

14.4.13 For the Southwest Storm Relief Sewer CSO:

a. the CSO spills on average 13 times in the Typical Year[iv]

b. the CSO spills for a total duration of 39 hours in the Typical Year

c. the spill volume from the CSO is approximately 228,000m^3 in the Typical Year, representing 0.6% of the total volume discharged to the tidal Thames in the Typical Year from all CSOs.

14.4.14 For the Heathwall Pumping Station CSO:

a. the CSO spills on average 34 times in the Typical Year

b. the CSO spills for a total duration of 200 hours in the Typical Year

c. the spill volume from the CSO is approximately 655,900m^3 in the Typical Year, representing 1.65% of the total volume discharged to the tidal Thames in the Typical Year from all CSOs.

14.4.15 Using the model, the annual polluting loading of biochemical oxygen demand (BOD), ammonia and total Kjeldahl nitrogen (TKN) (the sum of organic nitrogen, ammonia [NH_3], and ammonium [NH_4^+]) of spills have been defined as follows:

14.4.16 For the Southwest Storm Relief Sewer CSO

a. the CSO discharges 5,510kg of BOD in the Typical Year

[ii] 250m buffer has been included within the assessment area in order to take account of any off-site sources / receptors, as discussed in the Vol 2 Section 8 Land quality methodology.

iii In order to assess potential risk to aquatic organisms, reference was made to PLA approved sediment quality guidelines, namely the Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. The guidelines provide contaminant concentration limits in the form of TEL and PEL.

[iv] Typical Year: single year which is most representative of an observed typical year of rainfall with the dataset. The 1979-1980 'water year' defined as the 12 month period ending on the 30th September 1980

b. the CSO discharges 165kg of ammonia in the Typical Year

c. the CSO discharges 900kg of TKN in the Typical Year.

14.4.17 For the Heathwall Pumping Station CSO

a. the CSO discharges 62,510kg of BOD in the Typical Year

b. the CSO discharges 1,940kg of ammonia in the Typical Year

c. the CSO discharges 9,100kg of TKN in the Typical Year

14.4.18 Each discharge increases the risk of exposure to pathogens for river users who come into contact with the water. An assessment of health impacts upon recreational users of the River Thames was conducted and reported by the Health Protection Agency in 2007 (Lane, C, Surman-Lee, S, Sellwood, J and Lee, JV, 2007)[10]. The study concluded that risk of infection can remain for two to four days following a spill as the water containing the sewage moves back and forward with the tide[v]. The same study also noted that analysis of the illness events reported against discharges on the tidal Thames shows that 77% of cases related to rowing activities undertaken within three days of a CSO spill.

14.4.19 Assuming the average 13 spills per annum from the Southwest Storm Relief Sewer and 34 spills from the Heathwall Pumping Station CSOs occur on separate days, there could be up to a maximum of 188 days per year where recreational users are at risk of exposure to pathogens in the vicinity of the outfalls as a result of the Southwest Storm Relief Sewer and Heathwall Pumping Station CSO spills alone (Lane, C, Surman-Lee, S, Sellwood, J and Lee, JV, 2007)[11].

14.4.20 The operation of Southwest Storm Relief Sewer and the Heathwall Pumping Station CSOs results in the discharge of sewage litter along with the discharge of effluent. It has been estimated by the *Thames Tideway Strategic Study* (TTSS) (Thames Water, 2005)[12] that overflows from all the CSOs along the tidal Thames introduce approximately 10,000t of sewage derived solid material to the tidal Thames annually. Catchment modelling of the current CSO operation has defined the average volume of discharge from the Southwest Storm Relief Sewer and the Heathwall Pumping Station CSOs and assuming litter tonnages are proportional to discharge volumes, this would indicate that approximately 225t of sewage derived litter is discharged from Southwest Storm Relief Sewer and the Heathwall Pumping Station CSOs combined in the Typical Year. An assessment of the amenity effects of the sewage litter is given in Vol 3 Section 10 Socio-economics.

Construction base case

14.4.21 As explained in Section 14.3, both the construction base case and the operational base case would be the water quality in the tidal Thames with

[v] The EA has provided advice on CSO excursion areas[v], which states that CSOs below Tower Bridge will only impact the Thames Middle waterbody and those upriver of Tower Bridge will impact both the Thames Upper and Thames Middle waterbodies.

the Lee Tunnel and sewage works upgrades in place, as set out in para. 14.4.26 to 14.4.32 below.

14.4.22 The base case in Site Year 1 of construction taking into account the schemes described in Section 14.5 would not change since no new sensitive receptors would be introduced.

Operational base case

14.4.23 As noted above, the operational base case would be the same as the construction base case and would take into account water quality improvement achieved by the Lee Tunnel and the sewage works upgrades.

14.4.24 The base case in Year 1 of operation taking into account the schemes described in Section 14.6 would not change since no new sensitive receptors would be introduced.

14.4.25 Catchment modelling of the base case has demonstrated that by Year 1 of operation (assessed using 2021 modelled assumptions), the frequency[vi], duration and volume of the Southwest Storm Relief Sewer and Heathwall Pumping Station CSOs would have increased (as a result of increased population) beyond the current baseline as follows:

14.4.26 For the Southwest Storm Relief Sewer CSO

a. the CSO would spill 13 times in the Typical Year (the same as the current baseline)

b. the CSO would spill for 40 hours in the Typical Year (one hour more than the current baseline)

c. the spill volume from the CSO would be approximately 239,000m^3 in the Typical Year (11,000m^3 more than the current baseline).

14.4.27 For the Heathwall Pumping Station CSO

a. the CSO would spill 39 times in the Typical Year (five more than the current baseline)

b. the CSO would spill for 248 hours in the Typical Year (48 hours more than the current baseline)

c. the spill volume from the CSO would be approximately 748,000m^3 in the Typical Year (92,100 more than the current baseline).

14.4.28 The same catchment modelling has demonstrated that by the operational assessment year, the annual polluting loading of BOD, ammonia and TKN would have increased (as a result of increased population) beyond the current baseline as follows:

14.4.29 For the Southwest Storm Relief Sewer CSO:

a. the CSO would discharge 6,800kg of BOD in the Typical Year (1,300kg more than the current baseline)

[vi] Heathwall Pumping Station CSO only

b. the CSO would discharge 220kg of ammonia in the Typical Year (55kg more than the current baseline)

c. the CSO would discharge 1,100kg of TKN in the Typical Year (200kg more than the current baseline).

14.4.30 For the Heathwall Pumping Station CSO:

a. the CSO would discharge 88,800kg of BOD in the Typical Year (26,290kg more than the current baseline)

b. the CSO would discharge 2,910kg of ammonia in the Typical Year (970kg more than the current baseline)

c. the CSO would discharge 13,100kg of TKN in the Typical Year (4,000kg less than the current baseline).

14.4.31 Following on from the interpretation of the current baseline, as per para. 14.4.19, the number of days in which river users would be exposed to pathogens during the operational base case year (taking into account 2021 modelled assumptions) would be a maximum of 208 days in the Typical Year as a result of spills from the Southwest Storm Relief Sewer and Heathwall Pumping Station CSOs alone.

14.4.32 Similarly, the tonnage of sewage derived litter discharged from the two CSOs combined can be expected to increase by approximately 12%, from approximately 225t to approximately 252t in the Typical Year.

14.5 Construction effects assessment

14.5.1 This section presents the construction impacts that could occur at the site and identifies where no further assessments of effects is required (eg, where the impact pathway has been removed). The second part of the section identifies any effects that may occur and the likely significance of these effects.

Construction impacts

Temporary land take and morphological changes

14.5.2 In order to accommodate the temporary works at the Heathwall Pumping Station site, construction of a temporary cofferdam within the river channel would be required as described in Section 3.3 of this volume. The channel would be more constricted than at present and together with the new profile of the structure, this would be likely to lead to changes in flows (velocities, directions) and lead to changes in scour and deposition of sediments.

Release of sediments from piling and scour

14.5.3 Minor amounts of sediment could be released during piling operations. The total volume of sediment released to the tidal Thames by the proposed pilling activity at all construction sites has been estimated to be

890t[vii]. The proportion of this estimate that would originate from the Heathwall Pumping Station site is approximately 40t.

14.5.4 It is also possible that the temporary cofferdam would affect the river regime with the potential that localised increases in flow velocity cause scour of the river bed and foreshore and could result in the mobilisation of suspended solids (see Section 14.2). Any potential scour development during construction would be monitored and protection measures provided if set trigger levels are reached (see Vol 3 Appendix L.4).

