Thames Tideway Tunnel
Thames Water Utilities Limited

Application for Development Consent

Application Reference Number: WWO10001

Sustainability Statement

Doc Ref: **7.07**

Appendix A

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

Hard copy available in

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January 2013

Thames Tideway Tunnel

Creating a cleaner, healthier River Thames

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Appendix A: Sustainability appraisal - Thematic

A.1 Water quality

National policy and legislation

NPS (2012)

The NPS sets the requirements for assessing the effects on water quality and resources. It states that the decision maker will generally need to give impacts on the water environment more weight where a project would have adverse effects on the achievement of the environmental objectives established under the Water Framework Directive, and that relevant River Basin Management Plans have been given due regard.

Water Framework Directive (2000)

The WFD was transposed to UK law in 2003[1]. It is designed to prevent further deterioration of water quality and aquatic ecosystems, promote the sustainable use of water resources, reduce pollution from priority sources, and reduce groundwater pollution. The WFD has four objectives relevant to the project:

- WFD objective 1: Prevent deterioration of the status of all bodies of surface water.
- WFD objective 2: Protect, enhance and restore all bodies of surface water, with the aim of achieving good surface water status by 2015 (or 2027 where measures would take longer to implement).
- WFD objective 3: 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 (or 2027 where measures would take longer to implement).
- WFD objective 4: Reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances.

Thames River Basin Management Plan (2009)

The RBMP sets out the targets for improving the water environment within the Thames River Basin District[2]. It highlights the pressures in the river basin district including diffuse pollution from urban sources and point source pollution from water industry sewage works, particularly CSOs. It also highlights actions to meet the targets, including development of the Tideway Tunnels.

Other policy and drivers

NPPF (2012)

The NPPF states that planning should contribute to and enhance the natural environment by preventing both new and existing development from contributing to, or being adversely affected by, unacceptable levels of water pollution[3].

[1] EU (2000) *Water Framework Directive (2000/60/EC)*, transposed by HM Government (2003) *The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (S.I. 3242)*.

[2] Defra and Environment Agency (2009) *River Basin Management Plan – Thames River Basin District*, Environment Agency, Bristol.

[3] DCLG (2012) *National Planning Policy Framework*, DCLG, London.

London Plan (2011)

The London Plan is a key driver for the delivery of sustainable development including the protection and improvement of water quality and efficient use of water resources. Specifically, policy 5.14 sets out support for the Thames Tideway Tunnel in principle[4].

London Water Strategy (2011)

The Mayor's water strategy sets out 20 actions to improve London's use of and effect on water resources. In particular, 'Action 19' specifically highlights that the Mayor will work with Thames Water to implement the Thames Tideway Tunnel to greatly reduce discharges from CSOs and improve the quality of water in the River Thames[5].

Local Authority Local Development Framework Core Strategies

The various LDF Core Strategies set out policies to promote the protection and enhancement of the natural environment including water resources, appropriate to the needs of the locality.

Thames Water Corporate Guidance

Thames Water has defined a series of sustainability themes which will be used to shape its future plans. Two relate to water and water quality:

- Precious Water – driving down demand
- Sustainable drainage – preventing sewer flooding and pollution

Selection of the objective

The government's AoS for the Waste Water NPS considers the relationship a Thames Tunnel solution has with the objective to 'maintain and enhance water resources and quality'. The findings of the AoS were supportive of a tunnel solution, concluding that there would be a significant positive effect arising, particularly on water quality through the control of point source pollution. The government's findings identified:

- a positive effect on contributing to achieving good ecological potential in the Thames Estuary by 2027
- a significant positive effect on improving water quality by reducing CSO discharges
- uncertain effects from dewatering on groundwater abstraction licensees.

For the project appraisal, the principal driver for the objective arises from general alignment with the government's AoS framework, which assesses the contribution a Thames Tunnel solution would make towards maintaining and enhancing water resources and quality. This appraisal does not consider the relationship with the quantity of water resources used, since this has been addressed under resources and raw materials, in recognition that water is a resource required for the construction of the project. Having regard to the relevant policy context, existing AoS of the NPS and Thames Water's sustainability ambitions, the sustainability objective used for the project in relation to this theme is to "maintain and enhance river water quality".

Sustainability appraisal

"Maintain and enhance river water quality"

Guide Question: Will the project protect surface and groundwater quality?

The primary design intent of the project is to intercept CSOs and, in doing so, improve water

[4] Mayor of London (2011) *The London Plan*, GLA, London.

[5] Mayor of London (2011) *Securing London's Water Future – The Mayor's Water Strategy*, GLA, London.

quality within the tidal Thames. This is a substantial benefit in sustainability terms, to which the project would contribute significantly once in operation. These benefits are discussed further below.

The construction phase of the project has the potential to affect water quality, for example in relation to the potential of spills or sediment loads entering the river. Construction works are often necessary in or adjacent to the river bed. Deep excavation works and associated pumping would also be necessary, which may impact ground water.

With regards to surface water, the following activities could impact water quality in the river, primarily through disturbing sediments:

- dredging
- piling (including cofferdam construction)
- campshed construction
- barge operations
- loss of material (excavated material and fill material supplied) during transfer to barges.

Furthermore, in river structures are proposed on a number of sites which cause the potential for scour, and the deposition of sediments. The construction works associated with the Thames Tideway Tunnel would give rise to the disturbance and release of fine sediment. It has been estimated that the total fine sediment losses from the Thames Tideway Tunnel construction activities would be 14,600t (approximately 7,300m^3). The largest contribution to this total is from scour, which accounts for 5,900t (approximately 2,950m^3) and material losses, which account for 4,000t (approximately 2,000m^3). The smallest contributions arise from dredging and piling, 1,000t and 900t respectively (approximately 500m^3 and 450m^3). The existing sediment levels within the tidal Thames have been estimated to reach a peak of more than 40,000t in each tide as highlighted in *Volume 3, Section 11: Water resources – surface water* of the *ES*. In this context the release of 14,600t over the six year construction period would represent a small additional input of less than 10t per tide on average, which is an increase of 0.025%.

The project has undertaken an EIA which has identified the potential risks from the activities. Appropriate design measures to minimise such events have been incorporated in the plans and best practice construction techniques have been specified. These include stringent spill control measures at each of the site, which are brought forward through the *CoCP*. As such, it is anticipated that the construction of the scheme would not have any significant effect on surface water quality when considering the project as a whole. Further information is found within V*olume 3, Section 11: Water resources – surface water*. Localised impacts may however occur, which are explained within the water quality section of the site specific sustainability appraisal (Appendix B).

Whilst the objective principally relates to river water quality, the project has the potential to affect groundwater and other water bodies, which can directly and indirectly affect river water quality. Consequently, it is important to apply a holistic approach to issues that may affect river water quality and give some consideration to them.

Some 43% of groundwater bodies in the Thames river basin region are classified as being of good chemical status. The main reason identified for poor groundwater quality is linked to high or rising nitrate concentrations with some failures for pesticides and other chemicals.

The groundwater sources in the eastern part of the Thames are identified as being of poor groundwater quality and are anticipated to continue in this condition until post 2015[6].

Due to the ground conditions in which shaft construction would occur, the construction of the project would result in dewatering being required, particularly in the eastern section of the route. Modelling has been undertaken as part of the EIA and has concluded that at the majority of sites there would be negligible or minor adverse effects. Where moderate or major adverse effects were typically identified at an early stage (at Kirtling Street and King Edward Memorial Park Foreshore), measures have been proposed (predominantly involving internal dewatering), which has resulted in the effects being assessed as being negligible or minor adverse. Further details are available within the water quality chapters of the *Environmental Statement*. In terms of sustainability, dewatering would only occur during the construction of the scheme and has been substantially reduced as a result of design development in consultation with stakeholders. Similarly, the number of abstraction licence holders who would experience adverse effects has been reduced. In all cases, water arising from the dewatering process would be disposed of in a way which protects water quality in the river. Any discharges would be subject to the necessary treatment measures in accordance with the *CoCP* as well as regular monitoring and licences from the EA to ensure the quality of the water is appropriate for discharge. There are not anticipated to be any significant effects on groundwater quality during operation.

Guide Question: Will the Thames Tideway Tunnel enhance and prevent deterioration of water quality in the River Thames and Thames Estuary through point source pollution?

For centuries, the River Thames has been a key thoroughfare of London and has served a number of purposes, including the disposal of waste. Following the infamous 'great stink' of 1858 the world's first major combined sewage system was designed and built which reduced sewage pollution to the river. However due to the highly urbanised environment, discharges from industrial activities and surface water run-off meant that the water quality was still very poor. The tightening and enforcement of environmental legislation and the reduction in industrial activities within London resulted in a substantially improved river water quality since the 1970s[7]. However, a negative trend in water quality was subsequently observed during EA monitoring between 1985 and 1995, with water quality reducing from grade A (good water quality) to grade B (fair water quality) as assessed under the estuary classification scheme. Under the Water Framework Directive assessment methodology, the upper river (Teddington to Battersea Bridge) currently has moderate potential ecological status and good chemical status. However, further downstream (Battersea Bridge to Mucking Flats) although the ecological status is considered to be moderate potential, its chemical status is considered to fail[8].

Over 39 million m^3 of untreated sewage is discharged (varying between 10% and 90% concentration depending on the conditions) through CSOs into the River Thames each year. The deterioration in water quality is high due to increased levels of ammonia, pathogens and other substances, a reduction in dissolved oxygen, as well as general litter and debris

[6] Defra and Environment Agency (2009) *Water for Life and Livelihoods: River Basin Management Plan Thames River Basin District*, Environment Agency, Bristol.

[7] Thames Tunnel (2012) *Why does London's river need the Thames Tunnel?*, Thames Water [available www.thamestunnelconsultation.co.uk].

[8] Thames Tunnel (2011) *Preliminary Environmental Information Report*, Thames Water [available www.thamestunnelconsultation.co.uk].

without an appropriate response. The volume of CSO discharges is likely to increase in the future due to the growing population of London[9].

A number of recent events have highlighted the effects of CSO discharges and their effect on reducing water quality resulting in substantial fish fatalities. The current situation fails to meet the legislative requirements of the Urban Waste Water Treatment (UWWT) Directive, and the UK would be subject to enforcement action.

The operation of the Thames Tideway Tunnel, in combination with the Lee Tunnel (currently being constructed), would lead to a major reduction of point source pollution from CSOs into the tidal Thames. The modelling undertaken for the EIA process demonstrates a reduction from over 50 spills per year to up to four spills per year (in the Typical Year). This would result in an 87% reduction in the volume of combined sewage entering the tidal Thames.

Guide Question: Will the Thames Tideway Tunnel help to achieve Good Ecological Potential Status in the Thames Estuary by 2027?

The operation of the tunnel is anticipated to have a significantly beneficial effect on water quality, as it would provide the infrastructure necessary to substantially reduce CSO discharges. It would also provide the capacity needed to manage the increased volume of sewage from the growing population as well as potential surface run-off caused by climatic changes to the intensity and frequency of rainfall events.

Water Framework Directive objectives 2 and 3 have the aim of achieving good potential for a waterbody. While the Thames Tideway Tunnel would not result in good status being achieved for the entire tidal Thames, it represents an important step towards it by moving an additional 13km of the tidal Thames to 'good potential' from 'moderate potential'. Further details are available in *Vol 3 Appendix I.1* of the *ES*. For the section of the tidal Thames which would remain at moderate potential, there would be an improvement in Dissolved Oxygen (DO) levels as a result of the Thames Tideway Tunnel. The Thames Tideway Tunnel would assist the Thames Upper and Thames Middle waterbodies in reaching 'good potential' in combination with other measures proposed for the water body as part of the Thames River Basin Management Plan (2009). It would therefore be an important contribution to achieving good ecological potential.

[9] Thames Tunnel (2012) *Why does London's river need the Thames Tunnel?*, Thames Water [available www.thamestunnelconsultation.co.uk].

Summary

Short term:
During construction, a number of activities would have the potential to adversely affect surface water quality. This principally includes the development of in river structures which have the potential for local sedimentation and scour to occur. It has been assessed that, at a project wide level, the in-river works would result in the release of 14,610t (approximately 7,305m^3) of fine sediment over the course of construction. The peak release of fine sediments is anticipated to occur in 2017 and would result in 4,870t (approximately 2,435m^3). The largest contribution to this would be from scour and potential losses of material during transfer to barges. However, the total peak year release of fine sediments is an order of magnitude less than the natural variation of sediment load in the river (100,000 – 190,000t (approximately 50,000 – 95,000m^3) per year). Impacts would be controlled through the *CoCP*, and it is not anticipated that any significant adverse effects on surface water quality to the river would occur across the project as a whole. The objective to maintain water quality during construction would be achieved.

Medium to long term:
The operation of the Thames Tideway Tunnel would enhance water quality by substantially reducing CSO discharges. The Thames Tideway Tunnel would enable the Thames to meet the requirements of the UWWTD and move towards achieving Good Ecological Potential, although this standard would not be directly achieved by the Thames Tideway Tunnel alone. The scheme therefore supports the objective over the longer term by enhancing water quality.

A.2 Biodiversity

National policy and legislation

NPS (2012)

The NPS describes how the applicant should show that the project has taken advantage of opportunities to conserve and enhance biodiversity. It states that "development should aim to avoid significant harm to biodiversity and ecological conservation interests, including through mitigation and consideration of reasonable alternatives where significant harm cannot be avoided, then appropriate compensation measures should be sought" (4.5.6).

The NPS also states that "development proposals provide many opportunities for building-in beneficial biodiversity or geological features as part of good design. When considering applications, the decision maker should consider the extent to which the applicant has maximised such opportunities in and around developments" (4.5.14).

Wildlife and Countryside Act (WCA) (1981)

The Wildlife and Countryside Act 1981 is the main UK legislation relating to the protection of named animal and plant species and includes legislation relating to the UK network of nationally protected wildlife areas: Sites of Special Scientific Interest (SSSIs).

UK Biodiversity Action Plan (UK BAP) (1994)

The UK BAP describes the UK's biological resources and commits to a detailed plan for the protection of these resources, focusing on key habitats and species considered to be of particular significance to nature conservation within a UK context.

Other policy and drivers

NPPF (2012)

The NPPF recognises that planning should play a role in protecting, enhancing and contributing to the natural environment. This includes minimising impacts on biodiversity and providing net gains in biodiversity where possible. The NPPF sets out measures to minimise the impact on biodiversity including by planning for biodiversity at a landscape level across local authority boundaries.

London Plan (2011)

The London Plan is a key driver for the delivery of sustainable development, including the protection and enhancement of biodiversity. Policy 5.3, requires that development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and that they are considered at the beginning of the design process. This includes consideration to promote and protect biodiversity and green infrastructure.

Policy 7.3, requires that development proposals should, wherever possible, make a positive contribution to the protection, enhancement, creation and management of biodiversity. Proposals should also not adversely affect the integrity of European sites, and be resisted where they have significant adverse impact on European or nationally designated sites or on the population or conservation status of a protected species, or a priority species or habitat identified in a UK, London, or appropriate regional BAP or borough BAP.

Mayor's Biodiversity Strategy (2005)

This sets out the Mayor's strategic priorities for biodiversity in London and includes targets of no net loss of Sites of Importance for Nature Conservation, and that the areas of deficiency in access to wildlife sites are reduced.

Thames Water Corporate Guidance

As part of its ongoing commitment to sustainability, Thames Water has defined a sustainability theme 'Responsible operations – Investing in communities and being good neighbours'. As part of this it has developed its Biodiversity Strategy in 2012, which has a number of specific objectives with a focus for increasing access to nature and enhancing biodiversity within the Thames Water estate.

Selection of objective

The relationship between the Thames Tideway Tunnel project and the biodiversity of the tidal Thames is closely linked. The government's AoS appraised a Thames Tunnel solution against the sustainability objective 'to maintain and enhance biodiversity'. It identified that there would be the potential for both positive and negative effects on biodiversity. Through addressing the on-going problem of untreated sewage being discharged into the Thames Tideway, water quality would improve. It found that, in particular, if the problem of de-oxygenation of the water was reduced, it would substantially benefit fish species. However, the appraisal concluded that there would be an uncertain effect against this objective, as insufficient information was available to understand the location of worksites and impacts from the use of the river. It concluded that there would be a:

- positive effect on fish species within the Thames
- a potentially negative effect on bird populations in the Thames estuary due to changes in nutrient status
- potential impacts on ecology from increased river transport.

The sustainability appraisal builds on the government's findings and applies the objective to "maintain and enhance biodiversity".

Sustainability appraisal

"Maintain and enhance biodiversity"

Guide Question: Will priority habitats and species, and sites designated for their nature conservation value, including the Lee Valley SPA and Thames Estuary and Marshes SPA & Ramsar site, be protected and enhanced?

The tidal Thames is part of the proposed South East Marine Conservation Zone (MCZ) that was submitted to government in early 2012. The purpose of MCZs is to protect the full range of nationally important biodiversity, as well as certain rare and threatened species and habitats. The Thames Tideway offers important spawning habitat for smelt, and is one of the species for which the proposed South East MCZ would be designated.

