



RIVER CROSSINGS: SILVERTOWN TUNNEL

SUPPORTING TECHNICAL DOCUMENTATION

NEW THAMES RIVER CROSSING: SUSTAINABILITY APPRAISAL

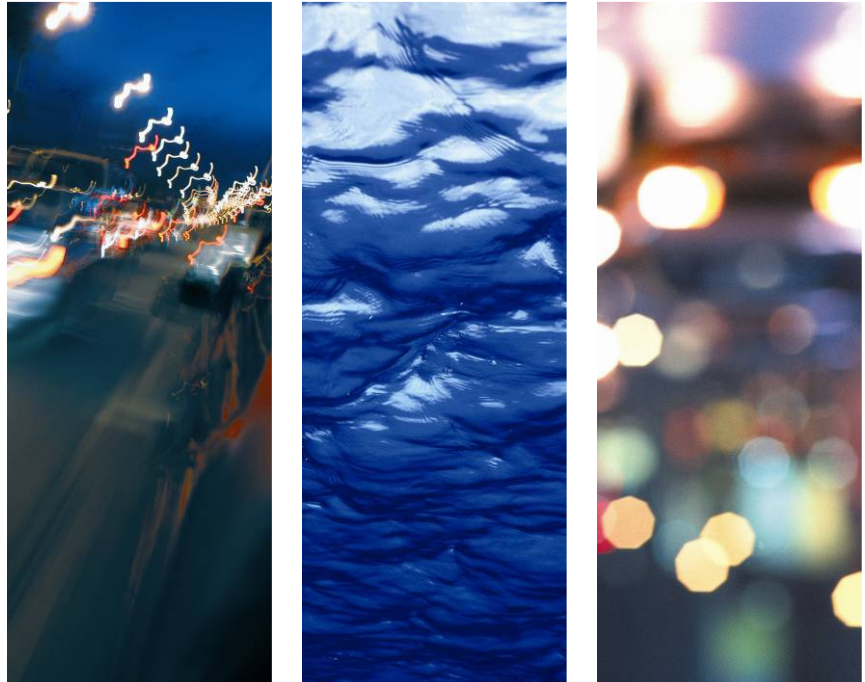
Mott MacDonald

January 2011

This report summarises the findings of a sustainability appraisal to review a number of options for a New Thames River Crossing in the east of London.

This report is part of a wider suite of documents which outline our approach to traffic, environmental, optioneering and engineering disciplines, amongst others. We would like to know if you have any comments on our approach to this work. To give us your views, please respond to our consultation at www.tfl.gov.uk/silvertown-tunnel

Please note that consultation on the Silvertown Tunnel is running from October – December 2014



New Thames River Crossing

Sustainability Appraisal

January 2011
Transport for London

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Executive Summary

Introduction

Mott MacDonald has been commissioned by Transport for London to undertake a sustainability appraisal to review a number of options for a New Thames River Crossing in the east of London.

Stage 1 options

A sustainability appraisal was undertaken in December 2009 on a number of options for a New Thames River Crossing at Gallions Reach and Greenwich to Silvertown. These options included:

- a bored tunnel between Greenwich and Silvertown;
- an immersed tube tunnel between Greenwich and Silvertown;
- a bridge between Greenwich and Silvertown;
- a ferry at Gallions Reach; and
- a bridge at Gallions Reach.

For the purposes of this report, these options have been referred to as Stage 1 options. The key findings of the sustainability appraisal for the Stage 1 options indicated that the provision of a crossing would be beneficial in terms of transport provision, opportunities for increased mobility for all social groups and promoting health benefits in terms of access to community facilities.

Stage 2 options

Since December 2009, the design team have developed a base case design for a bored tunnel between Greenwich and Silvertown. This base case design (referred to as Option 1) will comprise a twin bore, 2 lane uni-directional road tunnel with emergency escape facilities provided through connecting cross passages between the tunnels. From the base case design, two further sub-options were developed:

- Option 2 - a twin bore, 2 lane uni-directional road tunnel, as per Option 1, however the emergency escape facilities are provided by escaping into the tunnel invert and along the invert to safety, removing the need for cross connecting tunnels; and
- Option 3 – the same as Option 2, however Option 3 includes provision for pedestrian and cycle access in the tunnel invert.

For the purposes of this report, these options have been referred to as Stage 2 options. The location and the alignment of the Silvertown Tunnel were the same for all three options; therefore the sustainability appraisal has aimed to capture the subtleties in the design in terms of sustainability.

Overall the three options are all likely to have positive effects in terms of relieving congestion and improving local air quality, promoting sustainable transport links and improving health and well being by improving access to community facilities. Options 2 and 3 are likely to result in a significantly negative effect in terms of materials management as the tunnel diameter is greater than Option 1, resulting in an increased volume of excavated materials. However opportunities could be considered to reuse this excavated material on local proposed developments which would improve the options in terms of sustainability.

Option 3 is preferred in terms of sustainability as the option offers significantly positive effects in terms of transport and health and well being by providing segregated tunnel provision for pedestrians and cyclists, which are not included in Options 1 & 2.

Mitigation and enhancement measures have been suggested to help enhance and mitigate the predicted effects and minimise the risks discussed in the risk workshop in October 2010.

Abbreviations

Abbreviation	
AQ	Air Quality
DASTS	<i>"Delivering a sustainable transport strategy"</i>
DCLG	Department for Communities and Local Government
DDA	Disability Discrimination Act
DfT	Department for Transport
DLR	Docklands Light Railway
GLA	Greater London Authority
PT	Public Transport
SA	Sustainability Appraisal
SPG	Supplementary Planning Guidance
TfL	Transport for London

1. Introduction

1.1 Purpose of the Document

The following document summarises the findings of a sustainability appraisal to review a number of options for a New Thames River Crossing in the east of London, on behalf of Transport for London (TfL).

1.2 Background to the Commission

The overall objective of the New Thames River Crossings project is to overcome a set of problems that include:

- traffic congestion at existing crossing points;
- a lack of resilience with the existing highway network;
- the local economy suffers due to the day to day congestion at existing crossings points and commercial traffic in particular finds it difficult to cross the river;
- physical limitations on access for large vehicles at the Rotherhithe and Blackwall tunnels and Tower Bridge;
- the labour market south of the river finds it difficult to access new jobs;
- development is constrained, and there remain major opportunities for development on both sides of the river but particularly around the Greenwich peninsula, Royal Docks, London Riverside (in Barking) and North Bexley; and
- there is crowding on existing rail lines due to the high concentration of activity around the Isle of Dogs and Greenwich Peninsula.

To address these problems a series of key objectives for the new crossing or crossings have been identified through discussion with the Boroughs and the sub regional partnership . These are:

- to improve the efficiency of the highway network in the London Thames Gateway, especially at river crossings, and provide greater resilience for all transport users;
- to provide improved connections for local traffic and to discourage potential use of new crossing/s by longer distance traffic that should be using national routes such as the M25;
- to support the needs of existing businesses in the area and to encourage new business investment in London through reduced and more reliable journey times, and better access to markets and the labour market;
- to support the provision of and access to public transport services in the London Thames Gateway and, in particular, to improve access to new rail links being provided in the area and provide opportunities for more orbital public transport journeys;
- to promote walking and cycling by providing improved links across the Thames;
- to integrate with and support local and strategic land use policies including existing and future developments and to help improve the quality of the built environment in east London;
- to ensure that any proposals are acceptable in principle to key stakeholders, including affected Boroughs; and
- to identify options that are capable of being delivered, achieve value for money for TfL and the wider Greater London Authority (GLA) (reinforcing existing and planned investment in the area e.g. Crossrail, Docklands Light Railway (DLR) extensions and site remediation and environmental upgrades).