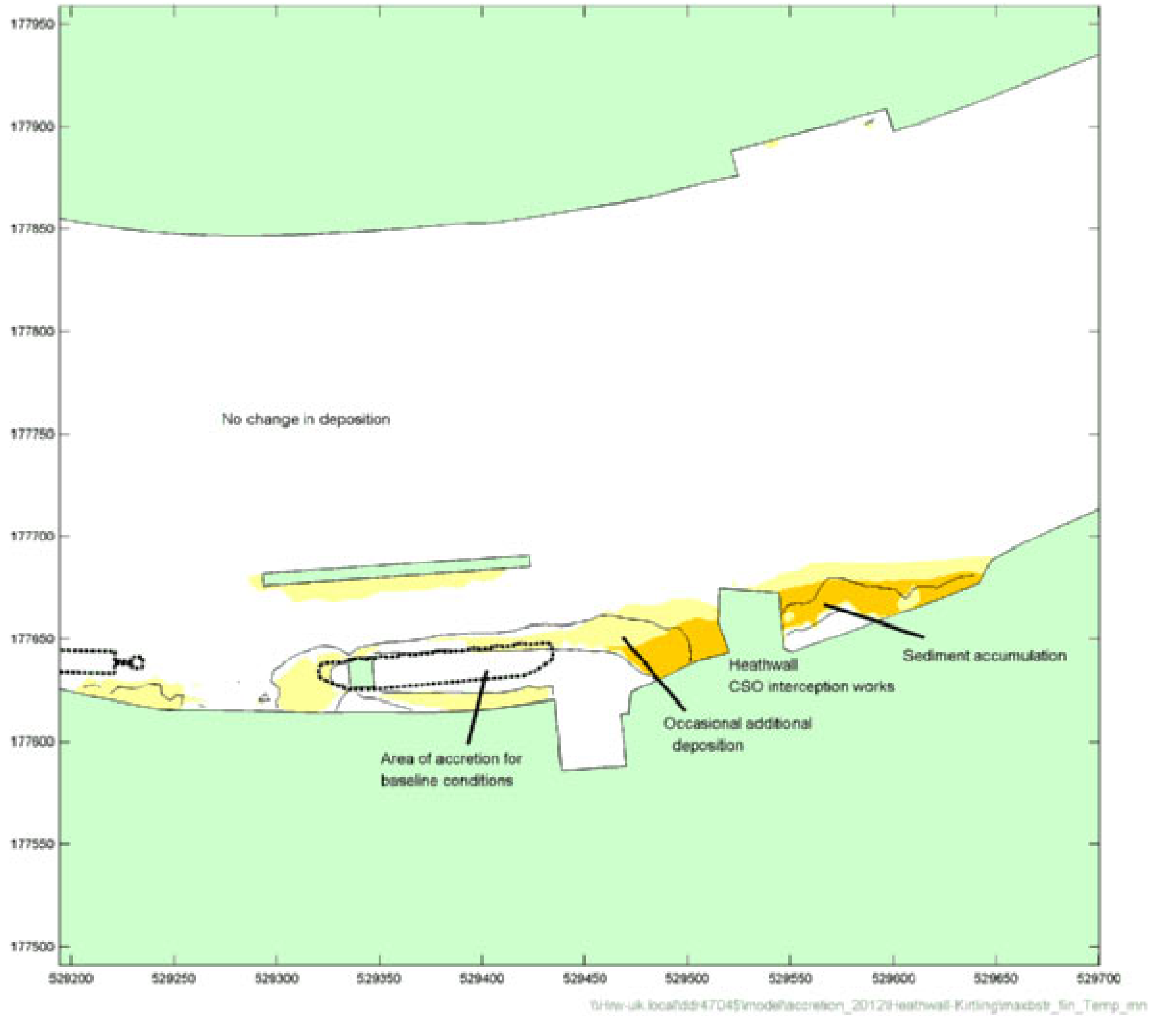
14.5.5 The Thames is a high sediment environment and levels already present within the tidal Thames are estimated to reach a peak of 4,000kg/s in the lower Thames estuary or more than 40,000t of sediment passing the site four times a day during spring tides. In this context, the volumes produced by the construction works from piling, dredging or scour would not be detectable against natural fluctuations in sediments and would not have an impact on surface water resources (HR Wallingford, 2006)[13] and are therefore not considered further within the assessment.

Deposition

14.5.6 The temporary cofferdam would be likely to lead to changes in flows (velocities, directions) and cause changes in deposition of sediments around the Heathwall Pumping Station site. These sediments could be those generated by the project itself but would also include sediments occurring naturally in the water column. Modelling carried out (Vol 3 Appendix L.3) has predicted the extent of this deposition, as shown below in Vol 15 Plate 14.5.1.

[vii] An assessment of the potential sediment losses anticipated from construction activities within the foreshore is provided in the *Habitats regulation assessment.*

Vol 15 Plate 14.5.1 Surface water – prediction deposition around temporary works at Heathwall Pumping Station site



14.5.7 Most deposition is likely to be localised and occur in newly created areas of slack water (as shown above in Vol 15 Plate 14.5.1) but may be remobilised by spring tides (for deposition during neap tides) or by large fluvial flows (for deposition during seasonal low fluvial flows). The overall impact on channel morphology would be negligible.

14.5.8 Impacts on channel morphology from deposition can have an effect on ecological receptors, by changing habitat availability. This effect is assessed in Section 5 of this volume.

Pumping and pollution during cofferdam construction

14.5.9 The main pathways for surface water quality impacts during construction at the Heathwall Pumping Station site are as a result of the requirement for a cofferdam to be constructed in the river channel for the main construction work. The cofferdam would be constructed by driving sheet piles into the river bed, which would be sealed and the water pumped out into the river channel. As the works would be in the channel, there would be a direct pathway for pollutants to be discharged to the river during the construction of the cofferdam which could impact on water quality in this location of the tidal Thames. The adoption of appropriate drainage and pollution control measures as included in the *CoCP* Part A (Section 8) (see para. 14.2.7) should remove the impact pathway.

14.5.10 Before being released to the river, the water to be pumped from behind the cofferdam would be subject to settlement, silt trap or other suitable method (see *CoCP* Part A (Section 8)) to ensure excessive levels of potentially contaminated suspended solids are not discharged to the tidal Thames. It is considered that via the proposed management of pumping out water from the cofferdam area, the pollution pathway is removed and therefore no impact is anticipated from this source and this is not considered further in the assessment.

Foreshore and contamination within the river channel

14.5.11 Foreshore sediment sampling carried out at the Heathwall Pumping Station site has shown contamination of the near surface sediments with levels of certain metals and PAH, which were elevated against the TEL and PEL (Canadian Council for the Environment, undated)[14]. An assessment of potential on-site contamination is provided within Section 8 Land quality. Given the current environment (ie, significant water flow and sediment movement), it is expected that the majority of mobile contaminants have already been leached from the sediment, although the disturbance of sediments caused by the proposed construction works could cause additional sediment contamination to be leached.

14.5.12 Any additional sediments input to the river as a result of construction processes would be minimal in comparison to the already high background levels (see para. 14.4.5) and any mobilised contaminants would be expected to be rapidly diluted and their potential impact on water quality attenuated. Sediments mobilised by the construction works (including piling for the cofferdam walls) are therefore likely to pose only a low risk of causing deterioration in water quality. Such sediments are continually transported along the tidal Thames as a natural action of erosion and deposition, as well as by other dredging operations and river users.

14.5.13 Therefore, there is considered to be no impact from this source and this is not considered further within this assessment.

Surface water drainage

14.5.14 Once constructed, the cofferdam area and the shaft construction work within it would be protected from flooding to ensure the construction activity is not affected by high water levels. This would require the cofferdam walls to be raised to at least the existing flood defence level. Surface water from rainfall on the CSO drop shaft construction area may need to be pumped periodically to ensure the working activities are not affected by ponding of rainwater, if drainage of surface water by gravity is not possible.

14.5.15 The construction of the working area and drainage of surface water from it could therefore create a direct pathway to the river for contaminated runoff, high suspended solids and other pollution from the site. However, appropriate site drainage would be used to control pollutants in the general site runoff, preventing the discharge of pollutants via combined or surface water drains as part of the surface water discharge from the construction site (see *CoCP* Part A (Section 8)). This would enable the pollution pathway to be removed and therefore there is considered to be no impact from this source. Surface water drainage is therefore not considered further within this assessment.

Debris accumulation

14.5.16 There is the potential for the cofferdam at Heathwall Pumping Station site to impact on the flow regime of the tidal Thames locally and causing an area of slack 'dead' water. Floating debris, oils and other pollutants could build up in the area if the flow of the river is unable to clear the accumulation due to the shelter provided by the various structures in the vicinity of the Heathwall Pumping Station site working area.

Dewatering

14.5.17 Based on the geology at the site, depressurisation of the Lambeth Group would be required. See Section 13 of this volume for further details on the dewatering requirements. Depending on the quality of the groundwater that is pumped out, there could be an impact on water quality of the tidal Thames.

A review of historical mapping has identified several contaminative activities on site. An assessment of potential on-site contamination is provided within Section 8 of this volume. Settlement of suspended solids within any groundwater that would be removed would minimise the levels of contaminants within the effluent, which tend to be associated with particulates. Additional treatment of the dewatering effluent, or remediation of groundwater, may also be carried out if required. It is therefore considered that there is no pollution pathway and hence no impact from dewatering.

Construction effects

14.5.18 The potential surface water impacts identified above as a result of construction at Heathwall Pumping Station site have been assessed for their likely effects on WFD objective compliance, compliance with other legislation and effects on other users of the surface waters. The surface water receptors are identified in Vol 15 Table 14.4.1 .

14.5.19 The WFD objectives set out in Article 4 of the WFD are as follows:

a. WFD1 – Prevent deterioration of the status of all bodies of surface water

b. WFD2 – Protect, enhance and restore all bodies of surface water, with the aim of achieving good surface water status by 2015

c. WFD3 – Protect and enhance all artificial and heavily modified bodies of water, with the aim of achieving good ecological potential and good surface water chemical status by 2015

d. WFD4 – Reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances.