The EIA process has identified relevant designated sites and given consideration to the effects the project may have on them. These sites include the proposed MCZ as well as Sites of Special Scientific Interest (SSSI), Sites of Metropolitan Importance (SMI), Local Nature Reserves (LNR) and Site of Nature Conservation Importance (SNCI).
European law and UK legislation and policy afford the highest level of protection to Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and internationally important wetlands (Ramsar sites), collectively referred to here as 'European sites'. Regulation 61 of

the Habitats Regulations requires the Competent Authority before authorising a project 'to make an appropriate assessment of the implications for that site in view of that site's conservation objectives', otherwise known as a 'Habitats Regulations Assessment' (HRA).

In undertaking a strategic level HRA for the Thames Tideway Tunnel solution, the NPS for Waste Water HRA concluded that that the project would not have a significant effect on the following European sites:

- Lee Valley Special Protection Area (SPA) (also a Ramsar site),
- South West London Waterbodies SPA (also a Ramsar site),
- Benfleet and Southend Marshes SPA (also a Ramsar site),
- Outer Thames Estuary SPA,
- Wimbledon Common SAC,
- Richmond Park SAC,
- Epping Forest SAC,
- Wormley Hoddesdonpark Woods Special Area of Conservation (SAC).

In relation to the Thames Estuary and Marshes SPA and Ramsar site, the NPS for Waste Water HRA concluded that: "the effects of the two NSIP schemes [Deephams STW and the Thames Tideway Tunnel] on the Thames Estuary and Marshes SPA and Ramsar site are uncertain, and therefore that a detailed Appropriate Assessment will be required at the project level on the basis of a more clearly defined scheme specification and design."

A HRA screening of the potential effect of the Thames Tideway Tunnel project on European sites, has concluded beyond reasonable scientific doubt that there would be no likely significant effects on any of the above European sites, either alone or in-combination with other projects and plans. Natural England has been supportive of the project, and have stated that they are in agreement with the approach and methodology Thames Water has taken to the HRA, as well as the conclusions drawn by the assessment. Further details are available within the *Habitats Regulations Assessment: No Significant Effects* Report which accompanies the application.

Volume 3, Section 5 – Aquatic Ecology of the *ES* sets out project wide effects. This includes an assessment of effects, both beneficial and adverse on habitats and species. In general, the majority of effects during construction would be negligible to minor adverse when considering effects on habitats and species. There would be a moderate beneficial effect on fish populations once the Thames Tideway Tunnel is operational as a result of a reduction in low dissolved oxygen fish mortalities. There would also be an increase in the diversity and abundance of fish and invertebrate populations as a result of improvements in water quality, making conditions more favourable for these species to thrive. The benefits are explored further below.

Guide Question: Will the Thames Tideway Tunnel result in no net loss of wildlife sites in London in accordance with the Mayor's Biodiversity Strategy?

Through the project's planning, the objectives of the Mayor's Biodiversity Strategy have been taken into account. Careful consideration has been given to the ecological sensitivity of sites during the site selection process to avoid negative effects on wildlife sites.

The Mayor classifies wildlife sites (Sites of Importance for Nature Conservation) into different tiers, dependent on their relative importance. Sites of Metropolitan Importance are the most important sites. The second tier is Sites of Borough Importance, and the third tier is Sites of Local Importance.

The foreshore sites are classified as being within the River Thames Site of Metropolitan Importance. The project would lead to the permanent loss of some 1.3ha of foreshore sites, associated with the permanent foreshore structures. The *ES* identifies that this represents 0.001% of the total area of the River Thames and tidal tributaries SMI. Whilst the area is relatively small, the effect associated with foreshore loss is considered to be moderate adverse, since although it is a small percentage of the Thames Tideway, it represents a permanent loss of designated habitat.

As a result of this, opportunities for habitat compensation have been evaluated for the project. The mitigation and compensation hierarchy sets out the preferential order in which to address effects on biodiversity: prevent, reduce and then compensate. In those cases where prevention, and subsequently mitigation is insufficient to maintain the ecological resources at a specific site, compensation schemes would be implemented, as per the hierarchy, with preference given to on-site compensation in the first instance. If this is not possible, off-site compensation would be considered.

Guide Question: Will the project contribute to the protection, promotion and management of aquatic ecology?

Due to the need to work in or adjacent to foreshore sites, there is potential to impact the aquatic environment during construction.

As documented in the Environment Agency's 'State of the Environment Report' (2012), the River Thames represents the largest continuous natural habitat in London, contributing 1% to the total area of all sites of conservation interest in the capital. However, the pollution that is released from combined sewer overflows can stay in the estuary for up to several weeks, moving up and downstream with the tide, causing a direct impact on fish and other species within the Thames. The potential impacts from construction, which would occur over the short-term must therefore be considered in the context of the significant long term benefits that would occur for the tidal Thames once the tunnel is operational.

At certain foreshore sites there would be a reduction in the extent, and some consolidation of, subtidal and intertidal habitat and an associated reduction in the extent of habitat for fish and invertebrates due to the presence of temporary and permanent structures in the river. Across the project this would affect approximately 6ha of these habitats during construction. The ES considers the temporary loss of foreshore habitat during construction to have a minor adverse effect. This is because measures would be put in place to ensure the removal of temporary structures and the intertidal habitat to be restored following completion of construction. The intertidal and subtidal habitats are expected to recover quickly and be available for colonisation by fish, invertebrates and algae following the removal of temporary structures. At certain sites permanent structures would remain in the foreshore. As stated above, approximately 1.3ha of subtidal and intertidal habitat would be permanently lost to foreshore structures resulting in a moderate adverse effect. The ES also notes that there would be negligible effects on fish movements as a result of the permanent structures in the foreshore.

Construction practices would be implemented to ensure that potential impacts to aquatic ecology are limited. Examples include:

- control measures to prevent spills of chemicals or silty water into the river during construction
- restrictions on dredging at sites close to fish spawning areas
- use of specialist piling techniques to minimise under water noise and vibration
- careful consideration of lighting to minimise disturbance to aquatic wildlife, particularly photophobic species.

Once in operation, one of the most beneficial effects of the project is predicted for fish populations. This would be realised through a reduction in wastewater entering the Thames and a consequent reduction in the occurrence of low dissolved oxygen related fish mortalities. Over 125 species of fish have been recorded in the River Thames including species such as migratory sea trout and those more sensitive to pollution such as shad and smelt. The Thames Tideway is important, because it can support a range of marine and fresh water fish through different stages of their life cycle, while estuaries are important for species that rely upon sheltered waters for protection, making them ideal for spawning adults and as nursery areas for young fish. Therefore the direct improvements which arise from the Thames Tideway Tunnel project in regards to water quality of the Thames would provide conditions which are conducive to species being better able to survive and live within the Thames. Such benefits would increase over time and could lead to a greater distribution of pollution sensitive fish species, an improvement in the quality of foraging habitat, and improvements in invertebrate populations as a result of improved dissolved oxygen and reductions in ammonia.

Guide Question: Will the project contribute to the protection, promotion and management of terrestrial ecology?

Ecology was one of nine environmental disciplines considered during the site selection process. All proposed sites have been subject to phase 1 ecological walkover surveys. In general, the large majority of sites are of low ecological value, and any features that were found are typically significant at the site level only. Where potential for protected species was identified, the relevant surveys were undertaken.

The site specific appraisal (Appendix B) provides further details on the ecological status of each site. Further details are also available within the terrestrial ecology chapters of the ES.

Throughout the construction phase, measures would be implemented through the *CoCP* to ensure the protection of ecological features. For example:

- the contractor would prepare an ecology and landscape management plan to ensure procedures are implemented to control and limit the disturbance to areas of conservation interest and legally protected and notable species
- lighting would be designed with consideration to terrestrial ecological receptors so as to prevent disturbance to notable species and ecologically sensitive areas
- where trees are retained on site they would be protected in line with BS5837 trees in relation to design, demolition and construction.

The design of the permanent works also has the potential to maintain and enhance aquatic and terrestrial ecology. This would be through measures that include:

- landscaping principles to include native planting and to seek a net gain in trees across the project
- nesting boxes
- consideration to lighting strategies
- fenders on the river wall
- intertidal terraces.

Summary

Short term: During construction there is potential for adverse impacts on aquatic ecology mainly through the loss of foreshore and disturbance. These have been limited through mitigation and, where not possible, through compensation. Surveys for terrestrial ecology indicate limited ecological resources with effects localised to specified sites and confined to the construction phase. In terms of European designations, the screening report identifies that there would be no likely significant environmental effects.

Medium to long term: The operation of the scheme is expected to have significant beneficial effects on water quality within the Thames which would have positive impacts on fish and invertebrate species. In summary the objective to maintain and enhance biodiversity is strongly supported by the project.

A.3 Climate change mitigation

National policy and legislation

NPS (2012)

The National Policy Statement states that the approach to emissions reduction should be aligned with the objectives of Defra's mitigation and adaptation plans to help deliver the UK's obligation to reduce greenhouse gas emissions by 80% by 2050. This should be achieved with regard to carbon budgets stemming from the Climate Change Act 2008, and within the context of the EU Emissions Trading Scheme.

Climate Change Act (2008)

The Climate Change Act introduces targets for carbon reduction up to 2050. By 2050, the UK pledges an 80% reduction in carbon emissions relative to the 1990 baseline. The Act also establishes mandatory carbon budgets which set the UK on a trajectory for achieving these targets.

Other policy and drivers

NPPF (2012)

The NPPF includes policies and supports development which helps to address climate change. These include:

- To help increase the use and supply of renewable and low carbon energy, local planning authorities should recognise the responsibility on all communities to contribute to energy generation from renewable or low carbon sources.
- Plan for new development in locations and ways which reduce greenhouse gas emissions.

London Plan (2011)

The Mayor is committed to making London a world leader in tackling climate change. Policies set out in Chapter 5 would deliver this intention.

In Policy 5.1, the Mayor seeks to achieve an overall reduction in London's carbon dioxide emissions of 60% (below 1990 levels) by 2025. This trajectory for emissions reduction is steeper than that required by the Climate Change Act, emphasising the intention to substantially reduce emissions within the region.

Thames Water Corporate Guidance

Climate change is an important aspect of Thames Water's future planning. It has established a theme of climate change mitigation – minimising its carbon footprint – and has established a commitment to reduce its contribution to climate change with the aim to reduce emissions in accordance with government policy, the Carbon Reduction Commitment Energy Efficiency Scheme and the Climate Change Act 2008. It has adopted a voluntary target to achieve a 20% reduction in emissions (compared to 1990 levels) for its scope 1 and 2 emissions by 2015.

Selection of the objective

The government's AoS coupled climate change mitigation and adaptation into a single thematic area with the objective "to minimise detrimental effects on the climate from greenhouse gases and maximise resilience and adaptability to climate change".

The sustainability appraisal undertaken for the project decouples the two issues, which, whilst linked by title, are distinctly separate in terms of policy drivers, design implications and relevance to the project. The government's AoS found that a Thames Tunnel solution would have a negative relationship on the ability to minimise emissions due to traffic during construction and operation.

With regard to climate change mitigation, the government's AoS found that the relationship between a Thames Tunnel solution and the objective would be negative. This reflects that emissions would be associated with the sourcing and preparation of construction materials which are likely to include high embodied carbon materials such as concrete and steel. Further emissions are likely to be generated during construction through the movement of materials, waste and workers to and from sites. Operation of new large scale waste water infrastructure would also be energy intensive and is likely to generate carbon emissions both through the treatment process and as a result of vehicle movements associated with the transport of residual waste.

It is noted that there would inevitably be emissions arising from the construction of infrastructure. The objective set for the project is to "Maximise energy efficiency and minimise the carbon footprint of the project", which reflects that opportunities to promote energy efficiency should be taken when possible and practical. Emissions should be considered, with a view to minimise these where economic and in keeping with the wider sustainability goals of the project, which is to deliver a long-term, durable tunnel able to fulfil its role for at least 120 years.

Sustainability appraisal

"Maximise energy efficiency and minimise the carbon footprint of the project"

Guide Question: Has the Thames Tideway Tunnel been designed to be energy efficient?

The tunnel would require energy during construction and in operation. During construction this takes the form of electrical energy from the National Grid, as well as from fixed and mobile plant powered by diesel and petrol. In operation, the tunnel would be powered by electricity from the National Grid.

A number of design measures have been considered during the development of the Thames Tideway Tunnel to minimise energy demands and promote energy efficiency. These include:

- Limited tunnel length from the three options identified at Phase 1, saving energy required for construction, particularly the operation of Tunnel Boring Machines (TBMs).
- Intercepting CSOs upstream from existing pumping stations reduces pumping activities at pumping stations, reducing existing energy consumption from these activities, albeit new pumping activities at the Lee Tunnel would be required.
- Contractors are required to shown to have given consideration to the energy efficiency in the procurement, maintenance and use of construction plant.

Due to the 120 year lifespan of the tunnel, operational energy use is an important consideration to take into account during design. The Thames Tideway Tunnel would require energy in operation, particularly for the operation of fans at the two active ventilation sites (Acton Storm Tanks and Carnwath Road. However, by far the largest demand for energy is from pumping activities at Beckton. Operational energy demand would be 8.5GWh per annum, which over the lifetime of the development equates to approximately 1,000GWh. The design includes a total pumping capacity of $15m^3$ per second. This is comprised of six variable speed pumps which allow for adjustments according to the volume of material requiring pumping from the tunnel.

Guide Question: Has Thames Water assessed energy, carbon dioxide and other greenhouse gases?

The Thames Tideway Tunnel project would require energy in construction and have emissions embedded in materials and other elements of the project life cycle. Emissions have been an important element of the project and considered through the development of an *Energy and carbon footprint report*.

The Thames Tideway Tunnel has applied the Atkins Carbon Critical Model™ to assess CO_2 and other greenhouse gas emissions expressed as CO_2e (carbon dioxide equivalent) arising in construction and operation. The model provides an estimation of the carbon footprint of the project (838,000t CO_2e), by considering the use of materials, transport and logistics, construction plant and machinery and operation against a database of carbon emissions factors. By far the largest source of emissions is from the consumption of materials (703,000t CO_2e or approximately 84% of the entire footprint). However, due to design measures, notably the reduction in length of the tunnel, it has been calculated that some 210,000t CO_2e has been saved. The next largest source of emissions is construction plant and machinery (87,000t CO_2e). This is followed by transport and logistics which accounts for 29,000t CO_2e. Due to the promotion of the use of river transportation, there has been a saving of approximately 7,000t CO_2e.

The model has helped the project team focus on 'hotspots', which are particularly energy intensive areas of the Thames Tideway Tunnel's construction and operation. The model would continue to be used by the appointed contractors to make detailed decisions about material choices and approach to design.

Guide Question: Has Thames Water considered lower carbon solutions?

The Thames Tideway Tunnel has been developed through a series of iterations, during which the emissions of CO_2 have been considered. The Thames Tunnel Strategic Study and other information presented within the *Needs report* identified other options that have been considered. This includes sewer separation, which would involve significant construction work to build a network of alternative sewers and the large scale application of SuDS. Having identified potential solutions to the pollution problem in the tidal Thames, a number of studies have been undertaken to assess the costs and benefits of these solutions, to identify a preferred solution and to undertake an assessment of the impact of that solution. This included consideration of environmental costs, including climate change.

The NPS for Waste Water reflects the alternatives to the Thames Tideway Tunnel that have been considered (paragraph 2.6.26). This included a non intervention strategy, relying on the existing system to mitigate reduced dissolved oxygen levels following discharges in the tidal Thames using the "Thames Bubbler". This makes use of oxygenation as well as

hydrogen peroxide dosing. This could be expected to be a lower carbon solution as it does not require substantial construction work. However, whilst this approach has helped reduce wide scale fish mortality, it is not considered to be a sustainable or complete solution over the long-term, and not considered to be feasible due to the frequency and volume of discharges of untreated waste water and the consequent environmental impacts.

Guide Question: Will the Thames Tideway Tunnel make use of, and contribute to, the production of renewable energy?

The Thames Tideway Tunnel would use grid electricity to power the tunnel in operation. The nature of the UK grid electrical supply is such that currently, the majority of electricity generation is via the combustion of fossil fuels. Consequently the consumption of electrical energy results in the emission of greenhouse gases, principally CO_2 from the combustion process. However grid electricity does, in part, include renewable and other low carbon forms of energy, which help to reduce the carbon intensity of the electricity.

The Climate Change Act sets out a number of challenging targets for the decarbonisation of the United Kingdom such that by 2050, total annual emissions of CO_2 would be reduced to 80% of the mass emitted in 1990. This requires intervention by a number for sectors, including the electricity supply sector to reduce the carbon intensity of the grid. Moving towards this 2050 target, an increasing amount of renewable electricity is likely to make up the mix of electrify in the national grid.

By the time the Thames Tideway Tunnel is constructed in 2023, the CO_2 footprint of the electricity supplied to the tunnel would be lower than that of today (2012). Thanks in part to a greater amount of renewable energy supplying the grid. The amount of energy generated from renewables could be expected to increase through the operational lifetime of the tunnel.

Additionally, opportunities for renewable energy linked directly to the Thames Tideway Tunnel have also been considered. The *energy and carbon footprint report* includes an analysis of the suitability of different types of renewable energy technology available to the project.

The operational phase of the Thames Tideway Tunnel represents the most realistic opportunity to introduce locally generated renewable energy. Whilst any measures remain an aspiration for the purposes of the application, there are a number of opportunities that would be explored, linked to the industry wide voluntary targets of 20% of renewable energy by 2020. The annual requirements for energy demand in operation are 8.5GWh, hence a 20% renewable contribution would represent approximately 1.7GWh.