A key aim of the Stage 1 study was to develop the shortlisted scheme options for the bridge and tunnel option at Silvertown/Greenwich to better gauge how or if the schemes are capable of being delivered and achieve value for money and the wider GLA whilst meeting the objectives identified above. It was also necessary to evaluate these alongside the proposals for options at Gallions Reach and the Thames Gateway Bridge location.

The experience to date with the Thames Gateway Bridge project has highlighted the importance of testing options against an agreed set of objectives and also being clear about the problems a scheme is seeking to address. The findings of the sustainability appraisal for the Stage 1 study are set out in this report.

The current London Plan policy makes it difficult to justify building any new road scheme; the regeneration benefits have far to outweigh any traffic or environmental effects. A suggested revision is included in the draft replacement London Plan which sets out the conditions where it would be acceptable to build new road capacity. However, any new road crossing is likely to generate adverse reaction from some groups and be scrutinised closely throughout any potential Inquiry process. Therefore, demonstrating that a robust and transparent process of option appraisal has been carried out is essential.

It will also be important to ensure that if a new fixed link is provided to give resilience benefits that the new capacity is not filled with generated trips. This would ultimately erode the benefits and place increasing pressure on the local road network.

1.2.1 Background to the Stage 2 Commission

Since the completion of the sustainability appraisal for the Stage 1 scheme options in December 2009, the design team has developed a base case option; a bored tunnel between Greenwich and Silvertown with a number of sub options regarding the provision of emergency escape facilities. A further sustainability appraisal has been carried out on these options and is referred to as Stage 2 for the purposes of this report. Stage 2 has reviewed the outcomes of the Stage 1 sustainability appraisal and carried out a further appraisal on a number of detailed design options for the tunnel option between Greenwich and Silvertown. This is set out in Section 4 – Design Evolution, of this report.

1.3 Summary of the approach for Stage 1 and Stage 2

1.3.1 Guiding principles, consultation and overview of process

The Sustainability Appraisal (SA) is intended to add value to the decision making process. The following principles are key to undertaking an integrated SA and the proposed methodology has been developed to reflect these:

Soundness – transparent audit trail;

Robustness –incorporates the requirements of the latest Government policy and guidance;

Effectiveness – fully integrated with the engineering process;

Efficiency –help the decision-making process and addresses issues of uncertainty.

The guiding principles that have been adopted for the study also take into account the following:

- WebTAG guidance;
- emerging Department for Transport (DfT) guidance on “*delivering a sustainable transport strategy*” (DASTS) and its five core values which are to;
 - reduce carbon emissions;
 - support economic growth;
 - promote equality of opportunity;
 - contribute to better safety, security and health;
 - improve quality of life and a healthy natural environment; and
- The London Plan Supplementary Planning Guidance: Sustainable Design and Construction (Mayor of London, 2006); and
- the emerging practice of an integrated approach to Appraisal of Sustainability as referred to in the Planning Act 2008, for national policy statements.

The London Plan Supplementary Planning Guidance (SPG) has been produced to provide additional information to support the implementation of the Mayor’s London Plan. The SPG provides guidance on the way that the seven measures identified in the London Plan Policy 4B.6, can be implemented to meet the London Plan objectives. The following seven measures identified in the SPG have been considered in the appraisal of the Thames River Crossing options and developing the sustainability objectives:

- re-use land and buildings;
- conserve energy, materials, water and other resources;
- ensure designs make the most of natural systems both within, in and around the building;
- reduce the impacts of noise, pollution, flooding and micro-climatic effects;
- ensure developments are comfortable and secure for users;
- conserve and enhance the natural environment, particularly in relation to biodiversity; and
- promote sustainable waste behaviour in new and existing developments, including support for local integrated recycling schemes, combined heat and power schemes and other treatment options.

The SA process adopted typically involves five stages which are aligned to the Sustainability Appraisal process based on Department of Communities and Local Government (DCLG) guidance, November 2005. These are as follows:-

- Stage A – Setting the context and objectives, establishing the baseline and deciding the scope of the SA;
- Stage B – Developing and refining the alternatives and assessing effects;
- Stage C – Preparing the SA Report;
- Stage D – Consultation on the draft plan and SA Report; and
- Stage E – Monitoring the implementation of the plan.

For this project Mott MacDonald will guide the SA up to stage C, preparing the SA report.

Consultation with stakeholders

No formal consultation was undertaken with statutory consultees, by Mott MacDonald. However, statutory consultees from the Environment Agency were present at the Stage 1 sustainability appraisal workshop.

1.3.2 Phase 1

Stage A – Setting the context and objectives, establishing the baseline and deciding the scope of the SA

A1: Identify policies, plans, programmes, and sustainability objectives

The purpose of this initial stage was to establish relevant planning policy guidance and best practice relating to sustainable development and project sustainability that are relevant to the Thames River Crossing project. How the project is affected by these outside factors, and how their objectives and requirements might be taken on board and any inconsistencies and constraints addressed have been documented.

This initial stage review considered guidance at the international, EU, national, regional and local levels, noting any targets or specific requirements included within them, and what these relate to.

The following key policies included in this review are:

- The London Plan (Mayor of London, 2008), including the SA of the London Plan (Mayor of London, 2006);
- The London Plan – Spatial Development Strategy for Greater London Consultation draft replacement plan (Mayor of London, 2009)
- Greenwich Borough Council:
 - LDF Core Strategy Issues and Options Report (Greenwich Council, 2008);
 - LDF Core Strategy Initial SA Report (Greenwich Council, 2008); and
 - Unitary Development Plan (Greenwich Council, 2006).
- Newham Borough Council:
 - LDF Core Strategy Preferred Options Report (Newham Borough Council, 2006);
 - LDF Core Strategy Scoping Report SA Objectives (Newham Borough Council, 2007); and
 - Unitary Development Plan ((Newham Borough Council, 2007).
- Bexley Borough Council:
 - LDF Core Strategy and Issues and Options Paper (Bexley Borough Council, 2006);
 - Sustainability Appraisal Scoping Report of the Core Strategy & Erith Area Action Plan (Bexley Borough Council, 2006); and
 - Unitary Development Plan (Bexley Borough Council, 2004).
- Barking and Dagenham Borough Council:
 - LDF Core Strategy Pre-Submission Report (Barking and Dagenham Borough Council, 2008)
 - Sustainability Appraisal of the Core Strategy Pre-Submission (Barking and Dagenham Borough Council, 2008)
 - Unitary Development Plan (Barking and Dagenham Borough Council, 1996)
- London Borough of Tower Hamlets Council:
 - LDF Core Strategy Proposed Submission Version (London Borough of Tower Hamlets Council, dna);
 - Sustainability Appraisal of the Core Strategy Pre-Submission Document (London Borough of Tower Hamlets Council, dna); and
 - Unitary Development Plan (London Borough of Tower Hamlets Council, 1998).

A matrix of the above policies has been prepared and included in Appendix A.