14.5.20 The significance of these effects has then been assessed based on the magnitude of the impacts as described in Vol 2 Section 14.

Temporary land take and morphological changes

14.5.21 The presence of the construction cofferdam in the channel would impact on the morphology of the tidal Thames in this location, altering it from its current state.

14.5.22 At the end of the construction, part of the riverbed would be reinstated following the removal of the temporary structures. This is due to the natural circulation of sediments within the estuary and the accumulation of silt and estuarine mud that is likely to occur. The temporary change is also unlikely to alter the “in place” mitigation measures identified in the RBMP as necessary to achieve good ecological potential. Therefore, because mitigation measures required to meet the WFD objective of Good Ecological Potential could still be implemented irrespective of the proposed development at this site, works at this site would not prevent any of the WFD objectives being met in the future. However, there would be a measurable change in foreshore morphology during construction and hence the effect is considered to be **minor adverse**.

14.5.23 Impacts on channel morphology can have an effect on ecological receptors, by changing habitat availability. This effect is assessed in Section 5 of this volume.

Debris accumulation

14.5.24 The change in flow regime of the tidal Thames due to piling activities may result in an area of slack ‘dead’ water, where floating debris, oils and other pollutants could build up and reduce the amenity value of the river for recreational users.

14.5.25 A change in appearance and aesthetic quality of the tidal Thames in the near vicinity of the site is likely, but it would not prevent or limit recreational use of the tidal Thames in this location. There are no abstractions or discharges that could be affected by this change in debris accumulation, which would also not affect compliance with the WFD or other legislation as it is not assessed under this legislation. Therefore, the effect is considered to be **minor adverse**.

14.6 Operational effects assessment

14.6.1 This section presents the operational impacts that could occur at the site. The second part of the section identifies any effects that may occur and the likely significance of these effects.

Operational impacts

Reduction in Southwest Storm Relief CSO and Heathwall Pumping Station CSO spills

14.6.2 Catchment modelling of the operational development case, (with the operational Thames Tideway Tunnel project) predicts that by Year 1 of operation, the frequency, duration and volume of spills from the Southwest Storm Relief CSO and Heathwall Pumping Station CSOs would substantially decrease (as a result of the capture of combined sewage overflows into the tunnel) as follows:

14.6.3 For the Southwest Storm Relief CSO

a. the CSO would spill on average once per year (12 times less than the operational base case)

b. the CSO would spill for an average duration of three hours (37 hours less than the operational base case)

c. the spill volume from the CSO would be approximately 3,900m^3 per year (235,100m^3 less than the operational base case).

14.6.4 For the Heathwall Pumping Station CSO

a. the CSO would spill on average four times per year (35 times less than the operational base case)

b. the CSO would spill for an average duration of 26 hours (222 hours less than the operational base case)

c. the spill volume from the CSO would be approximately 63,000m^3 per year (685,000m^3 less than the operational base case).

14.6.5 The frequency, duration and volume of spill at Heathwall Pumping Station site would therefore be reduced by approximately 93% as a result of the operation of the Thames Tideway Tunnel project.

14.6.6 Given the reductions in spills, the number of days in which river users would be exposed to pathogens in Site Year 1 of operation as a result of spills from the Southwest Storm Relief Sewer and Heathwall Pumping Station CSOs would be a maximum of 20 days in the Typical Year (a reduction of up to 188 days of risk of exposure).

14.6.7 Similarly, the tonnage of sewage derived litter from the CSOs can be expected to reduce by approximately 93%, from approximately 252t to approximately 18t, in the Typical Year.

14.6.8 The reduction in polluting load that would be discharged from the CSO with the project in place would be as follows:

14.6.9 For the Southwest Storm Relief Sewer CSO

a. the CSO would discharge 230kg of BOD in the Typical Year (6,450kg less than the operational base case)

b. the CSO would discharge 10kg of ammonia in the Typical Year (210kg less than the operational base case)

c. the CSO would discharge 40kg of TKN in the Typical Year (860kg less than the operational base case).

14.6.10 For the Heathwall Pumping Station CSO

a. the CSO would discharge 9,800kg of BOD in the Typical Year (79,000kg less than the operational base case)

b. the CSO would discharge 310kg of ammonia in the Typical Year (2,600kg less than the operational base case)

c. the CSO would discharge 1,400kg of TKN in the Typical Year (11,700kg less than the operational base case).

14.6.11 Catchment modelling of the 2080 development case (to account for the effects of climate change and predicted increases to population) predicts that by 2080 with the operational Thames Tideway Tunnel project , the frequency, duration and volume of the CSOs would be the following:

14.6.12 For the Southwest Storm Relief Sewer CSO

a. the CSO would spill on average once per year (the same as the Site Year 1 of operation development case)

b. the CSO would spill for an average duration of nine hours (six more hours than the Site Year 1 of operation development case)

c. the spill volume from the CSO would be approximately 30,250m^3 per year (26,350m^3 more than the 2021 development case).

14.6.13 For the Heathwall Pumping Station CSO

a. the CSO would spill on average five times per year (once more than the Site Year 1 of operation development case)

b. the CSO would spill for an average duration of 31 hours (five more hours than the Site Year 1 of operation development case)

c. the spill volume from the CSO would be approximately 111,000m^3 per year (48,000 m^3 more than the Site Year 1 of operation development case).

14.6.1 In summary the model predicts that in the 2080 development case scenario the Southwest Storm Relief Sewer and Heathwall Pumping Station CSOs at the Heathwall Pumping Station site would increase in spill frequency total spill duration and volume. These changes in spill frequency, duration and volume would be due to the impact of climate change, which is expected to lead to fewer, but more intense rainfall events during winter and drier summers.

14.6.2 Climate change is also predicted to increase average water temperatures, which combined with changes to rainfall patterns could affect water quality in the tidal Thames. As these water quality changes would be realised across the tidal Thames they have been assessed in Vol 3 Section 14 and climate change is not considered further within this site assessment.

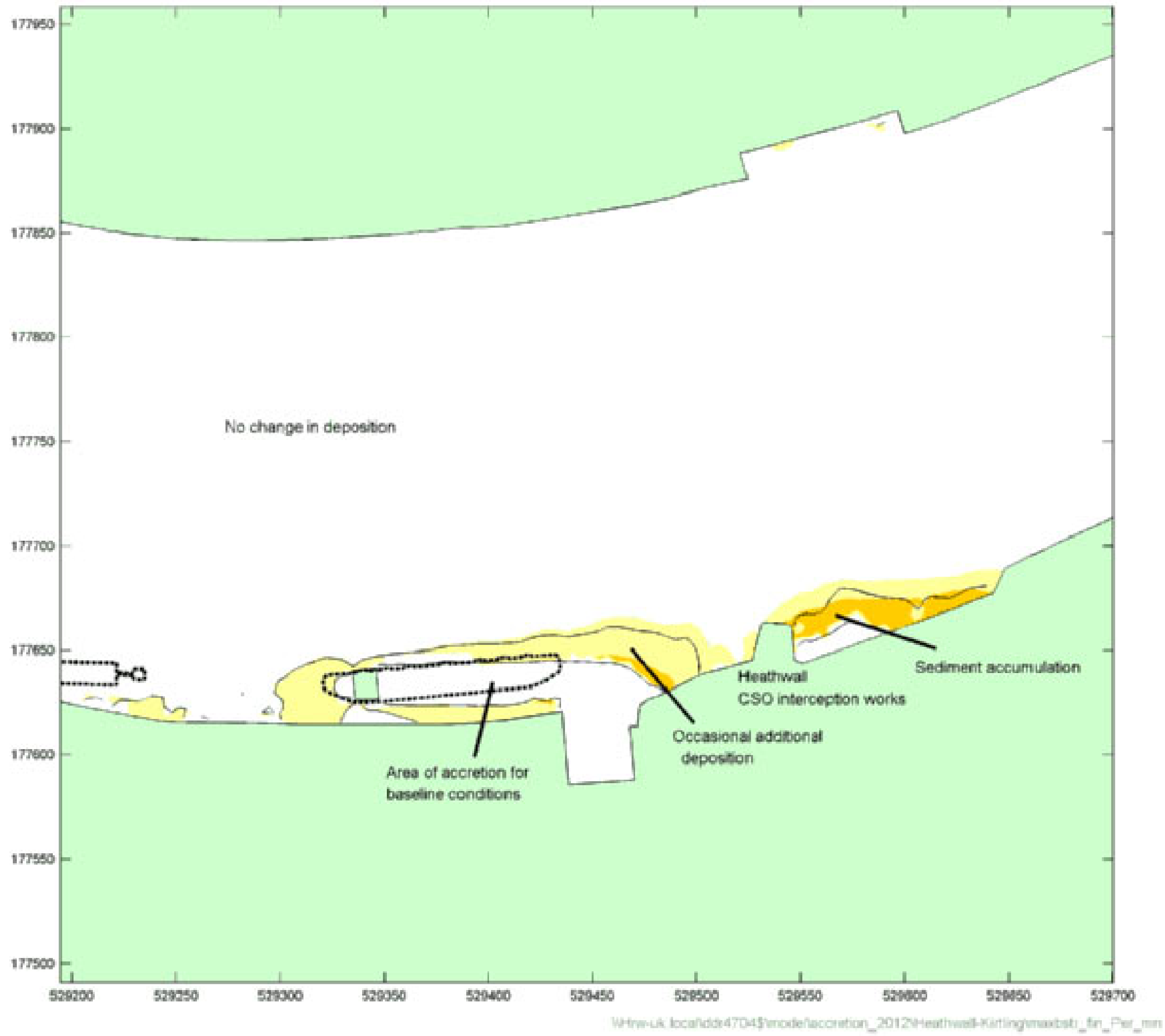
Permanent land take and morphological changes

14.6.3 In order to accommodate the permanent works at the Heathwall Pumping Station site, construction of a permanent structure within the river channel would be required as described in Section 3.2 of this volume. The permanent structure could affect the river regime with the potential that localised increases in flow velocity cause scour of the river bed and foreshore and could result in the mobilisation of suspended solids. The approach to scour protection for the permanent works is described in the *Engineering Design Statement* as described in para 14.2.13 and scour is not considered further with the assessment.