The capture of sewage, as opposed to its uncontrolled discharge into the river, offers the potential for sewage sludge (the residual product following treatment of sewage) to be used as a fuel source at Beckton. The Lee Tunnel masterplan included provision for an anaerobic digestion plant at Beckton. This would process sewage sludge from the Lee Tunnel into biomethane which would be used as a fuel in onsite gas turbines to generate electricity. The proposed plant was designed with sufficient capacity to process the additional sewage sludge from the Thames Tideway Tunnel. Currently all sewage sludge within the Thames Water region is put to beneficial use, with 72% recycled to agricultural land and the remainder used to generate renewable energy to power Thames Water's sites, or in land restoration (Thames Tunnel Annual Performance Report 2011/2012). It is anticipated that the sludge would be managed in this way at Beckton, although it is not expected that the energy generated for this process would be used to power the tunnel directly.

Other options include the use of a low head mini hydroelectricity plant which would recover energy from the Beckton sewage treatment works main outfall effluent as it drops through several metres to enter the River Thames. A preliminary feasibility study has been undertaken by Thames Water and further investigations suggest that a low head mini-hydro plant could generate at least 20% of the Thames Tideway Tunnel's operational energy requirements. Additionally, the sinking of CSO shafts has been suggested as an opportunity to install heat exchange pipework for ground source heat pumps which could be installed at future developments. Discussions on the feasibility and desirability of this option are ongoing, however, preliminary discussions indicate that this additional infrastructure may compromise the programme and build of the Thames Tideway Tunnel.

The *CoCP* requires energy management plans to be developed by contractors for the project. These encourage that consideration is given to the use of renewable energy to support construction activities, for example on temporary construction/ welfare buildings.

Guide Question: Will the Thames Tideway Tunnel project increase emissions of carbon dioxide and other greenhouse gases?

The *energy and carbon footprint report* identifies that the carbon equivalent embedded in the project to be 838,000t CO_2e during its construction and operation. As reported above, various activities have, and would continue to be, undertaken in an attempt to minimise this. These include measures set out within the *CoCP* (e.g. the requirement for energy management plans) as well as specific design principles, such as for energy efficient lighting).

In operation, the tunnel would require electricity to power pumps and fans. This too has a carbon footprint (estimated to be approximately 19,000t CO_2e over its lifetime), although could be expected to decrease over the life of the project in accordance with government's strategies to decarbonise the electricity supply sector. This has been estimated in the *energy and carbon report* which highlights that in the operating year 2023, the project's carbon footprint in operation would be 2,700t CO_2e.

Through successful implementation of the government's Low Carbon Transition Plan and other strategies stemming from the Climate Change Act (2008), it could be expected that the electricity required for the tunnels operation would be carbon free by the mid-2030s.

Summary

Short term: During construction the project would require energy and generate CO_2 emissions. Efforts have been taken to maximise energy efficiency in design as far as practical and possible, with a view to minimising the developments CO_2 footprint. By far the largest contribution of greenhouse gas emissions would arise during construction activities, the majority of which would be associated with carbon embedded in project materials, notably concrete. The detailed design and specification of materials provides an opportunity to explore practices to reduce this footprint, for example through cement substitutions or by specifying higher recycled content in steel. The extent to which this is possible would be balanced with the need to create a durable tunnel and would be explored with the contractors. In summary the objective would be supported by minimising emissions, although it is noted that substantial emissions would inevitably remain.

Medium to long term: The tunnel would require energy in operation, however the CO_2 equivalent associated with this energy may reduce through government's initiatives for decarbonising the energy supply sector. By 2035 it is envisaged that the carbon intensity of grid electricity would be zero. Consequently, the carbon footprint would be minimised over the operation of the project as explained within the *energy and carbon footprint report*. Similarly, the ventilation strategy for the Thames Tideway Tunnel has been designed in order to maximise passive ventilation, thereby increasing energy efficiency. The objective is supported in operation.

A.4 Change adaptation and flood risk

National policy and legislation

NPS (2012)

The NPS makes specific provisions to take account of climate change, including taking steps to adapt to its future consequences. It requires that applicants should use the latest UK climate projections to ensure they have identified appropriate adaptation measures. The UKCP09 is identified for this purpose. Any adaptation measures should also take account of the government's latest national Climate Change Risk Assessment, when available, and in consultation with the appropriate statutory consultees.

Climate Change Act (2008)

An Adaptation Reporting Power has been established under the Climate Change Act (2008), allowing the government to direct certain infrastructure companies and regulators to prepare reports on how they are assessing and acting on the risks and opportunities from climate change. Thames Water is obliged under the Act to prepare these reports every five years. Its first response to its 'direction to report' was published in January 2011, and recognises the importance of planning for climate change in new infrastructure assets.

Flood and Water Management Act (2010)

The Act provides for better and more comprehensive management of flood risk for people, homes and businesses. It recognises that serious flooding can happen at any time and that climate projections suggest extreme weather will happen more frequently in the future. Therefore, the Act is central to reducing the flood risk associated with extreme weather.

Other policy and drivers

NPPF (2012)

The NPPF recognises that planning plays a key role in helping shape places to minimise vulnerability and provide resilience to the impacts of climate change and flooding. Local Plans should take account of climate change over the longer term, including factors such as flood risk, coastal change, water supply and changes to biodiversity and landscape. New development should be planned to avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure.

Thames Water Corporate Guidance

Thames Water recognises that it has to deliver appropriate adaptation measures to protect public water supplies and the environment in the future. It has developed a sustainability strategy theme Climate Change Adaptation – future resilience, which it will use to measure future initiatives against. Its Adaptation Reporting Power Direction to Report published in January 2011 identifies the Thames Tideway Tunnel as a major capital infrastructure investment project, and states a need to ensure that it is resilient to the effects of Climate Change.

Climate Resilient Infrastructure (2011)

The government's publication identifies that new infrastructure will often have a life of 50 to 100 years (or more). To ensure its viability over its lifetime, new infrastructure needs to be resilient to a climate that could be significantly different in the future. When making decisions

about the provision of national infrastructure it will therefore be important to allow for future climate change and avoid closing off options, making it harder and costlier to adapt infrastructure in the future.

London Plan (2011)

Policy 5.10 requires that development proposals integrate green infrastructure from the beginning of the design process to contribute to urban greening, including within the public realm. Elements that can contribute to this include tree planting, green roofs and walls, and soft landscaping. Major development proposals within the identified Central Activities Zone should demonstrate how green infrastructure has been incorporated.

Policy 5.11 specifically requires that major development proposals are designed to include roof, wall and site planting, especially green roofs and walls where feasible, to deliver the following objectives:

- adaptation to climate change (i.e. aiding cooling)
- sustainable urban drainage (SuDS).

Policy 5.12 relates to flood risk management. Under this policy, development proposals must comply with the flood risk assessment and management requirements set out in PPS25 (Now the NPPF) over the lifetime of the development, and have regard to measures proposed in Thames Estuary 2100 (TE2100) and Catchment Flood Management Plans. Policy 5.12 goes on to state that development adjacent to flood defences will be required to protect the integrity of existing flood defences.

Policy 5.13 states that development should utilise SuDS unless there are practical reasons for not doing so. Development should also aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible, in line with a drainage hierarchy.

Mayors Climate Change Adaptation Strategy (2012)

The Mayor's strategy aims to assess the consequences of climate change on London, enabling it to prepare for the impacts of future climate change and extreme weather. The strategy includes a series of Mayoral actions and priorities for achieving this. The strategy is reliant on Mayoral action, as well as the action brought forward by central government and others. The Strategy sets out the Mayor's support for the Thames Tideway Tunnel due to the recognised potential for increased and more intensive rainstorms to result in a greater number of CSO spills annually.

Selection of the objectives

As identified in the climate change mitigation section above, the government's AoS considered the relationship of a Thames Tunnel solution against a linked objective, addressing both mitigation and adaptation. For this sustainability appraisal the objective is split and drafted to reflect the importance population change, as well as climate change, has on the sustainability of the Thames Tideway Tunnel.

As explored below, the need for the Thames Tideway Tunnel is driven directly from population change and the pollution problem that ensues from uncontrolled CSOs. Therefore the sustainability objective applied to the project is to "maximise resilience and adaptability to change". This reflects the importance of providing a project that is able to withstand both climate and population changes.

Also relevant is the consideration of flood risk. A separate objective has been identified for this purpose, which reflects that flood risk must be taken into account in the design of the project. The objective is "take account of flood risk in the design of sites".

The government's AoS found that there would be positive effects for climate change adaptation. This is because a Thames Tunnel solution would support London's resilience and adaptability to predicted climate change effects by minimising the volume of untreated sewage and rainfall. The appraisal also identified that a Thames Tunnel solution would not have the effect of alleviating flood risk however it would have a positive effect by increasing the capacity of the overall system to convey surface water.

Sustainability appraisal

"Maximise resilience and adaptability to change"

Guide Question: Will the Thames Tideway Tunnel project increase London's resilience and adaptability to the effects of population change?

Population change is an important driver for the project. When the first sewer interceptor system was built in the 1850-1870s the population of London that the system served was approximately three million. The interception sewers were originally designed for a population of four million and since this time, a number of additional sewers have been constructed to meet the demands of a growing population in London. Today, the population within the Beckton and Crossness Catchment has almost reached six million people.

The *Resilience to change* report explains how this growth has been taken into account in tunnel design. It applies population estimates within the London Plan to 2031, and thereafter, up to 2080, by applying a growth factor available from the Office of National Statistics (ONS). Based on this data, estimates suggest the total population in the Beckton and Crossness catchments would increase to over eight million by the 2080s.

A substantially larger population would increase the dry weather flow (DWF) that the sewer system conveys to the STW. This increase in DWF would not be sufficient to significantly influence the frequency with which CSO discharges are projected to occur but would use-up capacity and increase future CSO volumes.

The Thames Tideway Tunnel is part of a substantial investment plan to implement a suite of measures as part of the London Tideway Improvements to ensure London is resilient to

future change. The system upgrades, which include both the Lee and Thames Tideway tunnels and the increased capacity of Beckton and Crossness STWs, all serve to demonstrate how London's sewer network and treatment facilities are being made resilient to change.

Guide Question: Have the future effects from climate change been taken into account?

There is now unequivocal evidence that climate change is occurring, and that it presents a very serious risk. The best available climate projections for the UK are from the United Kingdom Climate Impacts Programme projections (UKCP09), based upon the Met Office Hadley Centre climate models. UKCP09 provides an estimate of the range of model-related uncertainties in the future projections, along with high, medium and low emissions scenarios. Thames Water has taken account of the 10, 50 and 90 percentiles (as required by the NPS) to explore the implications of these uncertainties at different time horizons in the life of the tunnel.

Climate change predictions suggest that warmer, drier summer months and warmer, wetter winter months would occur in the future. Whilst seasonal changes would occur, when considering rainfall across the year, the annual rainfall over the catchment is predicted to be similar to that of today. By the 2080s, it is predicted that wetter winter months would require the Thames Tideway Tunnel to operate more frequently as a consequential increase in the number and volume of discharges fill the tunnel to capacity.

More importantly, in summer months, due to the projected increase in air temperatures and potential for lower river flows into the tidal Thames, the potential risk to ecological harm increases. As explored in the Water Quality section above, this is because river water temperatures would be higher, reducing levels of dissolved oxygen (DO) and there would be less river water to dilute pollution. The Thames Tideway Tunnel has been designed to be resilient to these risks, by using the storage capacity of the tunnel to reduce the potential for storm flows into the river.

Guide Question: Will the Thames Tideway Tunnel project ensure continuity of collection and treatment of waste water during a typical year up to 2080?

Modelling suggests that in a typical year, climate change and population growth would mean that by the 2080s the frequency of CSO discharge events into the tidal Thames across the project as a whole would increase from the average of four that are predicted under present day conditions to an average of five for the median projection, with a range from four (10 percentile) to eight (90 percentile) spill events for the medium emissions scenario. The ES highlights that there would be a maximum spill frequency (which would occur between Greenwich to Henley Road) of 7 events in a typical year. This would be an 86% reduction from the maximum spill events anticipated under the 2080 scenario without the Thames Tideway Tunnel (Volume 3 of the ES). The Thames Tideway Tunnel would therefore continue to provide a good level of service in a plausible range of future conditions, though it is possible that the number of CSO discharge events could exceed the number that is currently considered to be acceptable.

Guide Question: Has Thames Water considered the effect of temperature change (e.g. the urban heat island effect)?

In addition to the effects of temperature change on river water quality, and aquatic ecology, the effects of increased summer air temperatures would also affect above ground development. Mayoral policy and guidance recognises the impacts would be most significant

on buildings and public spaces within the Central Activity Zone (CAZ). This may lead to a greater reliance on active cooling and energy intensive building services. However, for the Thames Tideway Tunnel project the impacts of this are less pronounced, as there would be very few buildings which would be affected in this way, and none of it would be regularly occupied by workers therefore reducing the need for extensive building services.

Changes in the area of hardstanding at sites may produce localised effects with regard to the urban heat island effect by altering the existing thermal mass. However, as many of the sites are adjacent to the River Thames, the effect of urban heat is reduced as a result of open space, increased air movements, and the heat mitigating properties of the water body. The project has considered the issue of urban heat and taken it into account during design. Where possible, the design principles for permanent development has sought to address the urban heat island effect by use of the following measures:

- the integration of planted brown roofs on kiosks and certain other permanent buildings
- a net increase in trees and landscaping across the project
- water saving measures have been considered for the project. These are discussed further in the resources and raw materials section.

Sustainability appraisal

"Take account of flood risk in the design of sites"

Guide Question: Will development associated with the Thames Tideway Tunnel occur in areas at risk of flooding?

The NPS requires that applicants produce Flood Risk Assessments (FRAs) which set out how flood risk has been taken into account. For development found to be within flood zones 2 and 3, applicants should prepare a FRA which demonstrates how the project passes the Sequential Test, and, specifically for developments within flood zones 3, these should address the Exception Test. This requires consideration as to whether the overall sustainability benefits of the project outweigh flood risk considerations (part a of the test), while ensuring the development is safe and does not increase flood risk elsewhere (part c of the test).

Much of London is located within Flood zone 3 – classified as being at high risk of flooding. The site selection process has generally identified sites which were within a corridor 500m from the river although there are exceptions, for example at Acton Storm tanks, which intercepts a CSO and is a main tunnel reception site further inland. The choice and selection of sites has been governed by a number of factors, which favour development near to the river. For the main tunnel drive sites, the benefit of river proximity has, in part, been to enable the use of river transport for the export of excavated materials from sites. For CSO sites, the desirability to intercept overflows as close to the CSO as possible, in many cases reducing the need for long connection tunnels has been a main driver. Consequently, many of the sites proposed for development (and most viable alternatives) are either adjacent to, or on, the foreshore of the River Thames. However, due to the proximity to the river, these areas also tend to be classified as being at higher risk of flooding and therefore are subject to a higher risk flood zone classification.

As the majority of sites are located within flood zone 3, the FRA applies the Exception Test. Volume 3, Section 12 of the ES provides a project wide FRA. This makes reference to the NPS and this *Sustainability Statement* and concludes that the Exception Test would be

passed, as the sustainability benefits outweigh the risks of flooding (part a of the test). It also identifies that part c of the test would be met as the tunnel would not increase the risks elsewhere.

Guide Question: Will the Thames Tideway Tunnel affect flood risk elsewhere in London?

A FRA for the Thames Tideway Tunnel project has been prepared. For the Exception Test part c) to be passed 'a FRA must demonstrate that the project would be safe, without increasing flood risk elsewhere, and, where possible, would reduce flood risk overall' as stated in the Waste Water NPS. The project-wide FRA considered all sources of flood risk throughout the project area. No project-wide risks from surface water, ground water, sewers or artificial sources were identified. Hydraulic modelling demonstrated that the Thames Tideway Tunnel project would have no significant impact on water levels or freeboard. The development in the foreshore provides an increase in the available storage at certain points of the tide by restricting the flow tide up the River Thames and no related mitigation is required or proposed for the foreshore works.

All potential implications to settlement and scour would be managed through onsite mitigation to ensure that there is no decrease in the standard of flood defence. Indeed, the *CoCP* clearly sets out requirements that would ensure that the existing flood defences would not be weakened or compromised.

The project-wide FRA demonstrates that the proposed development would therefore be considered appropriate, flood risk would be managed through appropriate design measures and the development would not lead to an increase in flood risk on the wider surrounding area. Flood risk improvements would be provided for most of the foreshore sites where new flood defences would be constructed as part of the permanent works. Part c of the Waste Water NPS Exception Test has therefore been met and consequently, the guide question is also considered to be supported.

Guide Question: Will the Thames Tideway Tunnel project alleviate potential flood risk?

The approach to the flood risk assessment has followed national policy guidance within the NPS, which in turn refers to other national guidance in the NPPF.

The Thames Tideway Tunnel is not designed as a flood risk solution for London, and as such, would not alleviate flood risk in London. However, there are various mechanisms in place to protect London from flooding. The operation of the Thames Barrier and maintained flood defences along the river length are examples of existing measures which serve to protect London from fluvial and tidal flood risk. In addition, the Thames Estuary 2100 (TE2100) project is designed to provide a long term flood risk management plan for the tidal Thames. This would require some existing defences being upgraded in response to future climate change. The project would support this, for example, the foreshore sites would include new flood defence walls as part of the permanent site boundary, offering an improved condition or maintained flood defence condition at all sites with allowances made for future increases in the heights of defence in accordance with the TE2100 project.