During the plans and programmes review, a number of key policy areas were identified that should be taken into account in developing the Thames River Crossing. These included:

- **Supporting diverse economic growth and development and economic stability** – This objective is fundamental to all development plans and is fundamental to the scheme.
- **Protection and enhancement of biodiversity** – The construction and operation of the Thames River Crossing should have due regard for existing natural areas in accordance with PPS9: Biodiversity and Geological Conservation, and the UK National Sustainable Development Strategy;
- **Improving health and well-being** – Promotion of the new Thames River Crossing for recreation and exercise opportunities such as walking, cycling and running will help to improve health and well-being in accordance with ‘Choosing Health: Making Choices Easier’ The Health White Paper, UK National Sustainable Development Strategy, PPS1: Delivering Sustainable Development, the London Plan Policy 3A.17 and 3A.20.
- **Encouraging the use of sustainable transport and improving accessibility** – Use of sustainable transport modes such as walking and cycling should be encouraged through the promotion of the New Thames River Crossing. Use of the New Thames River Crossing for sustainable transport use should be promoted in accordance with PPG5: Transport, The London Plan Objective 5, Policy 3C.1 – 4 and 3C.9 and London Borough Council’s LDF Core Strategies and UDP’s such as Newham Borough Council LDF Core Strategy Policies 6.5, 6.15, 6.47 and 6.48.
- **Protection and enhancement of cultural heritage and landscape character** –The construction and operation of the new Thames River Crossing should be in keeping with the surrounding character of the area in accordance with PPS5: Planning and the Historic Environment, the London Plan Policy 4B.10, 4B.14 and 4C.10 and London Borough Council’s LDF Core Strategies and UDP’s such as Bexley Borough Council LDF Core Strategy Issues and Options Paper Objectives 9 and 15.
- **Reducing noise and vibration** – The construction and operation of the new Thames River Crossing should minimise noise generation in accordance with PPG 24: Planning and Noise, the London Plan Policy 4A.14.
- **Climate change mitigation and adaptation** – Promotion of the new Thames River Crossing in particular for walking and cycling may help create a modal shift away from the private car. This would support policies on climate change through reduction of greenhouse gas emissions in accordance with PPS1: Planning and Climate Change – supplement to PPS1, UK National Sustainable Development Strategy, and the London Plan Policy 4A. 15.
- **Conserve and protect ground and surface water resources** –The construction and operation of the new Thames River Crossing should aim to use water resources efficiently in accordance with and the London Plan Policy 4A. 11 – 13.
- **Minimisation of flood risk** – Regular maintenance and appropriate drainage of routes is needed to ensure the PROW network and other access routes are not restricted to users because of flooding and muddy paths in accordance with PPG25: Development and Flood Risk, and the London Plan Policy 4C.7 – 8 and London Borough Council’s LDF Core Strategies and UDP’s such as Barking and Dagenham Borough Council LDF Core Strategy Pre-Submission Report Policy CR.1 and CR.4.
- **Protect, maintain and enhance open space** – The Thames River Crossing should be in keeping with the surrounding character of the area in accordance The London Plan Objective 1 and London Borough Council’s LDF Core Strategies and UDP’s such as Greenwich Borough Council’s LDF Core Strategy: Issues and Options Report, Objective K.
- **Minimise pollution levels and emissions of greenhouse gases** – The construction and operation of the new Thames River Crossing should seek to minimise air pollution levels and greenhouse gas emissions in accordance with The London Plan Policy 4A.6 and London Borough Council’s LDF Core Strategies and UDP’s such as Bexley Borough Council LDF Core Strategy Issues and Options Paper Objective 3.

A2: Collect baseline information and mapping

Baseline information provided the basis for predicting and monitoring the effects and helped to identify existing conditions, sustainability key issues and alternative ways of dealing with them in respect of national, regional and local targets and trends.

Information about the current and likely future state of the area has been collected to allow the project's effects to be adequately assessed. Where possible, existing published baseline data has been used.

Baseline information was collected for the following key topics:

- the historic environment;
- biodiversity and ecology;
- water;
- noise;
- air quality;
- contaminated land;
- landscape and visual;
- community;
- health; and
- equality.

Results of this exercise has been documented in the briefing papers included in Appendices D to M and any issues, constraints or opportunities have been highlighted. A list of the sources of information has been included in each briefing paper. Any limitations in the data collection exercise have been highlighted owing to its impact on developing a robust baseline description.

A3: Agree key sustainability issues with TfL

Sustainability issues and opportunities relating to the Thames River Crossing project were identified. Following consultation with TfL, a selection of the original sustainability issues were defined to address the key challenges for the project and some sustainability issues were scoped out.

A4: Develop objectives for the SA framework

The SA Framework used for the appraisal has been defined and is described in Appendix C. The SA Framework, in consultation with TfL, consists of a number of sustainability objectives.

The Thames River Crossing sustainability objectives are:

- **Biodiversity** - Conserve and enhance, where possible, the protection of existing species and the creation of new habitats.
- **Air Quality** - Minimise air pollution generation and ensure sensitive receptors are not exposed to unacceptable air pollution levels through avoidance or mitigation measures.
- **Noise** - Minimise noise generation and ensure sensitive receptors are not exposed to unacceptable noise levels through avoidance or mitigation measures.
- **Carbon Reduction** - Ensure where possible that low carbon options are taken on board during design/construction and operational phase.
- **Transport** - Support sustainable population and employment growth by improving transport connectivity and delivering an effective and efficient transport system for goods and people.

- **Water** - Manage and reduce the risk of flooding associated with the development options by ensuring, where possible, that ground and surface water quality is conserved and protected.
- **Landscape and open spaces** - Where possible protect and enhance the existing landscape and open spaces.
- **Cultural Heritage and archaeology** - Where possible preserve and protect cultural heritage and archaeological assets and ensure that the development compliments the local character.
- **Health and well being** - Improve health and well-being where possible by ensuring that the development does not unduly have a negative impact on the local community.
- **Equity and social inclusion** - Promote equality and social inclusion through the provision of improved transport services and equal access to employment and community services and facilities.

A5: Prepare scope of the SA for consultation by TfL

Stage A in the SA process would normally involve developing the evidence base and framework, as described in Stages A1 – A4 above, and presenting this in a Scoping Report. For the Thames River Crossing Project a series of briefing papers to inform each objective was developed. The briefing papers are included in Appendices D to M and outline the key baseline conditions and site specific constraints mapping for each topic around the four locations in the study.

1.3.3 Phase 2

Stage B – Developing and refining the alternatives and assessing effects

B1: Test New Thames River Crossing objectives against the SA Framework

It is essential that the sustainability objectives for the Thames River Crossing are in accordance with the overall project principles (as documented in the TfL 'Update on East London River Crossings Review', 8th July 2009), so they have been tested for compatibility as shown in Table 1.1. This will also help in refining the Thames River Crossing sustainability objectives as well as in identifying options.

The compatibility of the Thames River Crossing project objectives, have been tested against the sustainability objectives, listed above, using a matrix such as the one recommended by the Department for Communities and Local Government (DCLG) (2005) Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents.

Table 1.1: Matrix to test the Thames Crossing Sustainability Objectives against the overall project objectives

Project Objectives	Thames River Crossing Sustainability Objectives									
	Biodiversity - Conserve and enhance, where possible, the protection of existing species and the creation of new habitats.	Air Quality - Minimise air pollution generation and ensure sensitive receptors are not exposed to unacceptable air pollution levels through avoidance or mitigation measures.	Noise - Minimise noise generation and ensure sensitive receptors are not exposed to unacceptable noise levels through avoidance or mitigation measures.	Carbon Reduction - Ensure where possible that low carbon options are taken on board during design/construction and operational phase.	Transport - Support sustainable population and employment growth by improving transport connectivity and delivering an effective and efficient transport system for goods and people.	Water - Manage and reduce the risk of flooding associated with the development options by ensuring, where possible, that ground and surface water quality is conserved and protected.	Landscape and Open Spaces - Where possible protect and enhance the existing landscape and open spaces.	Cultural Heritage and Archaeology - Where possible preserve and protect cultural heritage and archaeological assets and ensure that the development compliments the local character.	Health and Well Being - Improve health and well-being where possible by ensuring that the development does not unduly have a negative impact on the local community.	Equity and Social Inclusion - Promote equality and social inclusion through the provision of improved transport services and equal access to employment and community services and facilities.
To improve the efficiency of the highway network in the London Thames Gateway, especially at river crossings, and provide greater resilience for all transport users.		+	+	+	++					
To support the needs of existing businesses in the area and to encourage new business investment in London through reduced										