Deposition

14.6.4 The permanent works cofferdam would be likely to lead to changes in flows (velocities, directions) and cause changes in deposition of sediments around the Heathwall Pumping Station site. Modelling carried out (Vol 3 Appendix L.3) has predicted the extent of this deposition, as shown below in Vol 15 Plate 14.6.1.

Vol 15 Plate 14.6.1 Surface water – prediction deposition around permanent works at Heathwall Pumping Station site



14.6.5 Most deposition is likely to be localised (as shown above in Vol 15 Plate 14.6.1) but may be remobilised by spring tides (for deposition during neap tides) or by large fluvial flows (for deposition during seasonal low fluvial flows). The impact on channel morphology would be negligible.

14.6.6 Impacts on channel morphology from deposition can have an effect on ecological receptors, by changing habitat availability. This effect is assessed in Section 5 of this volume.

Operational effects

Reduction in Southwest Storm Relief CSO and Heathwall Pumping Station CSO spills

14.6.7 The reduction in spills from the Southwest Storm Relief CSO and Heathwall Pumping Station CSO would represent an important contribution towards:

a. meeting the requirements of the Urban Waste Water Treatment Directive[15] (UWWTD) in relation to the two CSOs

b. meeting the required TTSS DO standards

c. moving the tidal Thames towards its target status under the WFD both locally and throughout the tidal Thames.

14.6.8 Therefore, the reduction in spills would result in a **major beneficial** effect, most notably in the context of the UWWTD. It should be noted that, as explained in Section 14.1, the water quality in the vicinity of the Heathwall Pumping Station site also depends on the project-wide improvements, as documented in Vol 3.

14.6.9 The associated reduction in exposure to pathogens would greatly improve the conditions for recreational users of the tidal Thames around Heathwall Pumping Station, allowing the tidal Thames in this location to be used more frequently with a reduced risk of exposure. This is considered to be a **moderate beneficial** effect.

14.6.10 The reduction in sewage litter discharge would also improve the aesthetic quality of the tidal Thames locally, improving conditions for recreational users. This is considered to be a **moderate beneficial** effect. As explained in Section 14.4, an assessment of the amenity effects of the sewage litter is given in Vol 3 Section 10 Socio-economics.

Permanent land take and morphological changes

14.6.11 The permanent structures proposed in the tidal Thames have been designed and engineered to allow minimise the impediment of flow and although some changes to flows are likely, the changes are unlikely to lead to further substantive deterioration of the morphological condition of the channel which is already modified by flood defences and channel dredging. In addition, the changes in flow are unlikely to lead to an area of slack ‘dead’ water around the permanent structures. The WFD objectives are not considered to be affected by this change, and hence the effect is considered to be **minor adverse**.

14.6.12 Impacts on channel morphology can also have an effect on ecological receptors, by changing habitat availability. This effect is outside the scope of the surface water assessment and is assessed in Section 5 of this volume.

14.7 Cumulative effects assessment

14.7.1 Considerable improvements in the water quality of the tidal Thames will occur as a result of the works associated with the Lee Tunnel and sewage works upgrades. These already form part of the base case and so are not considered as part of the assessment of cumulative effects.

14.7.2 Of the projects shown in Vol 15 Appendix N, which could potentially give rise to cumulative effects with the proposed development at Heathwall Pumping Station site, it is not considered that any would lead to cumulative effects on surface water. This is because the adverse effects that are considered likely for the construction and operational phases at this site are associated with the proposed in-river structures. The developments described in Appendix N are remote from the tidal Thames and are therefore unlikely to have significant effects on the channel morphology.

14.7.3 No significant cumulative effects have therefore been identified for the construction or operation phases at this site. Therefore the effects on surface water would remain as described in Section 14.5 and Section 14.6 above.

14.8 Mitigation

14.8.1 No significant adverse effects have been identified and no mitigation is required.

14.9 Residual effects assessment

Construction effects

14.9.1 As no mitigation measures are proposed, the residual construction effects remain as described in Section 14.5. All residual effects are presented in Section 14.10.

Operational effects

14.9.2 As no mitigation measures are proposed, the residual operational effects remain as described in Section 14.6. All residual effects are presented in Section 14.10.

14.10 Assessment summary

Vol 15 Table 14.10.1 Surface water – construction assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Thames Middle	Temporary changes to channel morphology (cofferdam and associated scour protection construction)	Minor adverse	None	Minor adverse
Thames Middle	Changes in aesthetic quality due to debris accumulation in slack water between structures	Minor adverse	None	Minor adverse

Vol 15 Table 14.10.2 Surface water – operational assessment summary

Receptor	Effect	Significance of effect	Mitigation	Significance of residual effect
Thames Middle and Thames Upper	Compliance with UWWTD and WFD. Improved water quality in the vicinity of the Southwest Storm Relief Sewer and Heathwall Pumping Station CSOs by reduced pollutant loading and no reduction of DO levels due to reduced spill frequency, duration and volume from the Southwest Storm Relief Sewer and Heathwall Pumping Station CSOs	Major beneficial	None	Major beneficial
Thames Middle and Thames Upper	Risk of exposure days to pathogens would be reduced to a maximum of 20 days in the Typical Year (a reduction of up to 188 days of risk of exposure)	Moderate beneficial	None	Moderate beneficial

Thames Middle	Sewage derived litter discharge at Southwest Storm Relief Sewer and Heathwall Pumping Station CSOs would be reduced by approximately 93% improving the aesthetic quality of the river locally	Moderate beneficial	None	Moderate beneficial
Thames Middle	Change in channel morphology caused by permanent foreshore/in-channel structures	Minor adverse	See Section 5 Ecology – aquatic	Minor adverse

References

[1] HM Government. *National Policy Statement for Waste Water: A framework document for planning decisions on nationally significant waste water* (March 2012). Available at: http://www.defra.gov.uk/publications/files/pb13709-waste-water-nps.pdf

[2] Department for Transport (DFT). *Transport Analysis Guidance* (WebTAG) (2003). Available at: http://www.dft.gov.uk/webtag/documents/overview/unit1.2.php.

[3] *The Urban Waste Water Treatment Directive, Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment. Available at:* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0271:EN:NOT

[4] Environment Agency. *River Basin Management Plan, Thames River Basin District* (2009).

[5] The United Kingdom Technical Advisory Group (UKTAG) to the WFD. Available at: http://www.wfduk.org.

[6] Environment Agency (2009). See citation above

[7] Environment Agency (2009). See citation above.

[8] HR Wallingford (report prepared for the Environment Agency). *Thames Estuary 2100, Morphological changes in the Thames Estuary, Technical Note EP6.8. The development of an historical sediment budget* (2006).

[9] Canadian Council for the Environment. *Sediment Quality Guidelines for the Protection of Aquatic Life*. Available at: http://st-ts.ccme.ca/.

[10] Lane, C, Surman-Lee, S, Sellwood, J and Lee, JV. *The Thames Recreational Users Study Final Report* (2007).

[11] Lane *et al*. See citation above.

[12] Thames Water. *Thames Tideway Strategic Study* (February 2005).

[13] HR Wallingford. See citation above.

[14] Canadian Council for the Environment. See citation above.

[15] *The Urban Waste Water Treatment Directive.* See citation above.

Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Environmental Statement

Doc Ref: **6.2.15**

Volume 15: Heathwall Pumping Station site assessment

Section 15: Water resources - flood risk

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Thames Tideway Tunnel
Creating a cleaner, healthier River Thames

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Thames Tideway Tunnel

Environmental Statement

Volume 15: Heathwall Pumping Station site assessment

Section 15: Water resources – flood risk

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15 Water resources – flood risk

15.1 Introduction

Background

15.1.1 This section forms a Flood Risk Assessment (FRA) for the Heathwall Pumping Station site. This FRA has been developed in line with the requirements of the National Policy Statement (NPS) for Waste Water (Defra, 2012)[1] Section 4.4 and includes a qualitative appraisal of the flood risk posed to the site, the potential impact of the development on flood risk on and off the site and an appraisal of the scope of possible measures to reduce the flood risk to acceptable levels. Further details on how the NPS requirements relevant to flood risk have been met can be found in Vol 2 Environmental assessment methodology Section 15.3.

15.1.2 The proposed development is described in Section 3 of this volume. Plans of the proposed development as well as figures included in the assessment for this site are contained in a separate volume (Volume 15 Heathwall Pumping Station Figures).