Guide Question: Will the project contribute to the sustainable management of surface water drainage in London?

The implementation of SuDS techniques has been considered for all sites. Details of SuDS

measures that could be applied at each site are provided within the site assessments of the *ES*. Where possible, a direct discharge into the tidal Thames has been the preferred disposal method. The SuDS measures that have been proposed take into account the EA's SuDS hierarchy together with site location, ground conditions and topography. In general, where SuDS techniques are unlikely to be sufficient to provide the required attenuation, the balance would be delivered by underground storage.

Design measures have been incorporated to address effective surface water management in accordance with the draft national standards established by the Flood and Water Management Act 2010. Where development occurs on greenfield sites, post-development run-off would not exceed pre-development run-off rates. At brownfield sites, drainage would comply with the Mayor's essential standard which would use SuDS wherever practical, and achieve a 50% attenuation of the site's pre-development peak surface water run-off rate.

Drainage measures would also be taken into account during construction. Control measures for flood risk during construction are detailed within the *CoCP* and include measures such as the use of permeable paving for all hardstanding surfaces on non-foreshore locations, so far as possible, and limiting surface water flows from sites during construction to existing run-off rates.

Summary

Short term: The implications of change from both population growth and climate change would not be significant during the short term. Specifically with regard to flood risk, the development takes account of flood risk in the design and construction of sites, and would incorporate drainage measures to reduce potential impacts from flooding. No significant changes in flood risk are expected as a result of the development.

Medium to long term: The NPS specifies that applicants should have regard to the predicted scenarios of climate change. The project has taken these modelled scenarios into account. The *Resilience to change report* identifies how the Tunnel would continue to be resilient to population growth and climate change up to 2080, and that additional adaptive measures could be introduced into the system over this period to ensure that water quality continues to be maintained. Consequently, the objective for the project to maximise resilience and adaptability to change would be met over the long term.

A.5 Excavated materials and waste

National policy and legislation

NPS (2012)

Paragraph 4.14.5 of the NPS requires new waste water infrastructure to implement sustainable waste management through the waste hierarchy (described below) and that during construction, excavated soils and subsoils would, where possible, be re-used on site. It requires that the applicants set out the arrangements that are proposed for managing any waste produced and prepare a Site Waste Management Plan. These should include information on the proposed waste recovery and disposal system for all waste generated by the development, and an assessment of the impact of the waste arising from development on the capacity of waste management facilities to deal with other waste arising in the area for at least five years of operation.

Waste Framework Directive (2008)

Article 4 of the revised Waste Framework Directive sets out the waste hierarchy to ensure that waste is dealt with in the priority order of prevention, preparing for reuse, recycling, other recovery and disposal. The Waste Framework Directive was transposed in to UK legislation in 2011[10]. This directly enshrined the waste hierarchy in English law for the first time. The Waste Regulations (England and Wales) require an establishment or undertaking (including waste operators, carriers and producers) to "take all such measures available to it as are reasonable in the circumstances" to apply the waste hierarchy in order to move waste management practices as far up the hierarchy as possible.

Other policy and drivers

Planning Policy Statement 10: Planning for Sustainable Waste Management (2011)

As highlighted in the NPPF (2012), until the National Waste Management Plan is published, PPS10 remains the valid policy driver for waste management. It primarily sets out the responsibilities for waste planning authorities, and policies for local authorities preparing local development documents. Key planning objectives for waste management which are relevant to the Thames Tideway Tunnel project include driving waste management up the waste hierarchy, help implement the EU and national waste policy and the help secure the recovery or disposal of waste without endangering human health and without harming the environment.

London Plan (2011)

The Mayor is committed to a policy framework for waste management which starts from the position that the best approach is to reduce the amount of waste that arises in the first place. Where this is not possible, he supports an approach based on the waste hierarchy that emphasises re-use, and then recycling and composting, before energy recovery and disposal.

Policy 5.20 requires that recycling and reuse levels of construction demolition and excavation (CD&E) waste of 95% are achieved by 2020.

[10] EU (2008) *Waste Framework Directive (2008/98/EC)*, transposed by HM Government (2011) *The Waste (England and Wales) Regulations 2011 (S.I. 988)*

Mayor's Waste Strategies (2011)

The Mayor's waste strategies set out measures to make a step change to be more resource efficient. Making Business Sense of Waste highlights plans to help businesses manage their waste more effectively including developing an understanding of the financial and commercial opportunities for managing waste, providing strategic investment to stimulate the development of new waste infrastructure and using the planning process in London to drive resource efficiency improvements in the construction and demolition sector. London's Wasted Resource strategy focuses on municipal waste and includes initiatives to increase London's recycling rate and provide new waste management infrastructure.

Thames Water Corporate Guidance

Waste is an important part of Thames Water's operations, particularly in the management of sewage sludge. One of its nine sustainability themes, which would be used to guide future plans within Thames Water, relates to 'Efficient Operations', specifically reducing the use of natural resources, minimising waste, and sustainable sourcing.

Selection of the objective

To reflect the direction of all levels of waste policy to address waste in line with a waste hierarchy, the sustainability objective applied to the project is to 'Minimise waste arising and its impacts on the environment and communities and to promote re-use, recovery, recycling and beneficial use'. This objective has been adapted from the government's version, to recognise the importance beneficial use of materials has for the project. The objective also reflects the need to 'drive' sustainable waste management, emphasising Thames Water's commitments in this area and to reflect the extensive activities that have been undertaken to secure this to date.

The government's AoS applies the objective "to minimise waste arisings, promote re-use, recovery and recycling and minimise the impact of waste on the environment and communities". The appraisal expressed uncertainty over the approach to waste management since detailed plans, with regard to the recycling or re-use of waste material associated with construction of a Thames Tideway Tunnel solution, were unknown. The AoS also identified uncertainty as to whether there would be identified outlets for re-use of excavated material and the disposal route for sewage sludge at Beckton.

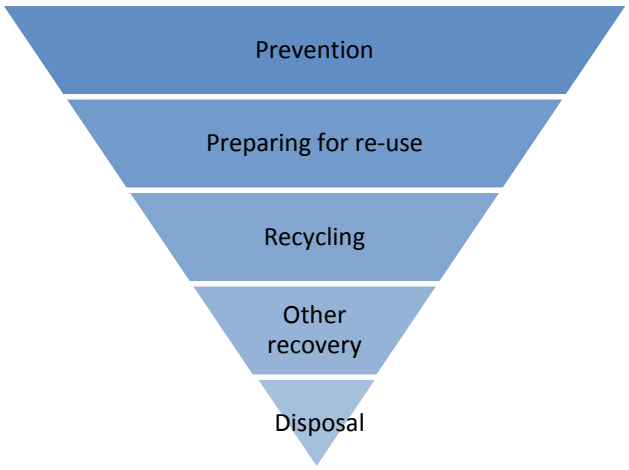
Sustainability appraisal

"Minimise arisings and its impacts on the environment and communities and to promote re-use, recovery, recycling and beneficial use"

Guide Question: Will the project encourage the management of construction, demolition and excavation waste in line with the waste hierarchy (which is prevention, preparing for re-use, recycle, other recovery, and disposal) in accordance with the Waste Framework Directive?

The revised Waste Framework Directive 2008/98/EC sets out the waste hierarchy to ensure that waste is dealt with in the priority order of prevention, preparing for reuse, recycling, other recovery (for example, energy recovery) and disposal as shown in plate A5.1 below.

Plate A5.1 Waste hierarchy



The *Excavated material and waste strategy* (EM&W Strategy) has been prepared in support of the project. The strategy is geared towards managing materials and waste arising from the project's construction, in accordance with the waste hierarchy. The strategy has three objectives, two of which are directly relevant to the hierarchy:

- To minimise waste to landfill by prioritising prevention and seeking to maximise re-use and recycling.
- To maximise beneficial use of excavated material arising from tunnel construction.

Thames Water has set the target to divert at least 80% of construction and demolition waste of the project from landfill. It has also established the target to beneficially use a minimum of 85% of clean excavated material. In working towards these targets, the project would substantially reduce the volume of material that is eventually disposed of through a landfill operation (disposal).

When following the hierarchy, the most sustainable practice is to prevent waste from occurring altogether. For the Thames Tideway Tunnel project this is demonstrated in the proposals to adopt the shortest route option of the three options presented at Phase 1 consultation. The proposed Abbey Mills route is 9km and 6.7km shorter than the River Thames and Rotherhithe routes respectively. This means that the route substantially reduces the volumes of excavated materials generated and, at the same time, removes the potential for waste to be generated from construction activities such as the fabrication of concrete sections. The estimated reduction of excavated material as a result of adopting the shortest route in comparison with the other proposed routes is between 354,000m^3 and 476,000m^3 respectively.

The EM&W Strategy includes further details on how the waste hierarchy would be used during construction.

Apart from the CSO material collected by the tunnel, once in operation the tunnel would generate very little waste directly. The type and extent of the waste generated is evaluated within the EM&W strategy.

The operation of the tunnel system would also increase the volume of solid waste arisings at Beckton STW. Waste produced at Beckton STW comprises the residues remaining after treatment of the sewage by the works. The waste includes:

- grit (which is predominantly recycled)

- fats, oils and greases (currently used in a biodiesel plant)
- rags and other solids (oversize screenings) (these are recycled where possible but some are sent to landfill)
- sewage sludge (which is currently used to produce energy in the on site sludge-powered generator. The residual waste produced from this treatment is made up of ash).

Sewage sludge is the main residual solid waste left of the sewage treatment process. The EM&W strategy estimates that the solid waste arisings at Beckton STW would increase by approximately three per cent as a result of the future operation of the Thames Tideway Tunnel. At present, all sewage sludge treated by Thames Water is put to beneficial use, with 72% treated and recycled to agricultural land as a nutrient-rich fertiliser (known as biosolids). The remainder is used to generate renewable energy to help power Thames Water's sites, or is used in land restoration. It is expected that the operational wastes generated as a result of the Thames Tideway Tunnel would be dealt with by the existing (and proposed) STW processes as part of the normal STW waste stream.

In view of the above, it is concluded that both in the construction and operation of the Thames Tideway Tunnel, waste would be managed in accordance with the UK Waste Hierarchy and the Waste Framework Directive.

Guide Question: Will the project affect existing waste management capacity?

Over 4.7 million tonnes of excavated materials would be generated as a result of construction activities. An assessment has been made of the likely impacts that this quantity of material would have on waste management infrastructure in London, the South East and the East of England. Section 8 of the EM&W strategy provides further details.

The Environment Agency's 'State of the Environment' reports, which have been published for each of these regions, stress that inert landfill capacity within these areas is limited[11,12,13]. In general, there has been a declining trend in the tonnage of construction, demolition and excavation waste (CDE) sent to landfill across these regions between 2000/01 and 2010[14].

As part of the project's EM&W Strategy, an Excavated Materials Options Assessment (EMOA) has been undertaken. This assessed the suitability of approximately 240 potential sites for managing material that would arise from the project. The analysis shows that there is currently sufficient capacity within the regions to use material from the Thames Tideway Tunnel beneficially. Furthermore, the trends in capacity indicate that sufficient space would continue to be available when the project construction is likely to commence.

The 17 preferred receptor sites identified by the EMOA and the reserve list have a combined capacity of 83 million tonnes (of which only 7 million tonnes is currently captured in the EA capacity data). This demonstrates there is capacity for the beneficial use of excavated material.

[11] Environment Agency. *State of the Environment – London*. (2010)
[12] Environment Agency. *State of the Environment – South East England*. (2010)
[13] Environment Agency. *State of the Environment – Anglian*. (2010)
[14] Environment Agency. *Waste Data Tables 2010. England and Wales - Landfill Input Trends 2000-2010*. Available at http://www.environment-agency.gov.uk/research/library/data/132647.aspx - (updated 13 September 2011). Accessed March 2012.

Since 2007, permitted inert landfill capacity in London, the South East of England and the East of England has been above 40 millions tonnes per annum, which reflects the continuing creation of inert landfill capacity. In the unlikely circumstance that no suitable beneficial uses were available and all the excavated materials were to be landfilled, it would use between 0.2% and 4.75% of the available capacity in any given year.

The SWMP system would require construction and demolition (C&D) waste to be treated and recovered where practical. The 187,000 tonnes of C&D waste anticipated to be generated from the project would represent approximately 2.7% of the 7 million tonnes treatment capacity in London and 0.3% of the treatment capacity within the South East and East of England.

The exact quantity of waste that would be classified as hazardous is still to be determined. The worst case assumption is that all 62,000 tonnes of made ground is sufficiently contaminated to be classified as hazardous waste. Disposing of this waste would only require approximately 4% of the current hazardous waste landfill capacity in London, the South East of England and the East of England.

Approximately 2,000 tonnes of welfare waste would be generated over the 6 year construction period. This is a small tonnage compared to the 8.5million tonnes of municipal and commercial and industrial waste produced in London per annum, for which there is 11.7 million tonnes of permitted recycling, treatment and disposal capacity in London alone. The vegetation waste which would be produced from site clearance is approximately 0.07% of the material composted in London during 2010.

The assessment presented in the EM&W strategy shows that there is sufficient regional capacity to accommodate the Thames Tideway Tunnel excavated material and wastes without having an impact on overall regional capacity.

Guide Question: Has Thames Water considered environmental and amenity impacts from excavated material and waste on communities?

As noted above, a large volume of excavated material and waste would be produced by the project worksites, which if handled inappropriately, could have an adverse effect on local communities and the environment. In reflection of this, the third objective established by the EM&W strategy is 'To minimise the impact of excavated material and waste on the environment and communities'.

Thames Water commits to managing work sites and handling any materials and wastes arising from the project in such a way that any potential impacts are minimised. In accordance with the *CoCP* and other relevant documents the following commitments are given:

- the removal of excavated material by barge would be prioritised at sites with river access
- Thames Water would give consideration to neighbours and engage with stakeholders to reduce amenity impacts from waste
- delivery and freight management practices on construction sites would be implemented to ensure timely removal of material
- Site Waste Management Plans (SWMPs) would be used to ensure construction and demolition waste would be effectively managed
- the EMOA also takes account of community issues in relation to the receptor sites identified.

At least 90% of excavated material arising at sites with direct usable river access would be removed by barge (*Transport Strategy*). During the implementation of the project, measures would be taken to ensure that up-to-date SWMPs are maintained and collated, which ensure that waste is managed appropriately at the site level.

Summary

Short term: The objective would be met for the project through Thames Water's commitments to sustainable waste management. Through the implementation of the EM&W Strategy, the project would control waste in accordance with the Waste Hierarchy. Whilst substantial volumes of material would be produced, this would be managed in a way which limits harm to the environment and communities and maximises opportunities for beneficial use of materials.

Medium to long term: Over the long term, the maintenance of the tunnel would produce limited volumes of waste. The sewage sludge generated from the project would be a small proportion of that currently managed at Beckton STW, and would be managed in a way which ensures that recycling and energy recovery is promoted.

A.6 Resources and raw materials

National policy and legislation

NPS (2012)

Resource and raw material use are not explicitly covered within the NPS; however, under section 5.5 which deals with the criteria for "good design", reference is made to the contribution to sustainable development from good design by ensuring developments that are attractive, usable, durable and adaptable.

Section 2.2.3 also seeks opportunities to reuse and recycle resources and to recover energy and raw materials where possible.

Other policy and drivers

NPPF (2012)

The NPPF does not specifically set out policies addressing resources and raw materials. However, it does highlight that planning should seek to encourage the reuse of resources and renewable resources. It states that mineral planning authorities should ensure that the capacity or operations to supply a wide range of materials is not compromised. It also highlights that the projected demand for raw materials should be considered, along with potential opportunities for meeting material demand through the use of secondary or other materials as alternatives to primary materials.

London Plan (2011)

Policy 5.3 Sustainable Design and Construction identifies the importance of efficient use of natural resources (including water), and securing sustainable procurement of materials, using local supplies where feasible.

Policy 5.20 Aggregates states that the Mayor will work with strategic partners to achieve targets of:

- 95% recycling/re-use of construction, demolition and excavation waste by 2020
- 80% recycling of that waste as aggregates by 2020.

Thames Water Corporate Guidance

Thames Water applies nine sustainability themes, which will be used to guide future plans within Thames Water. One of these relates to 'Efficient Operations'. Specifically, it relates to reducing the use of natural resources, minimising waste, and sustainable sourcing.

Selection of the objective

The sustainable use of resources is an important consideration for the project. Given the large volumes of materials required in construction and the types of materials required, the sustainable use of resources has been identified as a key area of the project's ongoing sustainability strategy.

The government's AoS included the objective to "promote the sustainable use of resources and natural assets and to deliver secure, clean and affordable energy". For the Thames Tideway Tunnel project appraisal, the generation of renewable energy through sewage sludge has been explored under the climate change mitigation topic theme, reflecting the

important role that renewable energy generation can have in displacing other grid electricity and tackling climate change. Within this sustainability appraisal, the sustainability objective focuses on the use of resources required during the construction of the project, with a focus on the consumption of materials and other natural resources. The relationship between sustainable resource use and durability is a complex issue. The NPS recognises that a durable project is an important criterion for good design (3.5.1). The focus of design has been to ensure that the Thames Tideway Tunnel is a durable piece of infrastructure, able to function for at least 120 years with minimal maintenance or intervention. These principles would be developed further through the detailed design stages of the project. The sustainability objective applied to the project is therefore to "promote the sustainable use of resources".