New Thames River Crossing



and more reliable journey times, and better access to markets and the labour market.		+			++				+	++
To support the provision of and access to public transport services in the London Thames Gateway and, in particular, to improve access to new rail links being provided in the area and provide opportunities for more orbital public transport journeys.		++	+	+	++				++	++
To promote walking and cycling by providing improved links across the Thames.		++	+	++	++				++	++
To integrate with and support local and strategic land use policies including existing and future developments and to help improve the quality of the built environment in east London.						+	++	+		
To ensure that any proposals are acceptable in principle to key stakeholders, including affected Boroughs.										++
To identify options that are capable of being delivered, achieve value for money for TfL and the wider GLA (reinforcing existing and planned investment in										

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the area e.g. Crossrail, DLR extensions and site remediation and environmental upgrades).										
To provide improved connections for local traffic and to discourage potential use of new crossing/s by longer distance traffic that should be using national routes such as the M25.		+	+	+	++				+	

Key

++	Thames River Crossing project objective directly promotes sustainability objective
+	Thames River Crossing project objective indirectly promotes sustainability objective
0	Thames River Crossing project objective has no link to the sustainability objective
-	Thames River Crossing project objective indirectly contradicts sustainability objective
--	Thames River Crossing project objective directly contradicts sustainability objective
?	Link depends on implementation of the Thames River Crossing

The matrix in Table 1.1 has highlighted that none of the Thames River Crossing project objectives and sustainability objectives contradict each other. The majority of the project objectives directly promote the transport sustainability objective. Two project objectives relating to value to money and consultation have a weak link to the sustainability objectives. A sustainability objective covering economic development and stability was originally outlined as a sustainability objective for the Stage 1 work; however this was scoped out by TfL at this stage.

B2: Develop New Thames River Crossing strategic alternatives

The purpose of this stage was to review potential options proposed to address the objectives identified in Stage A. As shown below, TfL had previously developed four options, in addition to these Mott MacDonald added a ‘do nothing’ scenario.

The options and alternatives considered for the Thames River Crossing:

- Option One: ‘Do Nothing’;
- Option Two: Vehicle and passenger ferry between Gallions Reach and Thamesmead;
- Option Three: Lower capacity bridge between Gallions Reach and Thamesmead;
- Option Four: Bored tunnel between Greenwich and Silvertown with a long-about at Silvertown and a low level half –diamond junction at Greenwich;
- Option Four Alternative – Bored tunnel with highway tie-in’s below A102;
- Option Five – Lifting road bridge between Greenwich and Silvertown with a long-about at Silvertown and high level half-diamond junction; and
- Option Five Alternative – Lifting road bridge between Greenwich and Silvertown with tie ins over the DLR with slip roads at Silvertown and a viaduct over the A102.

It was decided at the SA workshop not to assess the Option Four Alternative and Option Five Alternative schemes because engineering feasibility assessments had not identified these as preferable.

B3: Predict the effect of New Thames River Crossing and alternatives

The deliverables and outputs from stages B3 to B6 were completed in a workshop setting with representatives from Mott MacDonald, Transport for London and the Environment Agency, to ensure a robust assessment with valuable, multi-discipline input. The workshop outputs are documented in Appendix C.

The Thames River Crossing options including the ‘do nothing’ option, have been tested against the agreed SA Framework to determine their performance in sustainability terms. Positive as well as negative effects have been considered, and uncertainties about the nature and significance of effects have been noted.

The prediction of effects involves:

- identifying the changes to the sustainability baseline which are predicted to arise from the Thames River Crossing; and
- describing these changes in terms of their magnitude, their geographical scale, the time period over which they will occur.

B4: Evaluate effects of New Thames River Crossing and alternatives

Having identified the effects of the Thames River Crossing options, an assessment of the significance of these effects was conducted. It was noted whether the effect was likely to be positive, negative, neutral or uncertain, and the timescale and significance of the effect, e.g. whether it is likely to be short or long-term, major or minor. In some circumstances, the Thames River Crossing options may have either a positive or negative effect depending on how the option is taken forward. In this instance, this was noted in the assessment table as “D”, depending on implementation as shown in the Assessment Scoring Key below.

The method of recording the appraisal is given below:

Assessment Scoring Key:

++	Significant positive effect
+	Marginal positive effect
0	Neutral or no effect
-	Marginal negative effect
--	Significant negative effect
D	Effect depends on implementation
?	Uncertainty over effect

The aspects of the scheme have been appraised according to whether they would have a positive, negative or neutral effect to the sustainability objectives. A ‘Do Nothing’ option which assumes the Thames River Crossing(s) will not be implemented, has also been assessed to show the benefits or dis-benefits of implementing the Thames River Crossing against the baseline situation.

B5: Consider mitigation and enhancement

Where the Thames River Crossing project is likely to have significant sustainability effects, mitigation measures have been considered at the workshop held in November 2009, to prevent, reduce or offset any adverse effects and maximise positive effects. It was agreed at the workshop that mitigation measures would be worked on and reported formally at a later stage of the project. Since December 2009, the design team have since developed a base case design option and as such the design is now suitably progressed to provide an indication of possible mitigation and enhancement measures as described in Section 5 of this report.

B6: Propose monitoring measures

The design of monitoring measures at this early stage of the project is not practicable and it is recommended that this is considered at a later stage.

Stage C – Preparing the Appraisal of Sustainability Report

The SA report on the Thames River Crossing is a key output of this stage of the process. This report includes a detailed account of the appraisal process, including the findings of the assessment. Revision A of the SA report has been used by the design team to develop a base case design option. An update of the SA has been undertaken to reflect design evolution and is described in more detail in Section 4.

1.4 Document Structure

This document has the following structure:

Table 1.2: Document Structure

Section	Contents
1	Introduction
2	Stage 1 - Sustainability Issues for Options
3	Stage 1 - Summary
4	Stage 2 – Design Evolution
5	Conclusions and Recommendations
Appendix A	Policy Review Matrix
Appendix B	The Schemes
Appendix C	Sustainability Appraisals
Appendix D	Biodiversity Objective
Appendix E	Air Quality Objective
Appendix F	Noise Objective
Appendix G	Water Objective
Appendix H	Contaminated Land Objective
Appendix I	Landscape and Open Spaces Objective
Appendix J	Cultural Heritage
Appendix K	Health Objective
Appendix L	Equality Objective
Appendix M	Community Objective

2. Stage 1 - Sustainability Issues for Options

2.1 Introduction

This section gives an overview of the most important sustainability issues for each option. It deals with both the positive and negative impacts of the scheme. The focus lies on significantly positive and significantly negative effects. Marginally negative and positive effects are also listed, especially if more detailed investigation could turn these into significantly negative impacts leading to the re-appraisal of the option. The full assessment matrix including the score of all options against all objectives is included in Appendix C. Table 2.1 gives an overview of the sustainability objectives against which the Stage 1 options were scored.