15.1.3 A summary of the regulations and policy that have informed the assessment are presented in this section. Section 15.2 provides a summary of the elements of the proposed development relevant to flood risk. Section 15.3 provides an assessment of the flood risk to the site and elsewhere as a result of the development, during both the construction and operational phases. Section 15.4 provides details of the design measures that have been adopted within the proposals to ensure the flood risk to the site is not increased and ensure that flood risk does not increase elsewhere.

15.1.4 The assessment of flood risk should be considered in conjunction with the assessment of other water resources ie, groundwater and surface water. The assessment of effects on groundwater is presented in Section 13 Water resources – groundwater. The assessment of effects on surface water is presented in Section 14 Water resources – surface water.

15.1.5 A project-wide FRA has been undertaken and is presented in Volume 3 Section 15 Project-wide assessment.

Regulatory context

15.1.6 The NPS seeks to ensure that where the development of new waste water infrastructure is necessary in areas at risk of flooding, flood risk from all sources of flooding is taken into account at all stages in the planning process in order for the development to be safe without increasing flood risk elsewhere.

15.1.7 A review of planning policy relevant to the proposed development is provided in Vol 15 Appendix M.1.

NPS Sequential and Exception Tests

15.1.8 The Waste Water NPS aims to direct development towards low risk areas through the use of a sequential approach which avoids inappropriate development in areas at risk of flooding. Using this approach, preference should be given to locating projects in Flood Zone 1 although if there is no "reasonably available site" in Flood Zone 1 then projects should be located in Flood Zone 2. However if there is no "reasonably available site" in Flood Zones 1 or 2, then nationally significant waste water infrastructure projects can be located in Flood Zone 3 subject to the Exception Test.

15.1.9 The NPS states that the Exception Test should be applied where it is not possible for the project to be located in zones of lower probability of flooding than Flood Zone 3.

15.1.10 The requirements of the Exception Test are provided in Section 4.4.15 of the NPS. The test requires overall sustainability benefits (Part A) to outweigh flood risk, whilst ensuring the development is safe and does not increase flood risk elsewhere (Part C) and is preferably located on previously developed land (Part B).

15.1.11 The overall project is considered to pass the Sequential Test, as explained in Vol 3 Section 15. A project wide Exception Test is also provided in Vol 3 Section 15.

15.1.12 The proposed development of Heathwall Pumping Station would form an integral part of the Thames Tideway Tunnel project and so would help achieve the project-wide sustainability benefits described in the *Sustainability statement*. Given the project wide sustainability benefits, the proposed development is considered to satisfy part a) of the Exception Test.

15.1.13 The proposed development at Heathwall Pumping Station would not be entirely located on previously-developed land. However as detailed in Vol 3 Section 15 no reasonably alternative sites on developable previously-developed land were identified during the site selection process and as such the proposed development at Heathwall Pumping Station would satisfy part b) of the Exception Test.

15.1.14 This FRA shows that the proposed development would be appropriate for the area as flood risk to the development would be managed through appropriate design measures and the development would not lead to an increase in flood risk on the surrounding areas. Therefore, part c) of the Exception Test has also been met.

15.2 Elements of the proposed development relevant to flood risk

15.2.1 The proposed development at this site is described in Section 3 of this volume. The elements of the proposed development relevant to flood risk are set out below.

15.2.2 The Heathwall Pumping Station site is comprised of two parts; the northern part of the site, which is situated on the foreshore of the tidal

Thames, and the southern part incorporating Heathwall Pumping Station and Middle Wharf, located on land between the tidal Thames and Nine Elms Lane.

Construction

15.2.3 The construction elements of the proposed development relevant to flood risk would include:

a. A temporary campshed within the tidal foreshore for the loading and unloading of material.

b. A cofferdam to form the northern part of the site.

c. The tidal Thames flood defence wall, situated between the northern and southern parts of the site would be removed to allow site access, with the cofferdam (installed to the same height as the existing local flood defences) maintaining the current level of flood protection from the tidal Thames.

d. The interception of the Heathwall Pumping Station combined sewer overflow (CSO) would require the construction of an interception chamber and valve chamber. This would be constructed within the new foreshore structure and, once the system is operational, flows would be diverted through the valve chamber and into the CSO drop shaft. The existing Heathwall Pumping Station CSO would be maintained throughout the construction period by an extension through the cofferdam. This would allow the CSO to remain operational during the construction period.

e. The interception of the South West Storm Relief CSO would require similar structures within land-based part of the site which, once the system is operational, would divert the flows through the valve chamber and into the CSO drop shaft. The existing South West Storm Relief CSO would continue to operate throughout the construction period.

Code of Construction Practice

15.2.4 Appropriate guidance regarding flood defence construction and emergency planning is included in the *Code of Construction Practice (*CoCP*)*. The CoCP is provided in Vol 1 Appendix A. It contains general requirements (Part A), and site specific requirements for this site (Part B).

15.2.5 The CoCP (Section 8) states that no temporary living accommodation would be permitted onsite and that an evacuation route and safe refuge should be provided in the event of a flood event.

15.2.6 The CoCP (Section 8) states that the contractor would be responsible for providing and maintaining continuous flood defence provision, for both permanent and temporary works, to the statutory flood defence level[i] as detailed within the FRA. This is a requirement of the Thames River Protection of Floods Amendment Act 1879[2].

[i] The level to which the flood defences must be maintained to ensure that both the sites themselves and third-party land and assets in the surrounding area are protected from flooding.

Operation

15.2.7 The permanent structures at the Heathwall Pumping Station site relevant to flood risk would include:

a. A new flood defence wall tied into adjacent flood defences and completed with a crest height to the same level as the existing walls. The wall would also be designed to allow future raising in accordance with the Thames Estuary 2100 Plan (TE2100) (EA, 2012)[3] requirements.

b. Following construction of the proposed development, outfalls from the Heathwall Pumping Station CSO and the South West Storm Relief CSO would be intercepted. The overflows from the Heathwall Pumping Station CSO would be discharged via a newly constructed high level foreshore outfall apron.

c. Surface water runoff from the proposed development would be discharged directly into the tidal Thames.

15.3 Assessment of flood risk

Introduction

15.3.1 The NPS requires that all potential sources of flooding that could affect the proposed development are considered.

15.3.2 This assessment is based on a FRA screening exercise that identified relevant potential flood sources and pathways. The tidal and fluvial assessments have been based on Environment Agency (EA) flood zones which do not take account of the presence of existing defences.

15.3.3 The assessment of flood risk from the proposed development takes into account the proposed design measures detailed in Section 15.4.

15.3.4 It should be noted that due to the nature of a flood risk assessment, the risk based approach outlined in the National Planning Policy Framework (NPPF) (Communities and Local Government, 2012)[4] was considered to be preferable to the general environmental impact assessment (EIA) methodology described in Vol 2, Section 3. This approach is based on the probability of an event occurring as a result of the proposed development rather than a direct change in conditions. This is detailed further in the methodology (see Vol.2).

Tidal flood risk to the proposed development

Level of risk based on the flood zones

15.3.5 The Environment Agency (EA) Flood Map identifies the site to be located within Flood Zone 3. As the northern part of the site is located within the foreshore of the tidal Thames, it is part of the active floodplain of the tidal Thames and is subject to twice daily tidal inundation. This area is therefore considered as functional floodplain and is classified as Flood Zone 3b (land where water has to flow or be stored in times of flood). Due to the undefended nature of the floodplain at this location and the frequency at which tidal inundation occurs, the current risk of flooding to this foreshore part of the site (without the design measures) is considered to be very high (see methodology in Vol 2).

15.3.6 The southern part of the site is considered to be within Flood Zone 3a as it benefits from the presence of flood defences. The flood risk from this source for the southern part of the site is considered to be high, due to its location within Flood Zone 3a (see methodology in Vol.2).

15.3.7 The location of the site in relation to the flood zones is shown in Vol 15 Figure 15.3.1 (see separate volume of figures).

Existing tidal defences

15.3.8 A raised flood defence wall is aligned along the boundary of the tidal Thames and currently separates the northern and southern parts of the site. The tidal Thames flood defence wall currently protects the southern part of the site, which is situated behind the flood defence wall, but does not protect the northern part of the site which is located on the foreshore in front of the defences. The whole site is protected from extreme tidal flood risk by the Thames Tidal Barrier located approximately 19km downstream.

15.3.9 The EA have stated the statutory flood defence level at this location is 5.41m Above Ordinance Datum (AOD). The National Flood and Coastal Defence Database (NFCDD) (EA, 2011)[5] crest levels for the river wall adjacent to the site range from 5.84mAOD to 5.97mAOD.

15.3.10 Condition surveys of the flood defences carried out by the EA in April 2011 state that the defences range in condition from good (Grade 2) to fair (Grade 3).

15.3.11 The southern part of the site is protected from flooding by defences, but floodwaters could inundate this portion of the site in the event of overtopping (for example if the Thames Barrier fails to close during a tidal event) or a failure of the flood defences as a result of a breach.

15.3.12 The Strategic Flood Risk Assessment (SFRA) for the London Borough of Wandsworth (Scott Wilson Ltd, 2008[6] and Scott Wilson Ltd, 2009)[7] modelled breach events at several locations along the tidal Thames frontage including the Heathwall Pumping Station site (Breach P4). The south eastern part of the site and Nine Elms Lane is designated in the SFRA as an area of high hazard'[ii] (Defra and EA, 2008)[8]'. The south western part of the site is largely not inundated with small portions being at low hazard. However, this risk is residual and is not considered to compromise the long term operational function of the tunnel. Further detail regarding residual risk is provided within para. 15.5.4 and in Vol.3 Section 15.