Sustainability appraisal

"Promote the sustainable use of resources"

Guide Question: Will the recovery of raw materials be encouraged during the construction and operation of the Thames Tideway Tunnel project?

As stated in the excavated materials and waste section above, the project would give rise to approximately 4.7 million tonnes of excavated material. The *excavated material and waste* (EM&W) strategy contains an objective to maximise the beneficial use of thin material.

The materials generated through excavation of the tunnel present the opportunity for beneficial use, particularly for the following activities.

- use at former quarries undergoing restoration
- use at former landfills undergoing restoration
- habitat creation projects.

Thames Water has set a target within the *EM&W* strategy to beneficially use a minimum of 85% of clean excavated material. For the Thames Tideway Tunnel project, the definition of beneficial use of materials has been established through a series of workshops with the Environment Agency, as follows:

- the management of the arisings would lead to a beneficial reuse and bring land back into use, or provide ecological benefit
- the material is suitable for its intended use and would not harm human health or the environment
- alternative material would otherwise be required if material arising from the Thames Tideway Tunnel was not to be used.

In light of these principles, it is clear that the recovery of raw materials during construction for beneficial use would be a main focus of the approach to waste management.

In operation the sewage sludge intercepted by the Thames Tideway Tunnel would provide opportunities for energy generation as discussed in the climate change mitigation section. The Thames Tideway Tunnel would deliver an additional 3% of the sewage sludge managed at Beckton sewage treatment works. This provides the opportunity for energy recovery.

Guide Question: Will the efficient use of sustainable raw materials be promoted during construction of the Thames Tideway Tunnel?

The project would require over 1.28 million tonnes of concrete in construction, depending on its specification; this can have a direct impact on the depletion of natural resources.

The Thames Tideway Tunnel would be a design and build project, meaning that the detailed design (including the specification of materials) would be undertaken by the future contractors. At this stage it is not possible or practical to enforce specific requirements for the use of sustainable materials, however, such practices are typically cost effective approaches and, therefore, this could be expected to be undertaken.

The procurement process would be an important method in securing the sustainable use of resources and raw materials, as many of these opportunities can be best addressed by the future contractors. During the tendering process contractors would be encourages to consider sustainability in the work package including the specification of materials. Measures in the *CoCP* and those embedded in procurement would be used to promote the sustainable use of materials. Such factors would include:

- requiring contractors to hold a materials policy and demonstrate a proven track record of how resource efficiency can be promoted
- requiring the contractors to develop materials management plans
- encouraging contractors to reduce primary aggregates, for example by substituting these with secondary or recycled aggregates
- consideration to sourcing of materials, including the proximity and methods of handling
- requiring contractors to use FSC or PEFC timber, and
- expect contractors to explore all available opportunities to make use of the locally sourced-recycled aggregates for the use on sites and in certain applications.

Will the project minimise the demand for non-renewable resources?

A renewable resource is a resource which is able to replenish itself over the course of time, either through biological or natural processes. The majority of materials required in construction constitute non-renewable material. Whilst certain materials offer potential for direct reuse or recycling, the nature of the project is that there would be no decommissioning stage, and therefore there would be very limited opportunities, if any, to recover these materials for use elsewhere. As already explained, the over-riding driver for the sustainability of the materials is that they are durable, and able to tolerate the anticipated conditions. There is limited scope to substitute materials for renewable materials, although where practical, opportunities would be explored such as the use of timber in construction. A materials management plan, secured through the *CoCP*, would be prepared by contractors to set out how these principles may be supported.

Guide Question: Has Thames Water considered the impacts on the availability of water resources?

The government's AoS of the NPS considered the effects of a Thames Tunnel solution on maintaining and enhancing water resources and quality. The AoS concluded that, in relation to water resources, the effects of such a scheme were uncertain. This was due to the uncertainty of the volume of de-watering that may be required during construction which is affected by the project's specific route. In addition, the potential effects of de-watering on licensed groundwater abstraction boreholes were uncertain due to the lack of specific detail on the scheme[15].

During peak construction (expected to occur in 2018), water consumption required for construction works is anticipated to be approximately 762,500l/d. During the remainder of the

[15] Defra (2010) *Appraisal of Sustainability: National Policy Statement for Waste Water*, Defra, London.

project's construction period (which varies at individual sites but, project wide, falls between 2015 and 2022), the water consumption for construction would be less than the estimated peak construction usage rate. The water available for use within the London region during the peak construction period of 2018 to 2019 is calculated to be 2054.45Ml/d with a supply surplus of 7.90Ml/d[16]. Since one megalitre is the equivalent of one million litres, the project demand is approximately 0.76Ml/d, the equivalent of 0.04% of the total water available for use in the London region. Therefore, whilst construction activities would place an additional demand on water resources, their temporary nature and the relatively small volumes are not anticipated to notably affect water resources.

The operation of the development does not require a permanent water supply other than the location of fire hydrants within 100m to mitigate the potential risk of the activated carbon filter which is a potential fire hazard. This would only be used in an emergency and so this is considered to have a negligible effect on water resources.

The construction of the project would require dewatering at various sites. Modelling has been undertaken as part of the EIA and has concluded that at the majority of sites the effects of dewatering would be negligible or minor adverse. Where moderate or major adverse effects have been identified (Kirtling Street, Albert Embankment Foreshore, and Blackfriars Bridge Foreshore), these would typically arise due to the lowering of groundwater levels affecting existing abstractions. Mitigation measures have been proposed (predominantly involving lowering the water pump at abstraction points) which have resulted in the effects being reassessed as being negligible or minor adverse. Dewatering would only occur during the construction of the scheme and is not anticipated to have an effect on groundwater resources. In the long term, during operation, there are not anticipated to be any notable effects on groundwater levels, which would recover.

Consequently, the project has taken into account the Thames Tideway Tunnel's impact on the availability of water resources and it is not considered to affect the availability of water resources.

Guide Question: Has Thames Water considered opportunities for effective water usage?

Thames Water is committed to the sustainable usage of water, ensuring that its use is optimised and wastage is limited. As identified above, the project would require water for a number of activities. In most cases this water is essential to ensure the safe construction of the tunnel and the fabrication of concrete opportunities would be taken to control its usage and monitor its use. A Water Management Plan would be developed by contractors as a requirement of the *CoCP*. This would include measures to manage water during construction including ways to:

- measure potable water consumption
- set targets and report water consumption arising from activities.

Alternatives to potable water use on site would also be considered.

[16] Thames Water (2011) *Water – Planning for the Future: Draft Final Water Resources Management Plan*, Thames Water, Reading.

Summary

Short term: During construction, the project would inevitably require the use of a substantial volume of resources. The sustainable use of these resources is dependent upon the ability to deliver an effective and durable tunnel, which would continue to remain operational with limited maintenance or intervention for at least 120 years. In this regard, the objective can be considered to have been met. Steps have been taken in design to promote the sustainable use of resources, however, the majority of activities which would work towards this objective would be secured through detailed design and specification, and initiatives secured through the procurement process. Similarly, water resources are required for construction, primarily for the concrete and grouting of the tunnels and shafts, to ensure that the necessary engineering specification is achieved. Steps would be taken to limit potable water where practical. However, the anticipated volumes required during construction are considered to be a small proportion of the estimated volume of water available for use within the London region. Consequently, the effect on resources would not be substantial and would meet the objective.

Medium to long term: The objective would be met as the long term operation of the Thames Tideway Tunnel is not anticipated to place a substantial demand on materials or water resources. The tunnel would require only limited maintenance and the design of the tunnel ensures it is self cleansing, and does not require potable water for flushing the system.

A.7 Population, human health and equality

National policy and legislation

NPS (2012)

The NPS sets the requirements for assessing socio-economic impacts. Specifically, it describes how adequate provision of waste water infrastructure is clearly beneficial to society and to the population's health as a whole; however, the possibility of some adverse effects during construction could be expected to arise.

UK Sustainable Development Strategy (2005)

The strategy sets out the UK's methodology for implementing sustainable development. In particular, it highlights commitments to support sustainable communities through the creation of opportunities for improving people's education, health and their local environments. By focussing on deprived areas and providing the mechanisms to enable people to engage within their communities, the strategy also seeks to promote a fairer society.

Other policy and drivers

NPPF (2012)

The NPPF highlights that planning is an important tool for promoting sustainable development. It highlights that a better life for the population today should not result in a worse quality of life for future generations. The NPPF also highlights that planning should take account of and support strategies to improve health, social and cultural well-being for all and deliver sufficient community and cultural facilities and services to meet the local needs.

London Plan (2011)

The London Plan (2011) describes the Mayor's vision that London needs to ensure it becomes "A city that meets the challenges of economic and population growth in ways that ensure a sustainable, good and improving quality of life, and help tackle the huge issue of deprivation and inequality among Londoners, including inequality in health outcomes".

Thames Water Corporate Guidance

Thames Water is committed to corporate responsibility. This is communicated and put in to practice through a number of activities, including its community investment strategy, which has been developed in response to a wide range of feedback including customer research and stakeholder comments. This has objectives to:

- implement education initiatives for schools and their customers
- increase public access to their sites and contribute to cultural heritage
- enhance water-related visitor attractions
- enable improvements to the environment and wildlife.

Selection of the objectives

The thematic area 'population, human health and equality' has been consolidated for the purposes of this sustainability appraisal to cover two thematic areas addressed by the government in its AoS; 'population and health' and 'equality'.

In relation to the 'population and health' thematic area, the government's AoS assessed a Thames Tunnel solution against the objective "to protect and enhance the physical and mental health of the population". The AoS concluded that there would be a positive effect on

population and human health. Specifically it found that there would be positive effect on the health of river users. It also identified the potential for negative effects which may arise from emissions of vehicles and plant during construction of a tunnel. Thames Water is committed to health and safety, and would take all efforts to reduce impacts on the population during both construction and operation. The sustainability objective has been modified to align more closely with Thames Water's corporate position on health and safety and well-being. The assessment of direct physical and mental health is considered within the Health Impact Assessment. Therefore, the sustainability objective used within this appraisal of the project is:

- "Ensure health and safety, and support the well-being of communities in which the project operates".

The government's AoS also addressed the thematic area of 'equality' with the objective, "to encourage equality and sustainable communities". The government's AoS found uncertainty in this area, because the location of sites required to construct the tunnel was unknown. The AoS did recognise that the aim of a Thames Tunnel solution is to prevent existing adverse environmental, economic and health effects by preventing the discharge of untreated sewage into the Thames. This would result in positive effects on all sections of society, especially those who use the river. The objective was carried forward and has been used for this appraisal.

Sustainability appraisal

"Ensure health and safety, and support the well-being of communities in which the project operates"

Guide Question: Will the project affect the health or well-being of the population in those boroughs through which the Thames Tideway Tunnel passes?

A Health Impact Assessment (HIA) has been prepared for the application. The HIA is 'a combination of procedures, methods and tools by which a project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population. Accordingly, it identifies appropriate actions to manage those effects[17].

The government concluded that there would be various effects on human health and the population in its AoS for a Thames Tunnel solution. The HIA helps to refine the understanding of health impacts established by the AoS. To do this, it uses the World Health Organisation (WHO) definition of health, which is: 'a state of complete physical, mental and social well-being, and not merely the absence of disease or injury'.

According to the Health and Safety Executive, despite reductions in the number and rate of injuries over the last 20 years, the construction industry remains a high risk industry to work within[18]. Thames Water is committed to health and safety, which has influenced the day to day planning of the Thames Tideway Tunnel. The scale of construction activities is significant. The number of man-hours required to deliver the Thames Tideway Tunnel is estimated to be 4 million (19,000 years). To ensure health and safety throughout construction, Thames Water would implement its health and safety policy founded on 'Three

[17] Quigley, R., L. den Broeder, P. Furu, A. Bond, B. Cave and R. Bos. (2006) *Health impact assessment: International best practice principles. Special publication series No. 5*. Fargo, USA: International Association for Impact Assessment [accessed at http://www.iaia.org/publicdocuments/special-publications/SP5.pdf].

[18] Health and Safety Executive (2011) *Construction Work related injuries and ill health*, Health and Safety Executive [accessed at http://www.hse.gov.uk/statistics/industry/construction/construction.pdf],

Zeros– Zero Accidents, Zero Harm, Zero compromise'. A number of activities would be enacted to ensure that the workforce and members of the public around worksites are adequately protected in line with this policy.

Health and well-being of the population can be affected by construction related activities, for example, through the generation of noise, dust and vibration. These impacts have been assessed through the EIA process and have been minimised where possible through design measures and the application of a *Code of Construction Practice* (*CoCP*).

During operation, by diverting combined sewage for treatment as opposed to its uncontrolled discharge to the tidal Thames, the Thames Tideway Tunnel would substantially reduce the pathogen loading in the tidal Thames. The project would reduce risk days posed by pathogens by up to 98%, particularly in sections of the tidal Thames between Teddington and Greenwich. The project is, therefore, beneficial to the physical health of the local population, especially those either living within the vicinity or utilising the River Thames for recreation or work. Further details are provided within the surface water chapter of the ES.

There might also be broader benefits for the population. The NPS explains how projects, such as the Thames Tideway Tunnel, may have indirect health benefits for the local population, for example by increasing employment and so also living standards, or by promoting the use of open space and water for recreation and physical activity once construction is complete.

The AoS states that since 2008 an increase has been seen in the prevalence of childhood obesity meaning that England now has some of the highest level in Europe. The promotion of physical activity would play a vital role in the education of young people not only providing them with the opportunities to undertake physical education but also an understanding of the importance it plays in maintaining a healthy lifestyle. For this reason London Youth Rowing has been identified as the primary community investment partner for the project. London Youth Rowing's mission is to widen access to fitness rowing and the River Thames to young people from all walks of life across the capital.

Thames Water has trialled its Row 4 Results programme in schools (in each of the drive site boroughs), and also in Newham with the Lee Tunnel. Training has also been provided to school staff to enable them to deliver the sessions independently. Thames Water would continue to support health related initiatives in this way.

The government's AoS states how employment has implications for the health and well-being of a population. The project has developed a skills and employment strategy which has an objective to ensure that a suitable work force with the right skills is available to deliver the project. The skills and employment strategy also supports initiatives to promote science technology, engineering and maths (STEM) education and careers.

Research has shown that over the next 10 years, there will be a growing need for engineering related skills within the UK job market[19]. The UK therefore needs to rebalance its skills capacity to enable it to fill these positions.

Thames Water supports the STEM ambassador scheme, which enables members of the project team with related skills to volunteer in schools to inspire young people and demonstrate the importance and opportunities that studying STEM subjects can bring.

[19] Engineering UK (2012) *Engineering UK 2012 Report: The State of Engineering,* Engineering UK, London [accessed at http://www.engineeringuk.com/what_we_do/education_&_skills/engineering_uk_12.cfm].

Furthermore, a range of education materials which would be delivered through online resources called Thames Tunnel works. The resources would be delivered by teachers across London in a way that allows young people to see how the scientific and mathematic principles can be applied in real world situations, with focus on the project. Thames Water would also support a CREST (creativity in science and technology) project-based awards scheme. The scheme is recognised by UCAS (the universities and colleges accreditation service) and therefore students would be able to enhance their applications to university by taking part in CREST accredited projects. These materials would also all be available free of charge on the Thames Tideway Tunnel Tunnelworks website[20].

Guide Question: Has the project minimised potential nuisance to local communities?

As detailed in the NPS, the adverse effects during construction on the health of the population cannot be discounted as a result of changes in conditions such as air quality, dust, and noise. These effects are discussed further in section A.9 environmental protection and enhancement. As an overarching principle, the project has sought to prevent or reduce adverse effects and consider opportunities for beneficial effects. The design process has been developed through an iterative approach and has sought to minimise the potential nuisance to local communities wherever possible. Embedded design measures such as the site layout, the provision of noise sheds to provide acoustic screening and the selection of sites that enable the use of river transport to reduce nuisance from road transport have been identified and incorporated where possible. Further measures set out in the *CoCP*, have also been designed to minimise nuisance.

Sustainability appraisal

"Encourage equality and sustainable communities."

Guide Question: Will the project result in changes to community services or facilities?

Thames Water seeks to generate beneficial opportunities to the local community during construction where possible. Due to the nature of construction, there are anticipated to be some short-term effects at some individual sites. For example, at Barn Elms an area of the playing fields would be required during construction, although compensatory measures would be provided, including the provision of new changing facilities. Similarly, at Falconbrook, there is anticipated to be an effect on the library and community centre and nearby adventure playground. When considering the scheme as a whole the effect on community facility and service provision is anticipated to be minimal during both construction and operation.

Guide Question: Will the project adversely affect the more disadvantaged sections of society?

In recognition that new NSIPs could potentially create impacts on local communities, the NPS requires that the applicant should undertake and include in their application an Equalities Impact Assessment (EqIA) for the construction, operation and decommissioning phases of the project. An EqIA screening exercise has been undertaken which identified the potential impacts from the project on a number of community receptors. A full EqIA has been developed in support of the application. The EqIA assesses equality for all and ensures that the scheme does not discriminate against any individual or community.