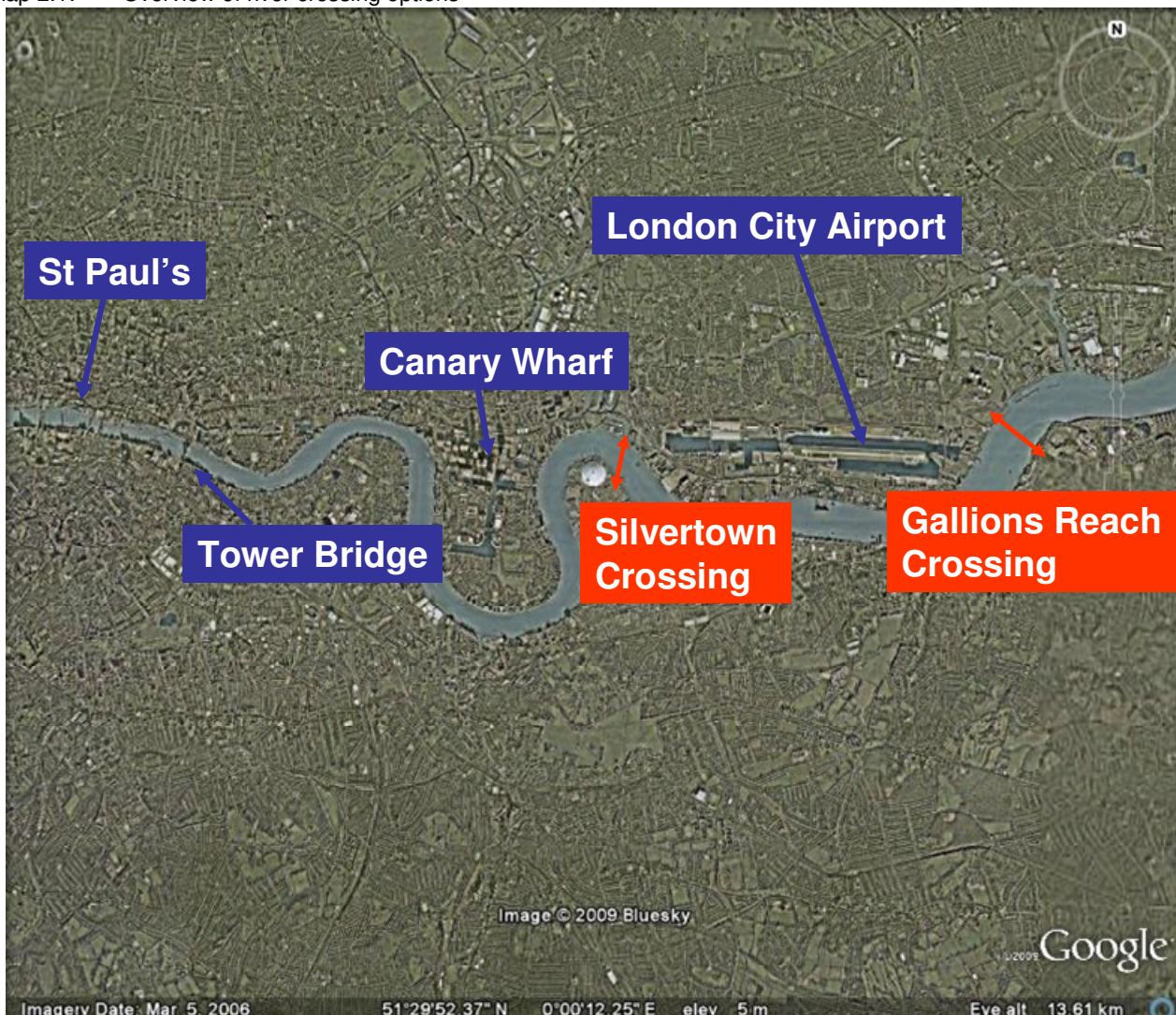
Table 2.1: Sustainability Objectives

Sustainability Objectives	
Biodiversity	Conserve and enhance, where possible, the protection of existing species and the creation of new habitats.
Air Quality	Minimise air pollution generation and ensure sensitive receptors are not exposed to unacceptable air pollution levels through avoidance or mitigation measures.
Noise	Minimise noise generation and ensure sensitive receptors are not exposed to unacceptable noise levels through avoidance or mitigation measures.
Carbon Reduction	Ensure where possible that low carbon options are taken on board during design/construction and operational phase.
Transport	Support sustainable population and employment growth by improving transport connectivity and delivering an effective and efficient transport system for goods and people.
Water	Manage and reduce the risk of flooding associated with the development. Ensure where possible, that ground and surface water quality is conserved and protected.
Landscape and Open Spaces	Where possible protect and enhance the existing landscape and open spaces.
Cultural Heritage and Archaeology	Where possible preserve, protect and enhance cultural heritage and archaeological assets and ensure that the development compliments the local character.
Health and Well Being	Improve health and well-being where possible by ensuring that the development does not unduly have a negative impact on the local community – seek to reduce health inequalities.
Equality and Social Inclusion	Promote equality and social inclusion through the provision of improved transport services and equal access to employment and community services and facilities.

2.2 Overview of the Options

Map 2.1 shows where the five options are located. The Silvertown Crossing consists of three options, a bored tunnel, an immersed tube tunnel and a lifting bridge. The Gallions Reach crossing consists of a smaller bridge or a vehicle and passenger ferry. Each option is considered in turn below. Further detail on each option is provided in Appendix B.

Map 2.1: Overview of river crossing options



2.3 Do nothing

The ‘Do nothing’ option considers what the impacts on the sustainability objectives would be if no new crossing was put in place.

Table 2.2: Main sustainability issues for the ‘Do nothing’ option

Objective	Score	Issue
Significant Effect		
Transport	■■	The network will become less resilient with increasing demand. The Blackwall Tunnel is over capacity at most times and there are resilience issues especially when vehicle breakdowns or maintenance requires the tunnel to be closed.
Marginal Effect		
Noise	■	Receptors may increase with housing developments in the area and more people will be affected by noise from road traffic congestion.
Carbon Reduction	■	It is assumed that traffic congestion increases which will increase carbon output.
Equality and Social Inclusion	■	Continued separation of the communities north and south of the river.

Not implementing a river crossing scheme has a largely neutral effect on the environment. Due to the absence of construction there are no significant temporary impacts but at the same time the environment is not enhanced. There are a number of negative impacts on the transport network and the local communities (continued congestion and accessibility issues).

2.4 Greenwich – Silvertown

2.4.1 Bored Tunnel

The bored tunnel runs from the A102 (Millennium Way) along Edmund Halley Way on the Greenwich Peninsula, under the Thames and emerges to link with the Silvertown Longabout.

The main sustainability issues for the tunnel are shown in Table 2.3 below.

Table 2.3: Main sustainability issues for the bored tunnel

Objective	Score	Issue
Significant Effect		
Transport	++	The tunnel provides a reliable link near the Blackwall Tunnel and improved network resilience. It has the advantage that it will always be open to traffic (apart from closure due to accidents). It provides access for cars as well as cross river public transport. It is an option to construct an invert for a separate pedestrian and cyclist tunnel.
Water	--	There is potential for contaminated groundwater (from former gasworks) to migrate off site causing impacts to ground and surface waters. Tunnel excavation can affect water quality in the wider area due to materials used (e.g. spray concrete lining, grouting materials). There are a number of other schemes proposed in the East London area (e.g. Crossrail, Thames Tideway) which, due to their cumulative impacts, may have an unacceptable impact on groundwater and surface water resources. This makes the impacts on water quality, conservation and protection a significant issue for the bored tunnel option.
Marginal Effect		
Air Quality	+	Reduced congestion and point source of emissions from ventilation stacks
Health and Wellbeing	+	Improved access arrangements for residents of the area.
Equality and Social Inclusion	+	Close to population with high density of equality groups. Improved access for these groups.
Noise	-	Increased traffic volumes and noise at the tunnel portals. According to the Greenwich future masterplan, a residential development is planned within close proximity of the tunnel portal. This is likely to result in a negative effect on nearby sensitive receptors.
Carbon Reduction	-	Increased traffic volumes, large energy use and carbon footprint of construction.
Landscape and Open Spaces	-	Proximity of ventilation stacks to resident population.