Tidal flood level modelling

15.3.13 The most extreme flood risk scenario that could affect the site would be a combination of a high tide with a storm surge in the Thames Estuary. This scenario, assuming the Thames Barrier is operational, is the EA's 'design flood' event, a hypothetical flood event representing a specific likelihood of

[ii] Designated using a combination of consequence and distance from the defence as per the Defra publication 'Flood Risks to People

occurrence, in this case the 1 in 200 year (0.5% Annual Exceedance Probability [AEP][iii]) flood event.

15.3.14 The EA Thames Tidal Defences Joint Probability Extreme Water Level Study (EA, 2008)[9] provides modelled tidal flood levels for the 1 in 200 year (0.5% AEP) for specific locations (model node locations) within the tidal Thames.

15.3.15 Vol 15 Table 15.3.1 presents the modelled tidal levels from this study for years 2005 and 2107 and model node 2.30,which is the most relevant (ie, closest) to the site (see Vol 15 Figure 15.3.1). It should be noted that the water levels are expected to decrease in the future due to an amended future Thames Barrier closure rule (see Vol 2), therefore the 2005 scenario produces the highest water level.

15.3.16 Vol 15 Table 15.3.1 also confirms that the flood defence levels at the site are above the 0.5% AEP flood level; therefore the site is protected from tidal flooding to the statutory level.

Vol 15 Table 15.3.1 Flood risk – modelled water levels

Return period	Flood level (mAOD)	Statutory flood defence level (mAOD)
0.5% AEP (2005)	5.01	5.41
0.5% AEP (2107)	4.99	

Tidal risk from the proposed development

New tidal defences

15.3.17 The presence of new permanent structures within the foreshore has the potential to influence the flood risk to the site itself and to the surrounding environment. The proposed development includes raising the foreshore to adjacent land levels and building a new flood defence to the existing statutory level. As a result, the northern part of the site which is currently located in Flood Zone 3b would be protected by defences and would be located in Flood Zone 3a and defended from tidal flooding therefore the risk of tidal flooding is considered to be high. Potential risks are described further in paras. 15.3.18 to 15.3.29 and measures included within the design are outlined in Section 15.4.

Flood defence integrity

15.3.18 The tunnel excavation process using tunnel boring machines (TBMs) and other construction methods, has the potential to create differential settlement (that is a gradual downward movement of foundations due to compression of soil which can lead to damage if settlement is uneven), which could affect the level of some of the existing flood defences. The proposed main tunnel route runs immediately adjacent to the tidal Thames river wall and the proposed connection tunnel runs underneath the line of the existing flood defences, which have the potential to affect the defences at this site.

[iii] A flood with a 0.5% Annual Exceedance Probability (AEP) has a 1 in 200 chance of occurring in a given year

15.3.19 The proposed design has been informed by consideration of settlement and the alignment and methods used have been selected to minimise it as far as possible.

15.3.20 A potential settlement of between 1mm and 37mm is estimated to occur across the river walls at the site. The flood defence levels following settlement is estimated to range from 5.80mAOD to 5.93mAOD. The sections of river wall at the site would therefore remain above the statutory flood defence level following this degree of settlement.

15.3.21 An initial assessment of the effect of construction activities on the structural integrity of flood defences at this site was undertaken by Thames Water. This considered effects from ground movement as well as a range of other construction-related impacts where applicable. The assessment indicated potential structural impacts on the flood defences at the site arising from additional surcharge loading, increased water differential, excavation in vicinity of tie rods,'Burland' damage[iv], tie-rod stress[v] increase and modification of existing wall.

15.3.22 The proposed schedule of works (Schedule 1 of *The Draft Thames Water Utilities Limited (Thames Tideway Tunnel) Development Consent Order*) includes a provision for "works for the benefit of the protection of land or structures affected by the authorised project" which would provide the powers to mitigate for any impact to the flood defences at the site.

Flood defence line

15.3.23 Both temporary and permanent works for the flood defences have the potential to influence the level of tidal flood risk to the surrounding area. However, as stated above, the proposed cofferdam and the new flood defence wall would be constructed in front of the line of the existing river wall and to the same height as the existing flood defences ensuring the current standard of protection is maintained. This approach ensures that the level of residual tidal flood risk would not change.

Scour management

15.3.24 The TE2100 Plan includes an assessment of the tidal Thames foreshore at this location where there are long lengths of naturally eroding reaches of the tidal Thames. Results from this Plan show that works within the foreshore at this site may have an influence on downstream river structures if the pattern of sediment movement is greatly changed. In addition, should any permanent and temporary works within the river cause the channel width to be considerably altered, the flow velocity of the river at this point may vary, thereby altering contraction scour across the channel bed.

15.3.25 A scour summary report outlines the modelling studies that have been undertaken to determine the magnitude of scour associated with both the temporary and permanent works at ten foreshore sites on the tidal

[iv] Tensile strains in gravity wall due to longitudinal differential settlement.

[v] Tie-rod stress analysis aims to determine the likely tie-rod stress change as a result of differential ground movement between a river wall and its anchor, caused by tunnel construction

Thames (Vol. 3 Appendix L.3) including the Heathwall Pumping Station site.

15.3.26 Scour is predicted at the Heathwall Pumping Station site to be greatest during construction with maximum estimated scour depths to temporary works of up to 2.7m. The contraction scour has been estimated during construction to be less than 0.1m across the river bed and less than 0.1m at the adjacent river walls.

15.3.27 During the permanent works local scour depths of up to 0.2m are predicted around the permanent works. Contraction scour has been estimated to be less than 0.1m. As a proactive approach permanent scour protection is envisaged at the base of the new flood defence wall.

15.3.28 Both the temporary and permanent works have therefore the potential to influence scour and /or deposition rates within the river and affect river structures including flood defences.

Loss of volume from the Tideway

15.3.29 The presence of temporary and permanent structures within the foreshore has the potential to reduce the availability of flood storage within the tidal foreshore of the tidal Thames. The effect of removal of flood storage on flood levels is propagated throughout the hydrological unit of the tidal Thames reach and has been modelled on a project-wide basis.

15.3.30 The Heathwall Pumping Station site is located within the reach of Chelsea to Westminster in the tidal and fluvial modelling study. The modelling identifies that for this reach the potential maximum decrease in peak water level is 0.029m during the temporary works scenario reducing to 0.014m during the permanent scenario. The modelling also identifies a potential maximum increase of 0.013m in peak water level during the temporary works scenario reducing to 0.004m during the permanent scenario. As identified in para. 15.3.9 the flood defences at this site are above the statutory flood defence level and when compared to the 1 in 200 year tidal level for the year 2107 would provide between 0.83-2.34m in freeboard. These predicted changes in water level and therefore freeboard are not considered to reduce flood protection at this site below design standard requirements and are therefore not deemed significant.

15.3.31 The results of the above modelling exercise show that the proposed project-wide works (both temporary and permanent works) are not considered to have a detrimental impact on the flood storage or tidal levels within the tidal Thames. This is discussed further in Vol 3 Section 15.

Fluvial flood risk to the proposed development

Level of risk based on the flood zones

15.3.32 At this location along the tidal Thames, both fluvial and tidal inputs are component parts of the resulting water level. The impacts of flooding from the tidal influence of the tidal Thames are judged to be of greater importance than those from fluvial influences (see methodology in Vol.2).

15.3.33 As the northern part of the Heathwall Pumping Station site is located within Flood Zone 3b, and as the tidal and fluvial floodplain cannot be distinguished from each other at this location the risk of flooding from this flood source is considered to be very high. The southern part of the site is protected from flooding by defences therefore the Heathwall Pumping Station site is considered to be located within Flood Zone 3a and as the tidal and fluvial floodplain cannot be distinguished from each other in this location the risk of flooding from this flood source is considered to be high. Further detail is included in Vol 2.

Fluvial flood risk from the proposed development

15.3.34 The northern part of the site is located in the functional floodplain of the tidal Thames. Fluvial influences were considered when developing the hydraulic modelling summarised in para.15.3.29. This is discussed further in Vol 3 Section 15 which summarises that overall, the results of the project-wide modelling exercise show that the proposed project-wide works are not considered to have a detrimental impact on the flood storage or tidal levels within the tidal Thames.

Surface water flood risk to the proposed development

15.3.35 Flooding of land from surface water runoff is usually caused by heavy rainfall that is unable to infiltrate into the ground or drain quickly enough into the local drainage network. Flooding can also occur at locations where the drainage network system is at full capacity and floodwater is not able to enter the system. This form of flooding often occurs in lower lying areas where the drainage system is unable to cope with the volume of water.

15.3.36 As part of the Drain London Project[vi] a Surface Water Management Plan was prepared for the London Borough of Wandsworth (Greater London Authority, 2011)[10]. The results of this study show that the Heathwall Pumping Station site is not located within a Critical Drainage Area (CDA)[vii], which indicates that the site is relatively less susceptible to surface water flooding than other areas in the borough. Flood depths of less than 0.1m for the 1% AEP rainfall event plus climate change allowance have been modelled across the site. Flood depths of 0.25m–0.5m for the same return period are modelled along Nine Elms Lane, to the south of the site.