[20] www.tunnelworks.co.uk

An example of how equality has been promoted is through the site selection process. This involved consideration of five disciplines; engineering, planning, environment, community and property. Equalities considerations were specifically included as one of the five criteria which made up the community discipline's assessment in the site selection process when assessing the shortlist of sites[21].
The five criteria were:

- proximity to sensitive receptors – the potential for use of a site to impact on sensitive receptors
- social considerations – the potential for use of a site to impact on community cohesion[22]
- economic considerations – the potential for use of a site to impact on the local economy
- health considerations – the potential for use of a site to impact on the health and well-being of the local community
- equality considerations – the potential for use of a site to disproportionately impact on any equalities groups.

These criteria were applied to ensure that equality considerations were factored in to site selection.

The Planning Act 2008 makes provision for developers of new nationally significant infrastructure to consult fully with the communities in which development would occur. Thames Water has undertaken a rigorous consultation process, including targeted consultations on the proposal, to ensure that everyone who had an interest in, or is likely to be affected by, the construction of the Thames Tideway Tunnel has a chance to raise their views. This consultation process included:

- statutory consultees
- local authorities, including directly affected local authorities and authorities that are adjacent to where works are proposed
- landowners, including property owners and lessees of shortlisted sites, and occupiers of properties above and adjacent to the potential tunnel routes
- community consultees, including the general public, local property owners/occupiers, local businesses, community representative and groups.

London is the most ethnically diverse city in the UK, with a population that speaks 300 languages and is represented by people with origins in over 150 countries. Thames Water therefore, sought to ensure that it was equally possible for everyone to respond to the consultation process and offered a range of solutions for people requiring assistance. The needs of people with disabilities has been considered throughout, with for example, consultation information available in large print, braille or audio format upon request. Thames Water's Customer Centre also offered a telephone service to translate consultation materials into any language on request.

The project's *Skills and employment strategy* includes an objective to promote opportunities for local people and disadvantaged groups. Potential activities to ensure opportunities are accessible to disadvantaged or under-represented sections of the population include:

- paying the wider Thames Tideway Tunnel workforce above the London living wage

[21] Thames Tideway Tunnel (2011) *Site Selection Methodology Paper,* Thames Water Utilities Ltd., Reading.

[22] The notion of 'community cohesion has been derived from the vision of the Institute of Community Cohesion (http://www.cohesioninstitute.org.uk/AboutUs/OurAims)

- seeking through contracts to employ local workers and those that are unemployed
- implementation of a diversity policy
- utilising a brokerage group(s) to assist contractors in selecting suitable ex-offender candidates for employment
- undertaking outreach activities at each key drive site led by a local opportunities and outreach group and resourced through appointment of a skills and employment manager.

Summary

Short term: During construction the project has potential to impact people and lead to general disruption from construction. Strict controls would be put in place to ensure that health and safety and *CoCP* requirements are implemented at all times. Thames Water has taken, and would continue to take a number of steps to ensure that any adverse affects on people's general well-being are reduced wherever possible. Consequently, the effects of nuisance on well-being have been minimised, although it is recognised that there may be some temporary effects that cannot be eliminated altogether. In such cases, Thames Water would provide compensatory measures. There would be no compromise on safety at any point by following Thames Waters ambitions for zero harm. An EqIA has been undertaken for the project. The Thames Tideway Tunnel has been developed to ensure equality has been integral to the approach to site selection and the way it has undertaken consultation. The *Skills and employment strategy* would further help to up-skill the population.

Medium to long term: Once in operation the project would bring health benefits for Londoner's using the river. The interception of CSOs would substantially reduce the release of pathogens, and the length of time people would be exposed to risks associated with this. The EIA process has demonstrated that the project would substantially reduce risk days by up to 98%, particularly in sections of the tidal Thames between Teddington and Greenwich, leading to health benefits for users of the river. As reflected by the government's AoS, a Thames Tunnel solution would prevent on-going environmental, economic and health effects by preventing the discharge of untreated sewage into the Thames. This would result in positive effects on all sections of society that make use of the river. The project is therefore considered to be equitable.

A.8 Economy

National policy and legislation

NPS (2012)

The NPS sets the requirements for assessing socio-economic impacts. Specifically, it requires consideration of the effects of regional and job creation, and the changing influx of workers during different phases and the changes to demands on services and facilities around the area[23].

Other policy and drivers

NPPF (2012)

The NPPF promotes sustainable development and makes it a central part of the planning system. Of particular relevance is its commitment to building a strong competitive economy. It states that weight should be placed on the need to support growth through the planning system and that plans should proactively meet the development needs of business to support an economy fit for the 21st century[24].

Government's National Infrastructure Plan (2011) and update (2012)

The Infrastructure Plan recognises that safe, reliable and efficient infrastructure networks form the backbone of every modern economy. The Thames Tideway Tunnel is specifically detailed in the Plan. The government has identified priority infrastructure investments based on three main criteria, which the Thames Tideway Tunnel satisfies:

- the potential contribution to economic growth – investment that enhances productivity and enables innovation
- nationally significant investment that delivers substantial new, replacement or enhanced quality, sustainability and capacity of infrastructure
- projects that attract or unlock significant private investment.

London Plan (2011)

The London Plan is a key driver for the delivery of sustainable development including economic growth throughout London. It highlights the importance of ensuring the necessary infrastructure is in place to support growth and meets the highest modern standards. Specifically, policy 5.14 sets out support for the project in principle. Policies in section 4 of the London Plan focus on economic growth[25].

Mayor's Economic Development Strategy for London (2010)

Sets out the policies designed to achieve the Mayor's economic vision for London. Of particular relevance is policy 5D which highlights that the Mayor will champion the case for investing in London to not only meet London's needs, but also to ensure London can continue to drive the UK economy. It states that the Thames Tideway improvements are part of the major investment requirements in London[26].

[23] HM Government (2012) *National Policy Statement for Waste Water*, The Stationary Office, Norwich.

[24] DCLG (2012) *National Planning Policy Framework*, DCLG, London.

[25] Mayor of London (2011) *The London Plan*, GLA, London.

[26] Mayor of London (2010) *The Mayor's Economic Development Strategy for London*, GLA, London.

Thames Water Corporate Guidance

Thames Water believes that a truly sustainable business needs to demonstrate robust financial performance and the capacity to deliver long-term value for customers. One of nine strategy areas relates to sustainable investment – taking the longer-term view and managing the financeability of its business. New infrastructure, like the Thames Tideway Tunnel must balance sustainability aspirations with customer bills, and operate within a closely regulated sector. Efficiency and wise investment of funds is therefore crucial.

Selection of the objective

The objective selected for the appraisal is consistent with that applied in the government's AoS of a Thames Tunnel solution, which is "to promote a strong and stable economy". The government's AoS concluded uncertain effects on this objective, although identifies positive effects of a Thames Tunnel solution from:

- job creation during construction
- general capital expenditure during construction
- reducing environmental costs, for example from EU fines, and
- the wider benefits from an improved environment, particularly on reputation and tourism. The AoS also identified a permanent negative effect of increased water bills for customers.

This appraisal considers these issues in further detail.

Sustainability appraisal

"To promote a strong and stable economy"

Guide Question: Will the Thames Tideway Tunnel project create local employment and skills development opportunities?

The Thames Tideway Tunnel is a Nationally Significant Infrastructure Project which by its nature is a large and complex project that would require a wide range of people, from specialist technical professionals through to general labourers.

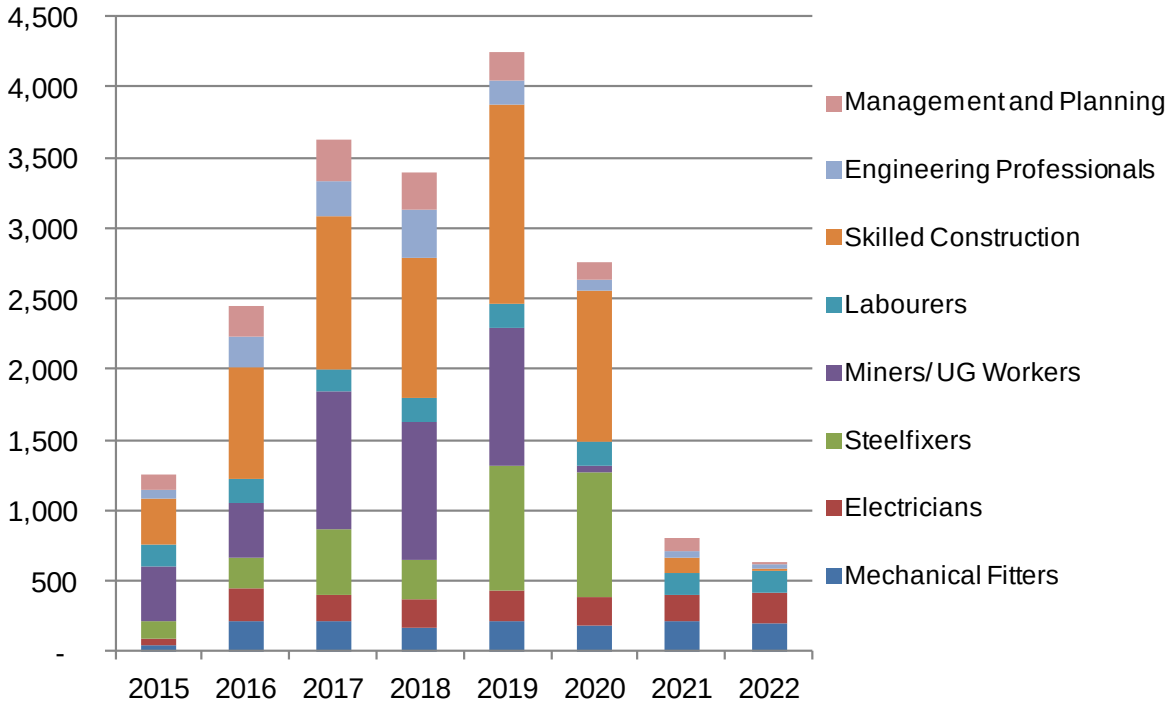
During construction, one of the main direct effects of the project is the substantial investment into the economy and the consequential generation of employment opportunities. At the height of construction, 4,250 workers would be directly employed on the project (see plate A8.1). The work profile and timing of the project compliments the reduction from the peak period of construction during the Crossrail project. The Thames Tideway Tunnel would therefore help to provide continuity of employment for these skilled construction workers[27].

The project would provide an equivalent of 19,000 employment years (equivalent to 4,600 employment years per £1 billion of spend), which is comparable to other major infrastructure projects in London, such as Crossrail, which generated 4,375 employment years per £1 billion spend[28].

[27] Crossrail (2010) *Skills and Employment Strategy*, [www.crossrail.co.uk].

[28] Thames Tunnel (2012) *Why does London's economy need the Thames Tunnel*, Thames Water.

Plate A8.1 The anticipated profile of direct employment for the Thames Tideway Tunnel project during construction



In addition to the direct employment from the project, there would also be wider employment benefits. By using widely accepted employment multipliers for the construction industry, Thames Water expects that a further 5,100 indirect jobs would be created as a result of the project[29]. These are likely to be in trades which support construction workers employed directly by the project, for example through increased employment further down the supply chain, and in local areas where construction is taking place (such as food outlets and local shops).

Due to the regulated nature of Thames Water's operation, procurement legislation is in place to promote fair competition and non-discrimination. This legislation is important to ensure equal opportunities for all, although it means that specific commitments cannot be made in relation to procuring services from the UK. However, in considering the comparable experience of the Lee Tunnel project, it is anticipated that the Thames Tideway Tunnel could recruit in excess of 20% of employees locally. Thames Water holds an aspiration to recruit locally on the Thames Tideway Tunnel project, especially among the drive site boroughs of Wandsworth, Hammersmith and Fulham, Southwark and the royal borough of Greenwich, with at least 25% overall from the directly affected boroughs. This would positively contribute to the provision of employment opportunities and would support the local and regional economy. Recognising that a number of these would be general labourers there would be significant opportunities to build on the apprenticeship programme (described in Population, Human Health and Equality) and reduce unemployment amongst young people.

The *skills and employment strategy* has been developed to ensure that the project's economic benefits would be maximised. It establishes objectives to ensure that a suitable workforce with the right skills is available to deliver the project. The project would require a wide range of skills. Potential activities to ensure an appropriate workforce would be

[29] http://Scotland.gov.uk/Topics/Statistics/Browse/Economy/Input-Output/IOTIIMults9804

available include:

- providing apprenticeships throughout construction contracts
- supporting the ongoing tunnelling and underground construction academy (TUCA) and the development of river transport related skills through the Thames training alliance
- monitor and encourage contractors to forecast and report future labour requirements, staff turnover rates and conversion rate of apprenticeships to on-going employment
- ensure strong links with the Lee Tunnel and Crossrail projects to provide channels for re-employment as labour demands on those projects decrease.

Guide Question: Will the project help to ensure long-term investment in London and promote sustainable growth in the regional economy?

The government's AoS identifies the general benefits of new waste water infrastructure to promote sustainable growth in the regional economy, and ensure long-term investment. However, it also found uncertain effects, as the expenditure required to construct a Thames Tunnel solution, and the potential environmental improvements that would be realised, would be off-set by an increase in customers' bills.

It is widely accepted that much of London's ageing infrastructure requires substantial investment to support the city's global competitiveness. Even at the height of the recent recession in 2009, the Mayor of London's Economic Recovery Action Plan recognised that investment in infrastructure was needed to avoid risking long-term damage to the prospects of the capital[30]. The government's National Infrastructure Plan sets out the importance of providing the necessary infrastructure to ensure the UK's economic competitiveness. It highlights that the Thames Tideway Tunnel is a key component of infrastructure required in London[31].

Thames Water estimates that the project would cost £4.1 billion to the start of operation in 2023. Defra's analysis has shown that there is likely to be an environmental benefit of between £3 billion and £5.1 billion[32]. The lower estimate assumes no population or income growth. The upper estimate is a conservative estimate that accounts for reasonable population and income growth.

Defra's report also highlights that there would be additional benefits that have not been quantified or considered in the analysis including:

- avoidance of damage to London's reputation as a business and tourism centre (especially given similar investments are being made in competitor locations, e.g. Paris)
- avoidance of long term adverse impact on value of riverside property
- short-term employment, economic growth or regeneration impacts related to construction.

As with procuring services, the procurement of materials is also subject to substantial procurement legislation. However, when considering the Lee Tunnel, approximately 80% of expenditure on contractors and materials was through UK based firms. It is anticipated that

[30] Mayor of London (2009) *Third Economic Recovery Action Plan Update*, GLA, London.

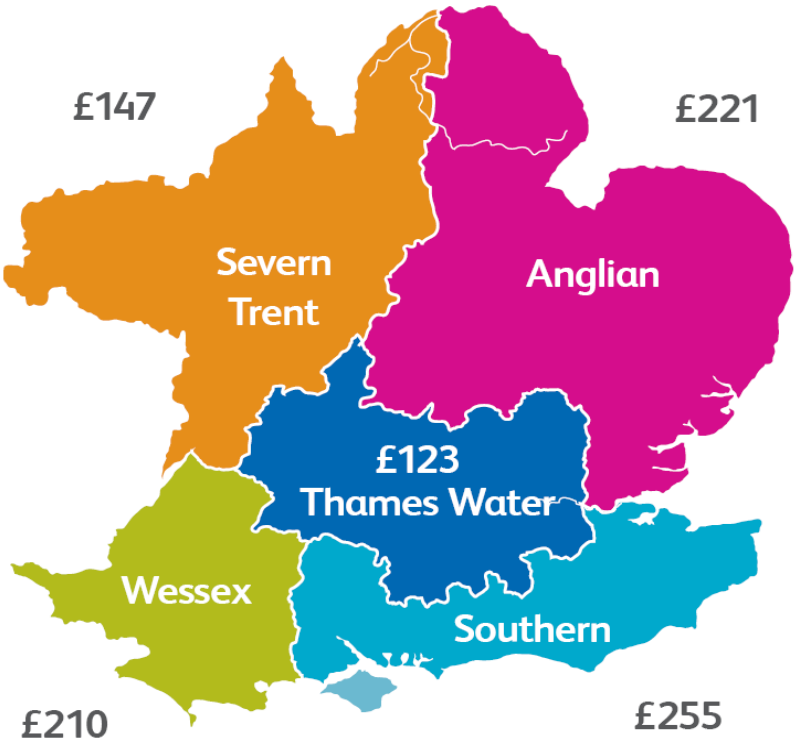
[31] HM Treasury (2011) *National Infrastructure Plan 2011*, TSO, Norwich.

[32] Defra (2011) *Costs and Benefit of the Thames Tunnel*, Defra, London.

small and medium sized enterprises (SMEs) would be able to realise a number of business opportunities from the project as well[33]. If achieved, this would have a substantial benefit on the UK economy by securing employment and stimulating economic growth. In addition, it is likely to contribute positively towards improving the UK's balance of payments (the difference between the value of goods and services, income and current transfers imported and exported), which in 2011 had a deficit of £29 billion[34]. Assuming 80% of the £4.1 billion cost of the scheme is spent in the UK, this could directly contribute £3.28 billion to the UK's GDP.