The main issue for the bored tunnel option between Greenwich and Silvertown is firstly the potential for contaminated groundwater (from former gasworks) to migrate off site causing impacts to ground and surface waters. Secondly, the materials required to construct a bored tunnel could cause impacts to water quality (e.g. sprayed concrete linings and groutings) and thirdly, there are a number of other proposed tunnelling schemes in the vicinity and their cumulative impacts are currently uncertain.

2.4.2 Immersed Tube Tunnel

The immersed tube tunnel is situated in the same location as the bored tunnel. While during operation most of the sustainability issues are the same as for the bored tunnel the difference in construction methods gives rise to different impacts during the construction period.

Table 2.4: Main sustainability issues for the immersed tube tunnel

Objective	Score	Issue
Significant Effect		
Transport	++	The tunnel provides a reliable link near the Blackwall Tunnel and improved network resilience. It has the advantage that it will always be open to traffic (apart from closure due to accidents). It provides access for cars as well as cross river public transport. It is an option to construct an invert for a separate pedestrian and cyclist tunnel.
Carbon Reduction	--	Increased traffic volumes, large energy use and carbon footprint during construction especially for the treatment of contaminated material/excavated materials could be intensive due to water content or contamination associated with the immersed tunnel option.
Water	--	The impacts on water quality and resources are significant. The issues are similar to those of the bored tunnel (see Table 2.3). There will however be greater impacts on the surface water quality. A large amount of dredging will be required and the handling of dredged material difficult due to water content.
Marginal Effect		
Air Quality	+	Reduced congestion and point source of emissions from ventilation stacks
Health and Wellbeing	+	Improved access arrangements for residents of the area.
Equality and Social Inclusion	+	Close to population with high density of equality groups. Improved access for these groups.
Biodiversity	-	Construction involves a deep trench across the rivers causing sediment suspension which will impact tidal species. Impact worst during construction – likely to recover.
Noise	-	Increased traffic volumes and noise at portal.
Landscape and Open Spaces	-	Proximity of ventilation stacks to resident population.

The impacts of the immersed tube tunnel on the water resources are harder to mitigate than for the bored tunnel. The main issue lies not with contaminated land but with the disturbance of surface waters and sediment suspension due to dredging.

2.4.3 Bridge

The proposed road bridge follows the same alignment as the tunnel from Millennium Way, across the Thames, to connect with the Silvertown Longabout. The bridge will pass under the DLR viaduct on the Silvertown side.

Table 2.5: Main sustainability issues for the bridge

Objective	Score	Issue
Significant Effect		
Noise	■■	The ramp from the road to the bridge will pass buildings between the 2 nd and 10 th storey. Traffic will be passing near to residents' windows. This is a constant source of noise as traffic passes the bridge. The noise will project a significant distance and the visual impact of the bridge heightens the individual's perception of noise. Noise is therefore the main sustainability issue for the bridge.
Marginal Effect		
Transport	+	Provides access for all modes and a connection across the river. Provides network resilience but is interrupted for shipping movements when bridge is lifted. The frequency of lifts is not known and therefore has been assumed to cause some disruption when compared to the other options.
Equality and Social Inclusion	+	Improved accessibility for local residents but need to ensure bridge accessibility suits old and disabled.
Carbon Reduction	-	Facilitates more trips. Stationary vehicles due to short term closures for shipping movements.
Water	-	Disturbance of local surface water resources/likely dredging requirements during construction.
Landscape and Open Spaces	-	Change in visual amenity, a lot of new development and a significant change in local landscape/townscape.
Cultural Heritage and Archaeology	-	There will be a change in the setting of the listed building at the Blackwall tunnel approach due to bridge approach routes, which will be located in close proximity to this building.

The transport benefits of the bridge are lower than those of the tunnel due to the necessary closures during lifting to allow for shipping movements. While a bridge can be considered a visual intrusion this need not be negative especially if innovative design is employed. The greatest issue of the bridge is the generated noise from traffic crossing the river as the ramp and bridge will pass existing residential housing in close proximity. The negative effect created by the traffic noise is also likely to have an impact on the planned future residential developments proposed as part of the Greenwich Peninsula Masterplan.

2.5 Gallions Reach

2.5.1 Ferry

There are two proposed options for crossings between Gallions Reach and Thamesmead. The first is a new vehicle ferry, which will require new road links to the Western Way in Thamesmead and a new approach road on the Gallions Reach side. The tie in to the road network on the Gallions Reach side is yet to be determined.

Table 2.6: Main sustainability issues for the ferry

Objective	Score	Issue
Marginal Effect		
Air Quality	+	There is no significant construction involved and congestion will be marginally reduced.
Transport	+	Longer trips south of river might be re-routed to shorter ones crossing the river. Overall greater access.
Health and Well Being	+	Link is creating access which is especially important for Thamesmead as it is comparatively isolated. Encourages active movement – cycling and walking.
Equality and Social Inclusion	+	Link opens up access to the wider public transport network on the north side e.g. DLR.
Biodiversity	-	There will be a loss of designated woodland adjacent to a conservation site.
Carbon Reduction	-	The ferry itself will cause emissions adding carbon to the environment.
Water	-	Dredging is a likely requirement during construction and operation, causing the movement of sediment. Constructing impermeable road structures on the river banks will increase the risk of flooding.
Landscape and Open Spaces	-	There is an overall net loss of open land.

The construction required for the ferry is minimal compared to the other options and only involves road access and a ferry boarding area. There are hence significant negative effects. Due to its lower capacity and non-permanent nature the transport benefit are however also lower.

2.5.2 Bridge

The second option follows a similar alignment to the ferry and the former proposed Thames Gateway Bridge location. The Gallions Reach connection is expected to be a viaduct connecting to an existing bridge that will link the new bridge to the A117 and A1020. The Thamesmead connection will be the same as proposed for the ferry.

Table 2.7: Main sustainability issues for the bridge

Objective	Score	Issue
Significant Effect		
Transport	++	The bridge provides local transport benefits encouraging short distance rather than long distance trips. Public transport can be routed across the bridge and it can be accessed by pedestrians and cyclists. It will provide indirect network resilience.
Marginal Effect		
Air Quality	+	Possible local decrease in air quality but relieving congestion in the wider area leading to wider air quality benefits.
Health and Well Being	+	Link is creating access which is especially important for Thamesmead as it is very cut off at the moment. Encourages active moment – cycling and walking.
Equality and Social Inclusion	+	Improved accessibility for local residents but need to ensure bridge accessibility suits old and disabled.
Biodiversity	-	Loss of locally designated areas. Some impact to inter-tidal habitats and bird breeding areas. Mitigation would need to enhance surrounding areas.
Noise	-	Increase low level background noise level, orientation of noise source more likely to impact receptors.
Carbon Reduction	-	Facilitates more trips. Could become neutral score if displaced journeys are shorter.
Water	-	Disturbance of local surface water resources/ likely dredging requirements during construction.
Landscape and Open Spaces	-	Marginally negative impact due to loss of open space but if bridge of innovative design could enhance landscape.

The bridge would mainly provide an opportunity for new and quicker local trips which will be a great benefit to the Thamesmead area. At this stage, it is not known to what extent the bridge could provide network resilience, especially relating to the Blackwall tunnel and whether the bridge would provide a feasible alternative to traffic using the tunnel at present. Further modelling could be undertaken at a later stage to determine this

2.6 Other Sustainability Issues

A series of other sustainability issues were produced during the evaluation process, which will require consideration for later stages.