15.3.37 The land to the west of the pumping station is approximately 4.5mAOD and is level across the length of the site. To the east of the pumping station, the land slopes slightly to the south from 4.45mAOD to 3.7mAOD. Surface water runoff flowing from the west would be restricted by the presence of the pumping station building. The road levels in Nine Elms Lane to the south of the site are lower than that of the site at 3.4mAOD. The road level declines slightly towards the north east at 3.2mAOD. Surface water runoff generated from the land to the south of the site would be likely to follow the route of Nine Elms Lane, rather than flowing onto the site.

[vi] A London wide strategic surface water management study undertaken by the Greater London Authority (GLA) and London Councils

[vii] Area susceptible to surface water flooding

15.3.38 As the site is shown to have potential low surface water flood depths (around 0.1m) and pathways are directed away from the site, the flood risk associated with this source is considered to be low (see methodology in Vol.2).

Surface water flood risk from the proposed development

15.3.39 An assessment of the likely significant effects of surface water from the Heathwall Pumping Station site is provided in Section 14 of this volume.

15.3.40 NPS requires that surface water runoff on new developments is effectively managed so that the risk of surface water flooding to the surrounding area is not increased. In accordance with NPS, runoff rates following the proposed development should not be greater than the existing (pre development) rates. Furthermore, the London Plan (Greater London Authority, 2011)[11] and the Mayor's Water Strategy (Mayor of London, 2011)[12] set out a preferred standard of attenuation to the greenfield runoff rate and an essential standard of 50% attenuation of the peak surface water runoff rate at peak times.

15.3.41 The southern part of the Heathwall Pumping Station site is currently 100% hardstanding (impermeable) surface and so would not create an increase in the total impermeable area. Surface water runoff currently drains from the site to gullies located along Nine Elms Lane.

15.3.42 The foreshore area of the site naturally drains directly to the tidal Thames without inundating surrounding land.

15.3.43 In agreement with the EA (as set out in their phase two consultation response), surface water runoff from the proposed site would be discharged directly to the tidal Thames. Due to the tidal nature of the receiving watercourse, surface water runoff rates to the Thames would not increase surface water flood risk to the site or surrounding area and would therefore not require attenuation prior to discharge.

15.3.44 In the event of a storm coinciding with a high tide event surface water drainage from the site may be restricted and would need to be stored on site. If necessary, on-site storage would therefore be provided to manage flood risk in the event of the tidelocking of the surface water outfall.

15.3.45 Following the implementation of the above approach to surface water management, the risk of flooding from this source as a result of the proposed development would be unchanged and remain as low.

Groundwater flood risk to the proposed development

15.3.46 Groundwater flooding occurs where groundwater levels rise above ground surface levels.

15.3.47 Groundwater levels in the upper aquifer (River Terrace Deposits) have been recorded by Thames Water at the nearest borehole SA1084. At this location the average recorded water levels of the upper aquifer are approximately 4.05m below ground level (bgl). This level is above that of the River Terrace Deposits (at 6m bgl at this site), suggesting that the upper aquifer is confined by the overlying Alluvium, and Made Ground at this location.

15.3.48 As the upper aquifer is confined at this site, there is no pathway for groundwater to reach the surface at the site. There is therefore no risk of groundwater flooding to the site (see methodology in Vol.2).

Groundwater flood risk from the proposed development

15.3.49 An assessment of the likely effects on groundwater at the Heathwall Pumping Station site is provided in Section 13 of this volume.

15.3.50 The main CSO drop shaft would pass through the Made Ground, Alluvium, River Terrace Deposits, London Clay, Harwich Formation and the Lambeth Group. The shaft would not extend into the lower aquifer. Groundwater inflows are expected during excavation within the Laminated Beds and Upper Mottled Beds that form part of the Lambeth Group. Sheet pilling would be constructed around the site to seal out any flows from the upper aquifer to the shaft.

15.3.51 During construction, groundwater depressurisation would be required in the Lambeth Group to prevent upward heave at the base of the shaft. Groundwater brought to the surface as a result of the depressurisation would be discharged to the tidal Thames following settlement.

15.3.52 The presence of the CSO drop shaft creating a physical barrier has been assessed as having a predicted rise in water levels (approximately 0.2m); however, this would result in increased hydraulic pressure within the confined unit rather than an increase of the water table. Therefore, there is no pathway for groundwater to reach the surface of the site. There is therefore no risk of an increase in groundwater flooding to the site as a result of the proposed development.

Sewers flood risk to the proposed development

15.3.53 The South Western Storm Relief Sewer (3455mm diameter) discharges to the tidal Thames at low level to the east of the Heathwall Pumping Station CSO outfall, by gravity through an inverted siphon.

15.3.54 The Heathwall Sewer (New Line) (1905mm diameter) combined sewer runs beneath Nine Elms Lane from the southwest to the Heathwall Pumping Station. The Heathwall Sewer (Old Line) is a combined sewer of 1219mm diameter that flows from the south and joins the Heathwall Sewer (New line) in Nine Elms Lane. The Heathwall Pumping Station functions to lift dry weather flows from the Heathwall Sewer to the Southern Low Level Sewer No. 1. The Southern Low Level Sewer No. 1 (1753mm diameter) flows beneath Nine Elms Lane in an easterly direction.

15.3.55 During storm conditions, flows from the Heathwall Sewer and the Southern Low Level Sewer No. 1 can overflow to the pumping station where they are discharged to the tidal Thames via the Heathwall Pumping Station CSO.

15.3.56 If the capacity of the Heathwall Sewer, Low Level Sewer No.1 and the Pumping Station were exceeded, sewage would surcharge through outlets such as man holes and gullies located along the length of the sewer. There are few manholes associated with the Southern Low Level Sewer No.1 and the Heathwall sewer along Nine Elms Lane. In the event of a surcharge, the pathway for sewage at ground level would follow the topography of Nine Elms Lane, to the northwest.

15.3.57 Thames Water flooding records (Thames Water, 2012)[13] show that there are no records of sewer flooding resulting from the surcharging of sewers within 200m of the site since 1990.

15.3.58 As there are no records of sewer flooding and no pathway for surcharged water to reach the site, the risk of flooding from this source is considered to be low (see methodology in Vol.2).

Sewers flood risk from the proposed development

15.3.59 Following the construction of the proposed development, the Heathwall Pumping Station CSO and the South Western Storm Relief CSO would be intercepted so that flows are diverted to the main tunnel. The Heathwall Pumping Station CSO would be intercepted downstream of the Pumping Station. Although the South West Storm Relief CSO discharges into the river directly adjacent to the Heathwall Pumping Station CSO, the two systems are hydraulically separate, and therefore the South West Storm Relief CSO would be separately intercepted. Flows from the two CSOs would be diverted to the same CSO drop shaft on Middle Wharf.

15.3.60 At present sewage discharges from the Heathwall Pumping Station CSO when the capacity of the Southern Low Level Sewer No. 1 is exceeded. Following construction, there would only be a restriction on sewage flows entering the main tunnel should the tunnel be closed or unavailable or in the event of a storm event exceeding design.

15.3.61 The Heathwall Pumping Station CSO outfall would be re-arranged so that flows are pumped to a new high level foreshore outfall apron when the main tunnel is at capacity. The existing culvert would be abandoned and sealed following construction of the new outfall.

15.3.62 Following construction, the South West Storm Relief CSO would discharge, by gravity, directly to the CSO drop shaft. A penstock would be used to restrict the flow to the main tunnel when the tunnel is at capacity. Under these circumstances, the flows from the South West Storm Relief CSO would discharge to the tidal Thames through the existing CSO outfall.

15.3.63 The CSO interception and connections have been designed so that there is no increased flooding risk in the existing system for the 1 in 15 year design storm when compared to the base case scenario[viii]. Further detail is provided in Vol 3 Section 15.

15.3.64 Following the construction of the proposed development the risk of flooding from this source would be unchanged and therefore would remain low.

[viii] The base case scenario comprises the sewage treatment works (STW) Improvements and Lee Tunnel in 2020s.

Artificial sources flood risk to and from the proposed development

15.3.65 There are no nearby artificial flood sources eg, canals, reservoirs, which could lead to flooding of the site.

15.3.66 The flood risk from this source both to and from the proposed development is not applicable at this site and therefore it has not been assessed further.

15.4 Design measures

15.4.1 Design measures have been incorporated into the proposed development to ensure that the risk of flooding to the site and from the site to surrounding areas is not increased during the construction and operational phases. These measures are described below although many have already been referred to in the preceding section.

Tidal and fluvial

Construction

Flood defences

15.4.2 The proposed tunnel alignment runs adjacent to the river wall flood defence and would have the potential to affect the integrity of these defences. During construction the level of the flood defences at the site would be monitored, and where required repairs would be made in agreement with the asset owner and the EA to ensure crest heights of the flood defences at the site are maintained to the existing level. With this strategy in place, no effects of settlement are anticipated.

15.4.3 Design options to preserve the structural stability of the flood defences at this site would be dependent on the contractor's construction methodology. Potential options for the impact to the river wall from surcharge loading and increased water differential may include temporarily supporting the wall within the temporary cofferdam while it is unfilled. Potential options at this site may also include strengthening works to the existing walls and/or temporary works to relieve tie-rod stresses.

15.4.4 It is envisaged that ‘Burland’ damage due to ground movement would be mitigated using pre and post construction survey, monitoring and if necessary reactive repair

15.4.5 As discussed in para. 15.2.3 a cofferdam would be constructed to tie into the existing defences at the necessary statutory flood defence height. This would ensure that the current level of flood protection is maintained during construction. Further information is included in the CoCP (Section 8).