It is recognised that Thames Water's customers' wastewater bills would increase to support the funding of the scheme. Analysis has estimated that the maximum annual increase would be between £70 and £80 based on 2011 prices. This would result in Thames Water's average wastewater bills increasing from being the cheapest in England (£123 per year in 2011/12, see Plate A8.2) to between £193 and £203 per year. This would still be below the national average of £211 per year[35].

Plate A8.2 Average wastewater charges 2011/12



Ofwat analysis shows that 11% of households spend more than 5% of their disposal income on water and sewerage bills, which is around the national average. The maximum increase of £80 to fund the Thames Tideway Tunnel would result in 15% of households spending more than 5% of their disposal income on water and sewerage bills which would be above the national average and second highest to South West Water[36]. However, the findings assume no changes to other water companies' bills and no increase in population.

[33] Thames Tunnel (2012) *Why does London's economy need the Thames Tunnel*, Thames Water.

[34] Office for National Statistics (2012) *Balance of Payments, 4th quarter and annual 2011* [accessed at http://www.ons.gov.uk/ons/rel/bop/balance-of-payments/4th-quarter-and-annual-2011/index.html].

[35] Defra (2011) *Creating a River Thames fit for our future: A strategic and economic case for the Thames Tunnel*, Defra, London.

[36] Defra (2011) *Creating a River Thames fit for our future: A strategic and economic case for the Thames Tunnel*, Defra, London.

More broadly, the project would provide the necessary infrastructure to enable London to increase its housing stock and realise its population growth estimates. This is vitally important since in doing so, a larger and more diverse labour market would be supplied which can support economic growth. Indeed, the growth in the population would mean that the cost of the project would more likely be spread across more people and therefore would result in the lower estimate of increase to bills.

The project would also help to avoid fines imposed on the UK by the EU. In 2004, the European Commission initiated infraction proceedings against the UK government, alleging that it has failed to fully implement the Urban Waste Water Treatment Directive (UWWTD) correctly with respect to overflows from the sewer network in London. This is due to urban wastewater collecting systems and treatment facilities in London not being compliant with EU legislation[37]. In October 2012 the courts found against the UK, so now the European Commission may now seek fines upwards of £100 million a year (Defra, 2011)[38]. The delivery of the scheme to comply with the UWWTD would avoid these fines.

Summary

Short term: There are clear benefits arising as a result of the project on London's economy. The significant investment being made by the project would have a substantially positive effect on employment and economic stimulus through direct and indirect expenditure and job creation. The construction of the Thames Tideway Tunnel is anticipated to generate a number of employment opportunities requiring a range of skill sets. At the height of construction activity, the project is anticipated to directly support approximately 4,250 jobs. It is also likely to indirectly support up to another 5,100 jobs.

Medium to long term: The project would provide the necessary essential infrastructure to support both population and economic growth. It would ensure that the aquatic environment is not directly affected by increased discharges of waste water from CSOs, and so would contribute to enhancing the environment and making the city more attractive to invest in. It has been shown that whilst average customer wastewater bills would increase to cover the costs of the project, they are unlikely to increase above the national average, given that Thames Water's wastewater bills are currently amongst the lowest in the country.

The project forms a fundamental part of the wider infrastructure needed to support population growth, and supply an appropriate labour market, which in turn is necessary to support the future economic growth of London. This benefit has been estimated to be approximately £3-5.1 billion.

Consequently, it is considered that the project would have a substantially positive contribution towards the objective of providing a strong and stable economy.

[37] Thames Tideway Tunnel (2010) *Needs report*, Thames Water Utilities Ltd., Reading.

[38] Defra (2011) *Creating a River Thames fit for the our future: A strategic and economic case for the Thames Tunnel.*

A.9 Environmental protection and enhancement

National policy and legislation

NPS (2012)

Air quality (para. 4.11.4) states that the decision maker should generally give air quality considerations substantial weight where a project would lead to deterioration in air quality in an area, or leads to a new area being determined, where the air quality breaches any national air quality limits. However, the policy also states that air quality considerations would also be important where substantial changes in air quality are expected, even if this does not lead to any breaches of any national air quality limits.

Noise and vibration (para. 4.9.8) states that the project should demonstrate good design through selection of the quietest cost effective plant available; containment of noise within buildings wherever possible; optimisation of plant layout to minimise noise emissions; and, where possible, the use of landscaping, bunds or noise barriers to reduce noise transmission.

Dust and artificial light (para. 4.12.7) states that the decision maker should satisfy itself that all reasonable steps have been taken, and would be taken, to minimise any detrimental impact on amenity from insect infestation and emissions of dust, steam, smoke, and artificial light.

Landscape Impacts (para. 4.7.14) states that the decision maker would have to judge whether the visual effects on sensitive receptors, such as local residents, and other receptors, such as visitors to the local area, outweigh the benefits of the development.

Historic environment (para. 4.10.11) states that in considering the impact of a proposed development on any heritage assets, the decision maker should take into account the particular nature of the significance of the heritage assets, and the value that they hold for this and future generations. This understanding should be used to avoid or minimise conflict between conservation of the significance and proposals for development.

Other policy and drivers

NPPF (2012)

The NPPF recognises that the importance of the natural environment and highlights that planning should conserve and enhance the natural environment and reduce pollution. It states that planning should recognise the intrinsic character and beauty of the countryside and the vitality of the urban areas. It also recognises the importance of conserving historic assets in a manner appropriate to their significance.

London Plan (2011)

Policy 7.14 sets out measures to improve air quality. It states that development proposals should minimise increased exposure to existing poor air quality and make provision to address local problems of air quality (particularly within Air Quality Management Areas (AQMAs)). It also seeks to promote sustainable design and construction to reduce emissions from the demolition and construction of buildings following the best practice guidance issued by the GLA and London Councils.

Policy 7.15 sets out measures to reduce noise and enhance soundscapes. It states that

development proposals should seek to reduce noise by minimising the existing and potential adverse impacts of noise on, from, within, or in the vicinity of, development proposals. It goes on to state that designs should separate new noise sensitive development from major noise sources wherever practicable through the use of distance, screening, or internal layout in preference to sole reliance on sound insulation.

Policy 7.12 relates to implementing the London View Management Framework. It states that with regards to river prospects, views should be managed to ensure that the juxtaposition between elements, including the river frontages and key landmarks, can be appreciated within their wider London context. With regards to townscape and linear views, these should be managed to enable the ability to see specific buildings, or groups of buildings, in conjunction with the surrounding environment, including distant buildings.

Policy 7.8 sets out measures relating to heritage assets and archaeology. It requires designer's of new development to identify, value, conserve, restore, re-use and incorporate heritage assets, where appropriate and to ensure that development affecting heritage assets and their settings should conserve their significance, by being sympathetic to their form, scale, materials and architectural detail.

Selection of the objectives

The government's AoS assessed a Thames Tunnel solution against a number of environmental objectives under separate thematic areas. These were:

- 'to maintain and improve air quality'
- 'to minimise the effects of noise, particularly where it would impact human health'
- 'to protect and enhance the character of landscapes and townscapes'
- 'to protect and conserve the historic environment'.

The government's AoS concluded the following main effects:

- A negative effect on air quality due to an increase in traffic and therefore vehicle emissions, associated with both the construction and operation of the scheme.
- A negative effect from noise due to construction activities expected to give rise to noise, although it recognises that there would be no noise effects during operation.
- An uncertain effect on townscape because of the unknown structures associated with the development in operation.
- The AoS recognised neutral effects on the historic environment as a Thames Tunnel solution would pass below the deepest archaeological horizons reducing impacts.

This appraisal consolidated these environmental thematic areas under the umbrella term of environmental protection, which has reduced repetition with the ES. The objectives have largely remained consistent with those applied by the government in the AoS. However, in the case of objectives for air quality and noise and vibration, these have been addressed through a single objective – "minimise significant adverse environmental effects relating to air quality, odour, noise & vibration, and lighting from construction and operation of the Thames Tideway Tunnel". This has been expanded to reflect the potentially wider effects that may occur through construction.

Sustainability appraisal

"Minimise significant adverse environmental effects relating to air quality, odour, noise & vibration, and lighting from construction and operation of the Thames Tideway Tunnel"

Guide Question: Will the project result in the worsening of air quality in existing areas of poor air quality (e.g. AQMAs)?

All local authorities are required to monitor air quality within their areas. Where levels of air pollutants exceed specific thresholds, Air Quality Management Areas (AQMAs) are designated to manage air quality within the area. Certain London Planning Authorities have adopted AQMAs along main roads, whilst others have adopted AQMAs which encompass the whole area. The decision maker is guided by the NPS to give air quality considerations substantial weight where a project would lead to a deterioration in air quality in an area, or leads to a new area being determined, where the air quality breaches any national air quality limits.

At the project-wide level, the effects of the project on air quality during the construction phase have not been found to be significant, although effects have been predicted at certain individual project sites. The biggest potential impacts on AQMAs would occur from gaseous and particulate pollutant emissions from vehicles and plant used on the site and transportation to and from the site, as well as dust from construction activities. Various control measures would be used through the *CoCP* to limit effects on air quality. The widespread use of river transport to limit HGVs on local roads would also reduce air quality impacts in local communities. Control measures are guided by Best Practice Guidance

published by the GLA (2006)[39], and include:

- preparation of site specific Air Quality Management Plans
- adopting a range of dust control measures on each site
- ensuring that the engines of all vehicles and plant onsite are not left running unnecessarily
- use of lorries that meet current best environmental practice including Euro 5 emission standards
- minimisation of movements of construction traffic around the site in both site layout and routine operations
- adopting operational procedures for tugs and other river transport to consider emissions and include methods to reduce these.

Guide Question: Will the project cause a worsening in odour?

The uncontrolled CSO events result in discharges to the tidal Thames, contributing to unpleasant odours and unsightly litter and sewage debris. The Thames Tideway Tunnel would result in the effective management of the vast majority of waste material. During construction, there would be a requirement to undertake connection works to the existing sewer systems. The contractors would be required to consider the potential increase of odour to sensitive receptors, and manage and control foul water flows as appropriate during these works.

The design of the tunnel employs various controls to reduce the possibility of odour during operation. The ventilation strategy ensures a flow of air is maintained to minimise the risk of odours associated with stagnant air being released as the tunnel fills. The air that is released as the tunnel fills, or is vented out, is passed through carbon filters that minimise odours. A quantitative assessment has been undertaken at all the sites for operational odour emissions. No significant effects are anticipated either at a site or project-wide level. Indeed in certain areas, odour levels may be improved as a result of the proposals.

Guide Question: Will the project lead to increased levels of noise and vibration at particularly sensitive receptors (e.g. housing, schools and hospitals)?

Adverse effects from noise and vibration could potentially arise during construction. These have been subject to assessment within the ES. Operational effects from the project are not expected to arise to any significant degree. The site selection process has taken into account the location and proximity of sensitive receptors. Whilst this has not been the only consideration in choosing the sites, it has helped to limit noise and vibration effects on sensitive receptors. The design evolution of those sites that have been selected has further reduced likely impacts from noise on sensitive receptors by modifying worksites to reflect the location and proximity of sensitive receptors. Further details are available within the Design and Access Statement.

Measures within the *CoCP* would be used as the primary means to control noise and vibration for the project during construction. The *CoCP* reflects specific noise mitigation proposals where sensitive receptors have been identified. The measures that would be employed include:

- noise generating activities would be sited away from sensitive receptors or screened so as not to exceed allowable levels
- careful selection of construction plant, construction methods and programming
- the use of site enclosures and temporary stockpiles to provide acoustic screening

[39] Best Practice Guidance (BPG), The Control of Dust and Emissions from Construction and Demolition,

- selection of piling methods to limit noise and vibration to acceptable levels (pressed in piling where possible)
- consideration to construction methods to limit impacts from underground tunnelling activities (e.g., temporary railways, conveyors)
- monitoring and intervention mechanisms established.

Guide Question: Will the project lighting cause nuisance at local receptors?

Lighting would be required for all worksites and would be in place on certain permanent sites.

The impacts of lighting have been given careful consideration in the design of sites to ensure that impacts on amenity and ecology are reduced. Lighting designs would take account of local sensitive receptors, and be informed through discussions with the local authorities and the police. The *CoCP* and site design principles address lighting:

- lighting to site boundaries would be provided and illumination would be sufficient to provide a safe route for the passing public
- lighting would be positioned and directed so as not to unnecessarily intrude on adjacent buildings and land uses, and to prevent unnecessary interference with local residents or passing transport users (road, rail or river)
- the lighting would be designed to comply with the provisions of BS5489, Code of Practice for the Design of Road Lighting, where applicable
- the Institute of Lighting Engineers Guidance Notes for the Reduction of Light Pollution, GN01 (2005) would be followed to ensure that light spillage is minimised.

There are instances where mitigation has been included and no further practicable mitigation can be adopted above those methods identified in the *CoCP*. The project has established a compensation policy relating to construction disturbance - for example, noise, dust, vibration, light disturbance from worksites at night, or damage to property as a result of construction - which may give rise to financial loss or damage to property. This is one means by which significant adverse construction effects may be offset.

Sustainability appraisal

"Protect and enhance the character of landscapes and townscapes"

Guide Question: Will the project result in adverse effects on locally valued landscapes or townscapes?

The effects of the project townscape have been considered within the EIA. It is not expected that the Thames Tideway Tunnel would cause any significant project-wide townscape effects, however it is acknowledged that some adverse effects could occur locally, particularly during the construction phase. Measures detailed within the *CoCP* and design principles would be implemented to help protect townscape and landscape effects at the site level. Measures would include:

- hoardings where required shall be of a design appropriate to the character of the surrounding townscape. The hoarding would be maintained in good condition throughout construction
- trees that need to be removed in a conservation area shall be replaced as close as possible to the original position with a species that relates to the character of the area
- any public furniture, fencing or railings shall be robust, durable and in keeping with the character of the surrounding townscape. Reference shall be made to any relevant local street design guides for specification of landscape elements.

In operation, it is relevant to note that there may be enhancements to local townscape as a result of the proposals. This has been achieved through an iterative design process, which has taken account the views of external stakeholders. All sites have undergone design reviews by the design council CABE, and the designs have followed the NPS requirements for 'principles of good design'. This ensures that the designs preserve and enhance the context and surroundings of the individual sites, whilst delivering the Thames Tideway Tunnel operational requirements in an effective way. Such measures include:

- seeking to provide a net increase in trees over the project as a whole
- providing historical interpretation at sites of heritage value,
- facing materials and detailing for new river walls would be compatible with the character of adjacent river walls.

Guide Question: Will the project affect the tranquillity of London's open spaces, green networks and public realm?

Due to the nature of London's riverside being predominantly developed, the number of locations where sites would affect open spaces and green networks is relatively limited. There are three proposed sites located in open spaces; Barn Elms, King George's Park and King Edward Memorial Park. Development at these sites has sought, as far as possible, to minimise the amount of land take required. After construction activities have ceased the area of land used would be reinstated. Consequently, whilst there may be some effect on the tranquillity of the open spaces, this would be temporary and limited to the construction period. Areas of public realm at sites along the riverside may be enhanced through the provision of improved seating, planting and public realm space from which to view the river. Similarly, enhancements would be made to King George's Park to increase accessibility and layout of the northern end of the park.

Sustainability appraisal

"Protect and conserve the historic environment"

Guide Question: Will London's historic environment be protected and conserved in a manner appropriate and proportionate to its significance during the construction and operation of the Thames Tideway Tunnel project?

Due to the design mitigation measures no significant project-wide effects have been identified upon the historic environment during the construction phase. Whilst adverse effects would arise during construction from impacts upon heritage assets common to a number of sites (e.g. prehistoric activity and post-medieval industrial archaeology along the river), these would not give rise to a significant project-wide effect due to this mitigation. The site-specific mitigation proposed at each project site is considered sufficient to protect against the adverse effects on these assets. The *CoCP* and heritage design principles would address these issues. For example:

- provision for the principal contractor to prepare a Heritage management plan for each project site, post consent
- protective measures, such as temporary support, hoardings, barriers, screening and buffer zones around heritage assets and archaeological mitigation areas, within and adjacent to worksites
- modern structural and environmental design, where it interfaces with a listed building or structure, would respect the historic structural and environmental behaviour of the adjacent listed structure
- relocation of historic materials: For the most significant elements that are removed (e.g., Lamp standards, Lions' head medallions, York stone paving etc.) the project would reuse them in the design where practical and appropriate

- where trees need to be removed in a Conservation Area they shall be replaced as close to their current positions as possible with a species that relates to the character of the area.

The project also aims to promote and enhance the historic environment through the Overarching Written Scheme of Investigation. For example an archaeological investigation of prehistoric timbers, which have been identified at Albert Embankment, would be undertaken. The Mesolithic timbers would be removed and investigated.

Summary

Short term: The construction of the Thames Tideway Tunnel would result in changes to noise and air quality, townscape views and historic environment assets. At the project-wide level these are not anticipated to be significant, although it is recognised that there may be particular issues at individual sites. Similarly, the effect of construction lighting and site hoardings may have a temporary detrimental effect on local receptors and landscape / townscape views to the site. The scheme has been designed to minimise any significant adverse effects as far as possible, and a comprehensive set of measures has been set out in the *CoCP* to minimise the effects.