It is assumed that the assessment scores put forward for each alignment option against sustainability objective have not included mitigation. The assessment may be improved if mitigation was put into action, however this has not been considered. The options have been assessed against the baseline briefing papers, found in Appendices D to M, with no future scenarios considered. Mitigation will be introduced in further assessments.

Climate change – adaptation to climate change

Sustainability objective 4, Carbon Reduction, looks to ensure where possible that low carbon options are taken on board during design/construction and operational phases. This does not consider climate change adaptations as it was felt that scoring factors, such as flooding, would prove difficult and should therefore be added to the commentary and note it as an issue. Adaptation should be looked at separately for each

objective not as a stand alone objective. Adaptations could include increased run off, higher levels of flooding and high wind speeds, all of which could be considered design issues. If the designer was to design appropriately to take these into account then the option would not require appraisal for them, although it is recommended to still record the adaptation. Any adaptations picked up within this sustainability appraisal will help to draw its attention to the designers.

The issues of climate change adaptation and the subsequent design also support the need for the emerging design to be future proofed. The sustainability objectives need to help highlight detailed design issues.

Excavated materials management and waste

Waste has been removed from the sustainability objectives to make them simpler, due to waste not being considered an objective but a design stage consideration. It was suggested that the TfL sustainable procurement policies are used to drive acceptable standards and that further information on the materials required for each option is required. For example the standard procedure with tunnel waste is to send it to landfill, however it may actually be reused and so more information of this nature is required.

It is important to note that it was possible to create or add in objectives through out the course of the workshop if it was felt that a factor was not being covered.

3. Stage 1 - Summary

3.1 Main Issues

The summary tables provided above (and in greater detail in Appendix C.1) indicate the key sustainability issues associated with the proposed options as assessed against the agreed objectives. The Thames River Crossing Schemes have not been assessed in comparison to each other.

The assessment has been based upon desk based publically available information. No site specific surveys or investigations have been carried and no consultation with statutory bodies or interested stakeholders has been undertaken to date.

The key findings indicate that provision of a crossing would be beneficial in terms of transport provision, opportunities for increased mobility for all social groups and promoting health benefits in terms of access to health/fitness facilities and opportunities for health/fitness improvements. There are potential negative impacts in relation to environmental aspects such as noise, water quality and biodiversity.

3.2 Issues to be considered for Stage 2

The purpose of this initial sustainability appraisal was to identify key headline issues for the various options under assessment. Within the briefing papers provided in Appendix D-M, recommendations for further studies and assessments are provided.

It is recommended for those issues where it has been recorded that a Thames River Crossing option directly contradicts sustainability objective further information is gathered to confirm these scorings.

4. Stage 2 – Design Evolution

4.1 Introduction

Since the sustainability appraisal of the Stage 1 options was carried out in December 2009, the design team has further developed a base case design, a bored tunnel between Greenwich and Silvertown as described in Section 2.4.1 (referred to as Option 4 in Appendix C.1). Hereafter this option will be referred to as Option 1. The following section presents a review of the sustainability objectives used for the Stage 1 options and a further sustainability appraisal of the updated options (Stage 2) for the new Thames River Crossing at Silvertown.

4.2 Stage 2 Options

A brief overview of the Stage 2 options are given in the following sections and further details are provided in the “Silvertown Tunnel Option – Addendum to Volume 1” report (Mott MacDonald, 2010).

4.2.1 Option 1

Option 1 is a twin 2 lane uni-directional bored road tunnels between Greenwich to Silvertown. This design is based on the traditional approach of providing emergency escape facilities using eleven inter-connecting passageways between the uni-directional tunnels. These passageways would have an excavated diameter of approximately 4.55m. The outside diameter of the road tunnels in Option 1 is 12.1m.

4.2.2 Option 2

Option 2 is based on the same concept of twin 2 lane uni-directional bored road tunnels as per Option 1; however the design team have explored the merits of providing emergency escape facilities through the tunnel invert. This would remove the need for inter-connecting passageways between the two tunnels. Using the tunnel invert for the emergency escape facilities would increase the outside diameter of the road tunnels to approximately 14.0m.

4.2.3 Option 3

Option 3 is based on the same design concept as Option 2, by providing emergency escape facilities through the tunnel invert resulting in the same outside diameter of approximately 14m. In addition, pedestrian access and a cycle way would be provided in the northbound tunnel invert. Option 3 would require two lift shafts at both the Greenwich and Silvertown tunnel entrances, to provide access for pedestrians and cyclists from the ground level to the low level.

4.3 Revised sustainability objectives

A review of the Stage 1 sustainability objectives given in Table 2.1 has been undertaken. This review was to ensure that the sustainability objectives were still relevant and appropriate, considering that the location and type of river crossing had been finalised since the sustainability objectives were originally developed.

It was considered that a number of the Stage 1 sustainability objectives are of lesser importance such as biodiversity and cultural heritage and archaeology, now that the location of the new Thames River crossing has been finalised. These sustainability objectives will remain in the Stage 2 sustainability appraisal, however there is likely to be little or no differentiation between the options.

Additional sustainability objectives such as materials management, climate change and economics, described further in Table 4.1, have been incorporated into the sustainability appraisal of the Stage 2 options described in Section 4.2.

Table 4.1: Additional sustainability objectives

Additional Sustainability Objectives	
Materials Management	Through the design process, promote the use of sustainable materials and waste management through minimising excavated materials. Where possible during construction, promote waste minimisation through reducing, re-using and recycling of materials.
Economics	Minimise the whole life cost of the option. Provide local employment and procurement opportunities during construction and operation of the Silvertown tunnel to encourage a local, sustainable economy.
Climate Change	This involves climate proofing the design to adapt to future climate risks such as warmer, wetter winters, hotter drier summers, risk of flooding, and increase of frequency of gales and extreme weather events.

4.3.1 Testing the Additional Sustainability Objectives

As outlined in Section 1.3.3, it is essential that the sustainability objectives for the Thames River Crossing are in accordance with the overall project principles. The sustainability objectives used in for the Stage 1 options have been tested for their compatibility with the overall project principles (as shown in Table 1.1). For completeness, the additional sustainability objectives used in the sustainability appraisal of the Stage 2 options have been tested against the overall project principles as shown in Table 4.2 using the key below:

Key

++	Thames River Crossing project objective directly promotes sustainability objective
+	Thames River Crossing project objective indirectly promotes sustainability objective
-	Thames River Crossing project objective has no link to the sustainability objective
-	Thames River Crossing project objective indirectly contradicts sustainability objective
--	Thames River Crossing project objective directly contradicts sustainability objective

Table 4.2: Matrix to test the Thames Crossing Additional Sustainability Objectives against the overall project objectives

Project Objectives	Thames River Crossing Sustainability Objectives		
	Materials Management - Through the design process, promote the use of sustainable materials and waste management through minimising excavated materials. Where possible during construction, promote waste minimisation through reducing, re-using and recycling of materials.	Economics – Minimise the whole life cost of the option. Provide local employment and procurement opportunities during construction and operation of the Silvertown tunnel to encourage a local, sustainable economy.	Climate Change - This involves climate proofing the design to adapt to future climate risks such as warmer, wetter winters, hotter drier summers, risk of flooding, and increase of frequency of gales and extreme weather events.
To improve the efficiency of the highway network in the London Thames Gateway, especially at river crossings, and provide greater resilience for all transport users.			+
To support the needs of existing businesses in the area and to encourage new business investment in London through reduced and more reliable journey times, and better access to markets and the labour market.		++	
To support the provision of and access to public transport services in the London Thames Gateway and, in particular, to improve access to new rail links being provided in the area and provide opportunities for more orbital public transport journeys.		+	+
To promote walking and cycling by providing improved links across the Thames.			++
To integrate with and support local and strategic land use policies including existing and future developments and to help improve the quality of the built environment in east London.	+	+	+
To ensure that any proposals are acceptable in principle to key stakeholders, including affected Boroughs.			
To identify options that are capable of being delivered, achieve value for money for TfL and the wider GLA (reinforcing existing and planned investment in the area e.g. Crossrail, DLR extensions and site remediation and environmental upgrades).		++	+
To provide improved connections for local traffic and to discourage potential use of new crossing/s by longer distance traffic that should be using national routes such as the M25.			