15.4.6 Appropriate Protective Provisions would be agreed with the EA for any works to the existing flood defences or within 16m of the flood defences on the landward side and within the river. These would be agreed prior to any works commencing.

Scour management

15.4.7 During construction the formation of scour would be monitored and mitigation proposed if the scour exceeds agreed trigger values.

15.4.8 Mitigation options could include riprap or rock fill, articulated concrete blocks, gabion mattresses and grout filled mattresses. The detailed approach to the implementation of these mitigation measures would be informed by the monitoring results as well as site specific design requirements. Further details are provided in *Scour Monitoring and Mitigation Strategy* (Vol 3 Appendix L.4).

Emergency plan

15.4.9 Appropriate emergency planning procedures would be adopted by the contractor during the construction phase to mitigate the potential consequences of a breach in the flood defence wall at the site or a failure of the Thames Barrier. Further information is included within the CoCP (Section 8).

Operation

Flood Defences

15.4.10 The permanent operational area would be protected from flooding through the provision of a new flood defence wall as outlined in para. 15.2.7. This would be located along the periphery of the operational area and would tie into existing flood defences, providing a continuous defence line at all times.

15.4.11 The new defences would be designed to ensure that future flood defence raising can be achieved to meet the TE2100 requirements.

15.4.12 As the new flood defence wall would be constructed to the same height as the existing flood defence level, the residual flood risk to the site would be unchanged compared to the existing scenario. As detailed in para. 15.5.4 and in Vol 3 Section 15, the residual risk to the site is considered to be appropriate and no further measures are required.

Loss of volume from the tideway

15.4.13 As discussed in para.15.3.30, the result of removal of tideway flood storage on flood levels has been considered on a project-wide basis and is discussed further in Vol 3 Section 15. The floodplain volume loss due to in-river structures has been minimised whilst maintaining fundamental engineering requirements and therefore no further measures are proposed.

Scour management

15.4.14 The shape of the protrusion for the permanent works has been designed to minimise the influence on river on the flow regime of the tidal Thames.

15.4.15 As a proactive approach permanent scour protection would be provided at the toe of the new flood defence river wall. It is assumed for the assessment that permanent scour protection would consist of loose large stone placed just below foreshore level. This permanent protection would be within the area of the temporary cofferdam.

Emergency plan

15.4.16 During the operational phase the site would not be permanently staffed. The site would be subject to occasional visits from maintenance personnel. An emergency plan would only be required for staff undertaking maintenance visits.

Surface water

Construction

15.4.17 In accordance with the CoCP all site drainage during construction would be drained and discharged to mains foul or combined sewers and where this is not practicable, the site would be drained such that accumulating surface water would be directed to holding or settling tanks, separators and other measures prior to discharge to the combined or surface water drains. Foul drainage from the site welfare facilities would be connected to the mains foul or combined sewer. Whilst this approach would help manage the risk of flooding from this source during construction, it would not reduce the level of risk associated with this flood source.

Operation

Scour management – surface water discharge

15.4.18 As outlined in para. 15.3.43 it is intended to discharge surface water from the operational site directly into the tidal Thames. This outfall would be of appropriate size for the potential discharge volumes.

15.4.19 A scour protection apron is included within the operational layout for the site. This would provide sufficient scour protection in front of the surface water outfall and therefore no additional measures are proposed.

Surface water management

15.4.20 Measures are required to ensure that surface water is effectively managed on the site and the flood risk to the surrounding area does not increase as a result of the permanent development on the site.

15.4.21 As described in para.15.3.43 surface water runoff from the site would be discharged directly to the tidal Thames. Due to the tidal nature of the receiving watercourse, surface water runoff rates would not increase surface water flood risk to the site or surrounding area and would therefore not require attenuation prior to discharge.

Groundwater

Construction and operation

15.4.22 Groundwater monitoring is proposed during construction and operation. Further measures regarding dewatering and maintaining groundwater levels are described in Section 13 of this volume.

Sewers

Construction

15.4.23 The South West Storm Relief CSO and the Heathwall Pumping Station CSO would be intercepted and flows would be diverted into the main tunnel. The Heathwall Pumping Station CSO would be re-arranged so it discharges onto a new foreshore outfall apron when the main tunnel is full, with the existing culvert being abandoned and sealed during construction. There are no other diversion works proposed for the site. No other sewers would be modified as a result of the works.

15.4.24 During the interception of the CSOs, sewage flows would be diverted within the network for the short duration of the breaking out/removal of the existing sewer, and the works would be managed so that the breaking out/removal works took place during dry weather (when the CSOs would be empty).

Operation

15.4.25 Following construction, there would only be a restriction on sewage flows entering the main tunnel should the tunnel be closed or unavailable or in the event of a storm event exceeding design.

15.4.26 The Heathwall Pumping Station CSO outfall would be re-arranged so that flows are pumped to a new high level foreshore outfall apron when the main tunnel is at capacity. The existing culvert would be abandoned and sealed following construction of the new outfall.

15.4.27 The South West Storm Relief CSO would continue to discharge through the existing outfall when the main tunnel is at capacity.

15.5 Assessment summary

Flood risk

15.5.1 The Heathwall Pumping Station site is located in Flood Zone 3a and 3b associated with the tidal Thames. As part of the proposed development, flood defences would be constructed, providing protection to the site from tidal flooding during both construction and operation.

15.5.2 In accordance with the requirements of the NPS, this FRA demonstrates that the proposed development is appropriate for the area as flood risk to the development would remain unchanged, as it would be managed through design measures and the development would not lead to an increase in flood risk on the surrounding areas. Therefore no significant flood risk effects are likely.

15.5.3 Vol 15 Table 15.5.1 provides a summary of the findings of the FRA undertaken for this site.

Residual risk to the proposed development

15.5.4 The residual risk to the site is the risk that remains after all design measures have been incorporated.

15.5.5 The site is at residual risk of tidal flooding in the event of a breach in the local flood defence wall along the edge within the system and surcharge through manholes and gullies.

15.5.6 It is considered that the consequence of a breach or failure of flood defences or a failure of the pumping station, would not compromise the long term operational function of the tunnel and therefore no additional mitigation measures above those outlined above are proposed. Further detail is provided in Vol 3 Section 15.

Residual risk from the development

15.5.7 Following the incorporation of the design measures outlined in Vol 15 Table 15.5.1, the level of residual risk from the development to adjacent areas would remain unchanged. The project wide residual risks are discussed in Vol 3 Section 15.

Vol 15 Table 15.5.1 Flood risk – FRA summary

Source	Pathway	Current flood risk to the proposed development	Design measures	Flood risk from the proposed development (post design measures)	Flood risk to the proposed development post design measures
Tidal	tidal Thames	Foreshore - very high Inland – high (but residual only)	Flood Defence height maintained. New flood defences built around the site so site defended from tidal flooding to statutory level (changing the Flood Zone from 3b to 3a). Scour management monitor and mitigate approach. Scour protection measures for permanent works. Monitoring of flood defence levels and repaired as required to maintain existing crest level.	No increase in tidal flood risk as a result of proposed development.	High due to change of foreshore site risk from Flood Zone 3b to 3a (but risk is residual only)
Fluvial	tidal Thames	Foreshore - very high Inland – high (but residual only)	New flood defences built around the site so site defended from fluvial flooding to statutory level (changing the Flood Zone from 3b to 3a). Scour management monitor and mitigate approach. Scour protection measures for permanent works. Monitoring of flood defence levels and repaired as required to maintain existing crest level.	No increase in fluvial flood risk as a result of proposed development.	High due to change of foreshore site risk from Flood Zone 3b to 3a (but risk is residual only

Source	Pathway	Current flood risk to the proposed development	Design measures	Flood risk from the proposed development (post design measures)	Flood risk to the proposed development post design measures
Surface water	Surrounding area	Low	Site drainage during construction in line with CoCP (Section 8). Discharge surface water to tidal Thames	No increase in surface water flood risk as a result of proposed development.	Low
Ground water	Underlying geology and groundwater levels restricted pathway	No risk	Monitoring proposed during construction and operation.	No increase in groundwater flood risk as a result of proposed development.	No risk
Sewers	Local drainage system	Low	CSOs maintained during construction. Flows diverted to the re-arranged Heathwall Pumping Station CSO outfall when discharge into the main tunnel is precluded.	Low	Low
Artificial sources	None	Not applicable	Not applicable	Not applicable	Not applicable

References

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

[2] Great Britain. *Thames River Protection of Floods Amendment Act 1879* London, The Stationery Office.

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

[4] Communities and Local Government. *National Planning Policy Framework (March, 2012).*

[5] Environment Agency. *National Flood and Coastal Defence Database* (October, 2011).

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

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

[8] Defra and Environment Agency. *Flood Risk to People, The Flood Risk to People Methodology (FD2321/TR1)* (March 2006)

[9] Environment Agency. *Thames Tidal Defences Joint Probability Extreme Water Levels 2008 Final Modelling Report* (April 2008).

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

[11] Greater London Authority. *The London Plan Spatial Development Strategy for Greater London* (July 2011).

[12] Mayor of London. Greater London Authority. *Securing London's Water Future. The Mayor's Water Strategy* (October 2011).

[13] Thames Water. *Sewer Flooding Records* (received June 2012).

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