Medium to long term: The operation of the Thames Tideway Tunnel is not anticipated to have significant noise or lighting effects. Air quality would be managed through a dedicated ventilation strategy that is designed to minimise the risk of odours by maintaining an air flow throughout the tunnel and expelled air is passed through carbon filters in ventilation columns. At a project wide level, there are not anticipated to be any significant effects on the landscape or townscape, although there would be changes to the river views at some locations. These are being managed through the use of design principles. The objectives during the operation of scheme would be supported.

A.10 Land use

National policy and legislation

NPS (2012)

The NPS requires consideration is given to land use (para. 4.8.3). It recognises that the re-use of previously developed land for new development can make a major contribution to sustainable development by reducing the amount of countryside and undeveloped greenfield land that needs to be used. However, this may not be possible for some forms of infrastructure.

Other policy and drivers

NPPF (2012)

The NPPF promotes sustainable development and makes it a central part of the planning system. Of particular relevance is its commitment to conserving and enhancing the natural environment. It states that the planning system should encourage the effective use of land by re-using previously developed land where appropriate[40].

London Plan (2011)

The London Plan is a key driver for the delivery of sustainable development including the protection and enhancement of the natural environment. There are specific policies for geological conservation (policy 7.20), the blue ribbon network of open spaces (policy 7.24) and the River Thames (policy 7.29). Specifically, policy 5.14 sets out support for the project in principle[41].

Thames Water Corporate Guidance

Thames Water has defined a series of sustainability themes which will be used to shape its future plans. Of relevance to this objective is 'Efficient Operations' which focuses on reducing the use of natural resources, minimising waste, and sustainable sourcing.

Selection of the objective

The principal driver for the objective comes from general alignment with the government's AoS, which assesses a Thames Tunnel solution against the objective "to contribute towards a more sustainable pattern of land use". The findings of the AoS were uncertain primarily due to the locations of the construction works being unknown at the time of assessment.

Having regard to the relevant policy context, the existing AoS of the NPS and Thames Water's sustainability themes, the objective identified for the project in relation to land use is to "make sustainable use of land and buildings".

Sustainability appraisal

"Make sustainable use of land and buildings"

The government's AoS concluded in relation to sustainable land use that a Thames Tunnel

[40] DCLG (2012) *National Planning Policy Framework*, DCLG, London.

[41] Mayor of London (2011) *The London Plan*, GLA, London.

solution would have an uncertain effect. This was due to a lack of information on specific sites which meant the assessment could not meaningfully consider the effect on open / green spaces or whether the sites would be located on previously developed land. However, the AoS did note that the majority of the tunnel would be well below ground and therefore would not directly affect surface land use except at construction sites and sites required for future operational access[42].

Guide Question: Has the route of the tunnel had an adverse effect on open spaces, green spaces or sports and recreation land?

Despite being one of the greenest cities in the world, London remains heavily urbanised and open and green spaces are highly valued. The Mayor's London Plan highlights the importance of open and green spaces for the enjoyment of the population, importance to biodiversity, and functional role in enhancing the environment (e.g. by mitigating the urban 'heat island' effect, air quality and noise levels)[43]. Within London there are 223 parks and green spaces that have been awarded the green flag award which reflects the quality of the environment. Despite the quality of many parks and green spaces, nearly 25,000ha of London (16%) have a deficiency of access to nature, with a downwards trend since 2005[44]. The Town and Country Planning Act (1990) defines open space in its formal sense although, the NPS guides decision makers to consider it in its wider sense, i.e., all open space of public value including not just land but also areas of water[45].

The majority of the sites required to support construction of the scheme are located largely on previously developed land and are unlikely to lead to significant effects on open or green spaces, sports or recreational land. However, since the foreshore is considered to be open space, sites that would affect the foreshore may have an effect.

Where open spaces, green spaces or recreation areas are affected, mitigation or other compensatory measures would be provided as appropriate. For example, at Barn Elms the existing sports changing facilities would be demolished as part of the development. However, mitigation measures would include replacing the facilities, and in this case no significant effect is anticipated.

Guide Question: Has the choice of sites for the project prioritised the use of previously developed land?

The sustainable use of land is a key element of the government's sustainability strategy and is emphasised in the NPS. The importance of the appropriate use of land is amplified within London due to the constraints of available land for development and the pressure on green and open spaces. Indeed, the London Plan highlights the importance of using brownfield sites so far as possible, with typically 94% of new properties being developed on previously developed land, well above the national average of 77%[46].

Efforts have been made to locate development on brownfield sites, however, this has not always been possible. The site selection process has been a rigorous exercise that has

[42] Defra (2010) *Appraisal of Sustainability: National Policy Statement for Waste Water*, Defra, London.

[43] Mayor of London (2011) *The London Plan*, GLA, London.

[44] Mayor of London (2011) *London's Environment Revealed: State of the Environment Report for London 2011*, GLA, London.

[45] HM Government (2012) *National Policy Statement for Waste Water*, The Stationary Office, Norwich.

[46] Mayor of London (2011) *London's Environment Revealed: State of the Environment Report for London 2011*, GLA, London.

brought together various disciplines and stakeholders (including Local Authorities in relation to the methodology) and has given consideration to a full range of sustainability issues (including environmental, communities, engineering, economic and planning constraints). There were three main stages which led from an initial identification of possible sites on a long list, through to proposed sites for the chosen route. The process has spanned two major public consultation events and specific targeted consultation, with comments taken on board and amendments made as appropriate[47]. Through the process, Thames Water has balanced the various issues to identify the least constrained sites available.

As a result, the project is broadly considered to have a positive effect in relation to the use of previously developed land.

Guide Question: Will the project maximise the efficient use of land and buildings?

Through the site selection process and design iterations of individual site layouts, the project has sought to maximise the efficient use of available land. The project has also sought to make use of existing structures where possible, for example sites located at pumping stations (Hammersmith, Falconbrook, Heathwall, Shad Thames, Earl, Greenwich and Abbey Mills) where the proposals make use of existing sewerage infrastructure, including buildings.

Therefore, the project is considered to have a positive effect in relation to the efficient use of land and buildings.

Summary

Short term: The location of sites has been subject to a rigorous process and selected sites have been identified based on identified constraints, stakeholder input and targeted public consultation. It is broadly considered that, given the premium of available land in London, the sites have been selected appropriately and are considered to have maximised the use of previously developed land.

Medium to long term: The operation of the scheme is not anticipated to have a significant effect on the sustainable use of land. The land take for permanent development is substantially lower than that required during construction, and in a number of cases would support neighbouring developments in being brought forward.

[47] Thames Tunnel (2013) *Final Report on Site Selection Process*

A.11 Sustainable transport

National policy and legislation

NPS (2012)

The National Policy Statement identifies in section 4.13, that there are economic, social and environmental impacts associated with the transportation of materials, goods and personnel to and from site. The consideration and mitigation of any such effects are considered to be in the context of sustainable development. The NPS encourages the use of rail and water-borne transport in order to alleviate the transports effects wherever possible and cost effective.

Other policy and drivers

NPPF (2012)

The NPPF provides support for sustainable transport, this focus's upon the social, environmental and economic problems related to transport movements. The NPPF encourages the minimisation for the need for travel and also encourages more sustainable transportation. It also advocates the creation of facilities for charging plug-in and other ultra-low emission vehicles and the prioritisation of pedestrian and cyclist movements with access to high quality public transport.

London Plan (2011)

Policy 6.1 promotes the use of public transport, walking and cycling and reducing the use of cars. It also seeks the expansion of the 'Blue network' (river transportation both freight and passenger).

Policy 6.3 requires the impact of new developments upon the current transport system to be assessed, through plans such as a transport strategy, adhering to the TfL's Transport Assessment best practice guidance for major planning applications. Construction Logistics Plans should be provided and be aligned to the London Freight Plan.

Policy 6.9 states that developments should provide changing and shower facilities for cyclists (and other users). Developments should also provide safe, secure and accessible cycle parking facilities.

Policy 6.10 sets out that high quality pedestrian walking facilities should be provided for developments.

Policy 6.14 promotes the use of rail and waterways for the transportation of freight by alternative means than the traditional HGV, such as transporting freight by railway and water.

Policy 7.26 encourages the expansion and use of the London waterways for the transportation of freight goods. Projects close to navigable waterways should maximise their use for the transportation of bulk goods.

The London Freight Plan (2007)

The London Freight Plan provides best practice guidance and refers to the importance of fostering a shift from road to sustainable freight transport by increasing the use of rail or water transport modes.

Selection of the objective

The government's AoS includes the objective to 'minimise the detrimental impacts of travel and transport on communities and the environment, whilst maximising positive effects'. Against this objective, the government's AoS concluded uncertain effects for traffic and transport due to the uncertainties regarding the additional traffic that would be generated by the scheme in the long term, and whether appropriate mitigation, such as the development of a transport strategy to minimise effects on local transport networks would be specified or effective. The AoS did however identify positive effects for promoting sustainable transport during construction, through the predicted use of barge and rail transport.

For the project level appraisal, the objective has been refined to 'minimise the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising use of sustainable transport'.

It has been tailored to closely reflect the project and to address the transportation of construction materials and excavated waste. The disposal of ash at Beckton would be subject to other planning consents, which include consideration to the transport of this material. The assessment of the movement of ash, or any strategy to manage it, has not formed part of the EIA process for the Thames Tideway Tunnel due to these other controls being in place. The focus of the sustainability objective for the project is therefore on construction materials and excavated waste. Similarly, given the limited level of influence the project holds in the context of London's transport system, reference has be given to prioritising sustainable transport, which is an important focus of planning policy, rather than maximising positive effects from transport. This encourages the use of more sustainable forms of transport, such as those recognised by the AoS.

Sustainability appraisal

"Minimise the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising use of sustainable transport"

Guide Question: Will the project affect local transport networks and manage the associated impacts on local communities?

A *Transport Assessment* has been undertaken for the project which identifies the anticipated vehicle movements at each of the sites. Considering the project as a whole, the number of HGV movements required is low in comparison to London-wide traffic levels and therefore are not expected to have any significant effect upon the volume of traffic within London. On an individual site basis, the number of vehicles varies greatly, from 350 HGVs (equivalent to an average of 2 per day) at Bekesbourne Street, up to approximately 51,550 HGVs (equivalent to an average of 36 per day) at Kirtling Street[48]. In recognition to the potential adverse effects these HGVs can have on communities and the environment, Thames Water intend to reduce the number of HGVs on the transport network through the widespread use of river transport.

The *CoCP* sets out requirements for the contractors to produce traffic management plans, for transport movements which are required by HGV. This would influence the routes used by HGVs. HGVs would be required to access the site from the Transport for London road network (TLRN) and strategic road network (SRN), with the aim to minimise effects on residential properties, businesses and sensitive receptors, such as schools as far as is

[48] Thames Tideway Tunnels (2013) *Transport Strategy*, Thames Water, Reading.

reasonably practicable. HGVs would be allowed to park on roads outside designated zones and contractors would liaise with suppliers to ensure HGVs do not arrive outside of standard working hours, unless agreed with the local planning authority[49].

The operation of the Thames Tideway Tunnel would require occasional vehicle movements to and from site for maintenance purposes. However, these are anticipated be infrequent and temporary in nature. Such visits would typically occur every three to six months and would consist of a light commercial vehicle. More substantive inspections are envisaged to occur approximately once every ten years, where it would be necessary to use two cranes to facilitate the lowering and recovery of tunnel inspection equipment. They are not anticipated to have a significant effect on the transport network.

Guide Question: Will Thames Water prioritise sustainable transport modes for moving materials to and from the sites?

The project has been brought forward with regard to the need to construct the tunnel as efficiently as possible, and with regard to optimising the use of river transportation. This has influenced the selection of sites and the engineering strategy. Thames Water intends to utilise river transport to minimise the number of HGVs for moving bulk materials to and from sites. The transport strategy highlights that a minimum of 90% of the following materials would be transported by river barge[50]:

- main tunnel excavated material from the main tunnel drive sites at Carnwath Road Riverside, Kirtling Street, Chambers Wharf
- import and export of cofferdam fill material at eight sites with direct river access, shaft excavated material from ten sites, and excavated material from connection tunnels, interception and associated structures at eight sites
- import of sand and aggregates for main tunnel secondary lining for the main tunnel drive sites at Carnwath Road Riverside, Kirtling Street and Chambers Wharf.

In total, the river would be used to transport approximately 53% of materials for the project (assuming 90% of materials which can be transported by river are moved by barge). Contractors would be encouraged through the procurement process to explore options to increase this proportion.

In addition, the *CoCP* highlights other measures designed to promote the sustainable transportation of materials to and from site. These include ready-mix suppliers for all sites needing to source sand and aggregate by river or rail and using best practice measures for road transport, such as adoption of EURO 5 vehicles (or the current level at the time of the works) as a minimum.

Guide Question: Will Thames Water prioritise sustainable transport modes for workers accessing sites?

Thames Water would implement controls to ensure that the impacts from worker transport are minimised. As part of this it would prioritise sustainable transport for workers and restrict the use of private vehicles accessing work sites. During construction, workers accessing the sites would be made up of two primary groups - staff and labour workers employed by the contractor, and project management staff. A Project Framework Travel Plan (PFTP) has been developed, which sets a framework to manage both types of workers. It has been developed with the primary objectives of:

[49] Ibid.

[50] Thames Tideway Tunnels (2013) *Transport Strategy*, Thames Water, Reading.

- enhancing construction worker and visitor awareness of sustainable travel options to enable more informed travel choices to be made
- maximising the proportion of worker and visitor trips to and from the site which are made by sustainable modes
- enhancing the health and fitness of construction workers and visitors through the encouragement of sustainable travel.

The PFTP details a number of measures that would be implemented through Site Specific Travel Plans at each worksite. The contractual requirements of these plans would specifically include:

- no parking on site for workers[51] unless otherwise agreed with local authorities
- co-operation with project management and local authorities to deter parking by workers in the surrounding area
- a permit system to control operational vehicles on site
- provision of transport to and from public transport nodes where sites are at a distance from public transport services
- provision of cycle parking facilities on site
- providing visitors with advance information on travel routes to the site
- promoting car sharing (for instance via the 'LiftShare' scheme) where no other sustainable transport option is practicable
- providing information on options for a 'guaranteed lift home' service for occasions when car sharers are unable to obtain a lift home with a regular driving partner
- providing worker transport for less accessible sites.

The measures implemented through the travel plans would prioritise the use of sustainable transport through:

- travel awareness
- walking
- cycling
- public and worker transport
- arrangements for car travel and parking.

The encouragement of workers to cycle to work is supported through the provision of welfare facilities, including showers at the sites, as well as secure cycle parking. A number of the sites benefit from being in proximity to a wide range of frequent public transport options including underground, national rail trains and buses.

The Transport Assessment concludes that the numbers of construction workers are not expected to affect the public transport network due to the numbers being low in comparison to existing London-wide usage of the public transport network. Furthermore, cyclists and pedestrians are not expected to cause any significant effects and neither is there expected to be any effects upon river services.

Guide Question: Will the project minimise marine navigation impacts?

Due to the use of a number of foreshore sites and the proposed use of river transportation, there are likely to be a number of effects on marine navigation both during temporary construction works and as a result of lasting operational structures. Construction requirements may result in the temporary closure of bridge arches, particularly at Blackfriars

[51] With the exception of site parking for operational vehicles which would be limited to vehicles such as mini buses, management and maintenance vehicles, and worker parking at Beckton and Abbey Mills.

Bridge Foreshore and Victoria Embankment Foreshore sites, or result in new structures and mooring points (such as temporary mooring for barges delivering or receiving materials from drive sites). Unforeseen circumstances or events may also require temporary adjustments to navigation along the river. Preliminary Navigation Issues and Risks Assessments have been prepared for each of the eleven sites that may have an effect on river navigation. These would be submitted with the application.

The construction phase would also lead to an increase in river traffic, which may include affecting operational arrangements of other organisations such as Thames Clipper services.

The *CoCP* highlights that the contractor would be required to produce an individual river transport management plan (RTMP) for each relevant site. This would need to be prepared in conjunction with the Port of London Authority (PLA) and the Maritime and Coastguards Agency (MCA) as well as relevant stakeholders. The RTMP document would highlight the roles and responsibilities for activities associated with river transportation including marine navigation, dredging and emergency procedures. Other mitigation measures would typically include the management and co-ordination of river transport, physical measures around structures or vessels such as fenders, buoys and the relocation of mooring points.

Summary

Short term: The sustainability objective relates to minimising the detrimental impacts associated with the transport of construction materials and waste on communities and the environment, by prioritising use of sustainable transport. The objective is supported by Thames Water's proposals to minimise impacts and prioritise sustainable transport options. The key effects on transportation are during the construction period. The project is not expected to have a significant effect on London's transport infrastructure, although it is recognised there may be localised effects at specific sites. Where possible the need for HGVs has been minimised through the use of river transport and through implementing controls in the *CoCP*. By making use of the TLRN or SRN the effect on residential properties, businesses or other sensitive receptors would be minimised.

Medium to long term: During the operational phase of the project transport effects would be minimal. The project is minimising transport movements and associated impacts on the communities and environment through the design of the Thames Tideway Tunnel and permanent infrastructure which requires limited maintenance. Consequently site inspections would be relatively infrequent and would only have an occasional, temporary effect. The new structures in the river may have a permanent affect on the location of some mooring facilities, although it is not anticipated to have a substantial effect on navigation.

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DCO-DT-000-ZZZZZ-070700