national highways

Lower Thames Crossing

6.4 Environmental Statement Non-Technical Summary (NTS)

APFP Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 6

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Lower Thames Crossing

6.4 Environmental Statement Non-Technical Summary (NTS)

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1 Introduction

1.1 Background

1.1.1 National Highways is the Government company charged with operating, maintaining and improving England's motorways and major A-roads.

1.1.2 The A122 Lower Thames Crossing (the Project) would provide a connection between the A2 and M2 in Kent and the M25 south of junction 29, crossing under the River Thames through a tunnel. An overview of the Project route is presented in Plate 2.1.

1.1.3 The Project is identified as a Nationally Significant Infrastructure Project under the Planning Act 2008, which means that an application for a Development Consent Order (DCO) is required to build and operate it. National Highways' application for a DCO will be examined by the Planning Inspectorate, which will report its findings to the Secretary of State for Transport. The Secretary of State will then issue a decision on the application.

1.2 Purpose of this document

1.2.1 This Non-Technical Summary provides an easily readable summary of the Environmental Statement (ES) for the Project, which has been submitted as part of the DCO application. The ES reports the findings of an Environmental Impact Assessment (EIA). It describes the potential impacts of the Project on local communities and the environment, and explains the measures that would be taken to reduce negative (adverse) effects before reporting the likely significant effects of the Project.

1.3 The Environmental Statement (ES)

1.3.1 The ES has four volumes:

a. Volume 1: the main report chapters, providing Project information and environmental assessments (Application Document 6.1)

b. Volume 2: drawings ('figures'), photographs and other illustrations to support the main report chapters (Application Document 6.2)

c. Volume 3: technical appendices (Application Document 6.3)

d. Volume 4: the Non-Technical Summary (this document – Application Document 6.4)

1.3.2 Chapters 1-4 of the ES provide background to the Project, and Chapters 5-16 provide environmental topic assessments. A summary of likely significant effects is then provided in Chapter 17.

1.3.3 Each environmental topic chapter explains the subject, describes the existing environment ('baseline conditions'), identifies measures to protect the environment, and then reports the significance of likely environmental effects.

1.3.4 The full ES and further information on the Project are available from the Planning Inspectorate's website: https://infrastructure.planninginspectorate.gov.uk/projects/south-east/lower-thames-crossing/

1.3.5 This includes the Introduction to the Application (Application Document 1.3) which describes how the application documents fit together.

2 The Project

2.1 Need for a new Thames crossing

2.1.1 For over 58 years, the Dartford Crossing has provided the only road crossing of the River Thames to the east of London. It is often congested, as it regularly carries higher numbers of vehicles than it was originally designed for. Delays can increase when accidents and incidents occur, and it can take hours for traffic to clear.

2.1.2 The Dartford Crossing is a critical part of the country's road network, connecting communities and businesses south and north of the River Thames and providing a vital link for journeys between nearby major ports and the rest of the UK. Reliable crossings of the River Thames allow businesses to operate effectively and allow residents to access housing, jobs, leisure and retail facilities on both sides of the river.

2.2 Scheme Objectives

2.2.1 Working with the Department for Transport (DfT) Scheme Objectives were agreed. The Lower Thames Crossing aims:

a. to support sustainable local development and regional economic growth in the medium to long term