The matrix in Table 4.2 has highlighted that none of the Thames River Crossing project objectives and additional sustainability objectives contradict each other. The majority of the project objectives directly promote the economics sustainability objective.

4.4 Methodology

4.4.1 Approach

The approach used for the sustainability appraisal of the Stage 2 options has been consistent with that used for the Stage 1 options, as documented in Sections 1.3.2 and 1.3.3. The approach has used the baseline information provided in Appendices D to M and updated design reports and drawings. Unlike the sustainability appraisal on the Stage 1 options, a workshop has not been held with stakeholders to agree the assessment scores for each of the Stage 2 options. The Mott MacDonald design team has provided specialist engineering input into the sustainability appraisal of the Stage 2 options to help identify whether the design options would have a positive, negative or neutral effect on the sustainability objectives. The options have been assessed against the baseline information provided in Appendices D to M and not compared to each other. The findings from the sustainability appraisal on the Stage 2 options have contributed to the risk workshop held in October 2010.

4.4.2 Assumptions

The following assumptions have been taken into consideration for the appraisal:

- the allocated assessment scores for each option against the sustainability objectives have not included mitigation;
- all the sustainability objectives are equally weighted;
- the design life for the options is 120 years; and
- the assessment has focussed on the New Thames River Crossing, and therefore there has been limited consideration given to future neighbouring developments such as Crossrail and the proposed London Cable Car. At the time of the appraisal, information contained in the Environmental Statement which was produced for the London Cable Car was not available.

Table 4.3 gives an overview of the sustainability issues for each option using the following assessment scoring key:

Assessment Scoring Key

++	Significant positive effect
+	Marginal positive effect
0	Neutral or no effect
-	Marginal negative effect
--	Significant negative effect
D	Effect depends on implementation
?	Uncertainty over effect

The full assessment matrix including the score of all options against all objectives is included in Appendix C.2.

Table 4.3: Summary table of the Stage 2 – Sustainability Appraisal

Stage 2 Options	Sustainability Objectives												
	Biodiversity	Air Quality	Noise	Carbon Reduction	Transport	Water	Landscape and Open Space	Cultural Heritage and Archaeology	Health and Wellbeing	Equality and Social Inclusion	Materials Management	Economics	Climate Change
Option 1: Twin 2 lane uni-directional bored road tunnels between Greenwich to Silvertown. Design based on the traditional approach of providing emergency escape facilities using eleven inter-connecting passageways between the uni-directional tunnels.	0	+	-	-	+	--	-	D	+	+	-	-	D
Option 2: Twin 2 lane uni-directional bored road tunnels providing emergency escape facilities through the tunnel invert, removing the need for inter-connecting passageways between the two tunnels.	0	+	-	-	+	-	-	D	+	+	--	-	D
Option 3: Twin 2 lane uni-directional bored road tunnels providing emergency escape facilities through the tunnel invert. In addition, pedestrian access and a cycle way would be provided in the northbound tunnel invert which would require two lift shafts at both the Greenwich and Silvertown tunnel entrances, to provide access for pedestrians and cyclists from the ground level to the low level.	0	+	-	-	++	-	-	D	++	+	--	--	D

The main issues for the three options relate to materials management and economics. Options 2 and 3 result in more excavated material compared to Option 1 due to the greater tunnel diameter required for the emergency escape through the tunnel invert. Options 2 and 3 also result in a negative effect on economics due to the higher construction costs. Option 3 delivers more significantly positive effects in terms of transport and health and well being due to the provision of pedestrian and cycleway tunnels.

5. Conclusions and Recommendations

5.1 Conclusions

A sustainability appraisal was undertaken in December 2009 on a number of options for a New Thames River Crossing at Gallions Reach and Greenwich to Silvertown. For the purposes of this report, these options have been referred to as Stage 1 options. The key findings from this appraisal process indicated that the provision of a crossing would be beneficial in terms of transport provision, opportunities for increased mobility for all social groups, facilitating walking and cycling for Options 2 and 3 and promoting health benefits in terms of access to community facilities. The appraisal process highlighted that there may potentially be negative effects in relation to noise, water quality and biodiversity, and this was largely dependent on the location and alignment of the New Thames River Crossing.

Since December 2009, the design team have developed a base case design for the Silvertown Tunnel option comprising of a twin bore, 2 lane uni-directional road tunnel with a number of sub-options for emergency escape facilities. For the purposes of this report, these options have been referred to as Stage 2 options. The location and the alignment of all these options were the same; therefore the appraisal process has aimed to capture the subtleties in the design in terms of sustainability.

Overall the three options for the Silvertown Tunnel are all likely to have positive effects in terms of relieving congestion and improving local air quality, promoting sustainable transport links and improving health and well being by improving access to community facilities. Options 2 and 3 are likely to result in a significant negative effect in terms of materials management as the tunnel diameter is greater than Option 1, resulting in an increased volume of excavated materials. However as outlined in Section 5.2.1, opportunities could be considered to reuse this excavated material on local proposed developments which would improve the options in terms of sustainability. Option 3 is preferred in terms of sustainability as it offers significantly positive effects in terms of transport and health and well being by providing segregated tunnel provision for pedestrians and cyclists, which are not included in Options 1 & 2. Mitigation and enhancement measures outlined in Section 5.2.1 have been suggested to help enhance and mitigate the predicted effects and minimise the risks discussed in the risk workshop in October 2010.

5.2 Recommendations

5.2.1 Mitigation and Enhancement Measures

The following works and measures are recommended for further consideration in the next phase of the design process:

- undertake traffic modelling to assess the level of potential traffic congestion resulting from the new tunnel and associated effects on air quality and health;
- consult with the local planning authority to identify future projects that may provide an opportunity for reusing the excavated material;
- if opportunities do not exist to reuse the material, investigate possible landfill options;
- consider sustainable modes such as river barges for transporting materials to site and removing excavated materials;
- draft a code of construction practice, in consultation with the local planning authority, to outline construction practice including the hours of working to minimise risk of noise and vibration complaints;
- undertake a landscape and visual impact assessment and consult with English Heritage regarding the appropriate design of the tunnel entrances to take into consideration surrounding built environment,

especially at the Greenwich entrance to take into consideration the listed building at the entrance to the Blackwell Tunnel;

- provide consideration to construction haul routes as part of a transport management plan to minimise disruption on surrounding road network;
- if Option 3 is taken forward, consider security provision in the pedestrian and cycleway tunnels such as CCTV and lighting;
- consider using renewable energy sources for lighting provision in the tunnel;
- consult with the Environment Agency, the Port of London Authority and the Marine Management Organisation as the design progresses, to determine requirements for consents to undertake works; and
- undertake archaeological desk study to determine further survey requirements in consultation with the local planning authority and English Heritage.
- Identify a programme for undertaking appropriate ecological surveys to inform future design iterations

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