b. to be affordable to government and users

c. to achieve value for money

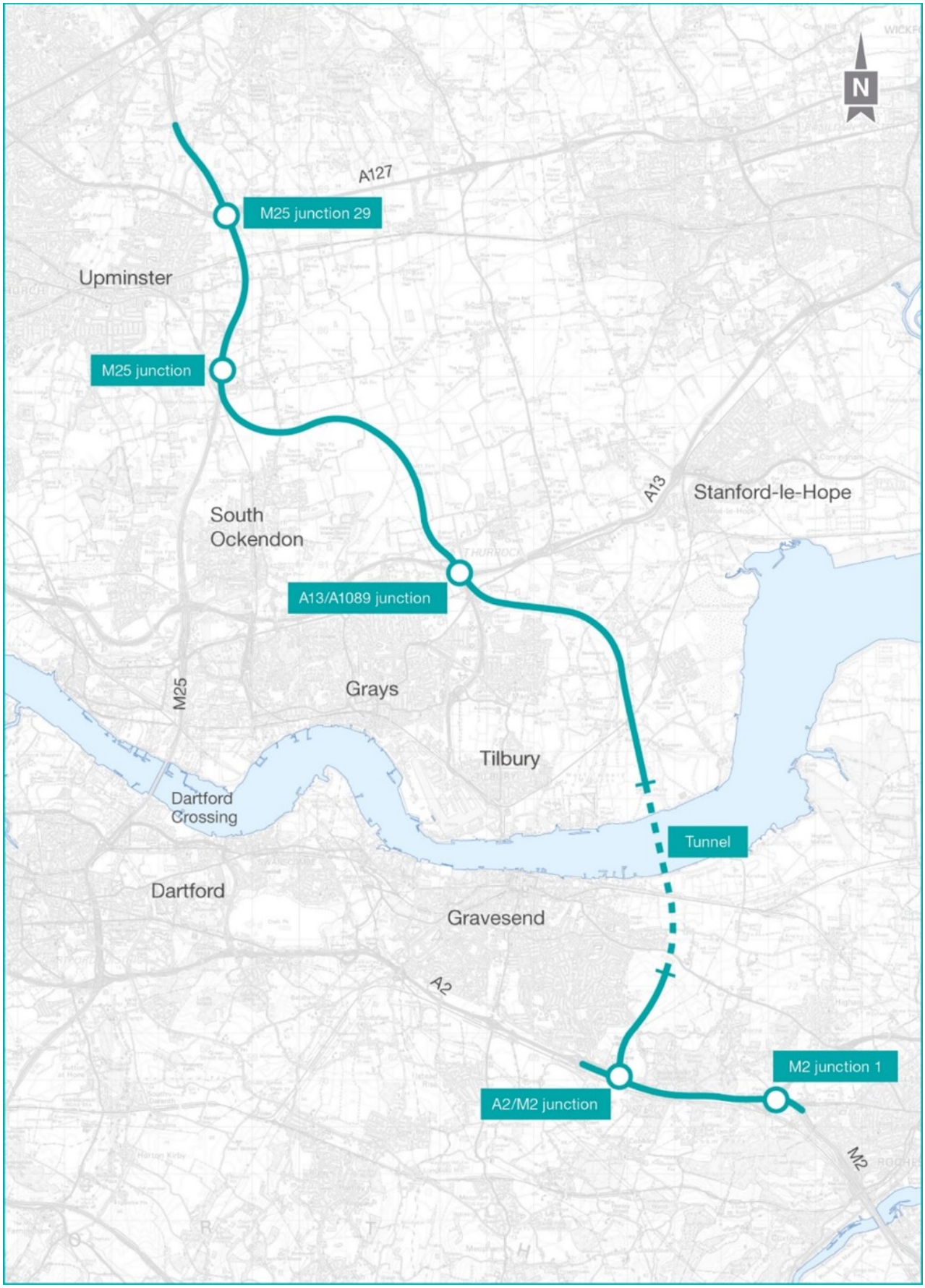
d. to minimise adverse impacts on health and the environment

e. to relieve the congested Dartford Crossing and approach roads, and improve their performance by providing free-flowing, north-south capacity

f. to improve the resilience of the Thames crossings and the major road network

g. to improve safety

Plate 2.1 Overview map of the Lower Thames Crossing



2.3 Alternatives and consultation

2.3.1 Plans for a new Lower Thames Crossing have been in development since 2009, with extensive studies and consultation leading to this DCO application. These have included consideration of various crossing locations and crossing methods, including whether a bridge or a tunnel was the most suitable option, and different road routes.

2.3.2 Early studies from 2009 confirmed that improvements at the existing Dartford Crossing would only provide a short-term solution to traffic issues. A rail crossing of the River Thames with a combined road crossing was also considered at that time, but not progressed as a potential solution as there was no reasonable business case. Various potential road crossing locations across the lower Thames area were identified for further consideration.

2.3.3 Road crossing options continued to be developed and assessed, including both tunnel and bridge solutions. Environmental impacts were considered, as well as other factors such as engineering and cost. Public consultations held in 2013 and 2016 enabled community input into the consideration of alternatives at key stages.

2.3.4 Following extensive assessment of a range of route and crossing options, and input from the public and other stakeholders, the preferred route was announced in April 2017.

2.3.5 The preferred route continued to be refined as engineering and environmental information became available, and to take into account feedback from stakeholder and community engagement. The Project design was then presented for Statutory Consultation between October and December 2018. To support this consultation, a Preliminary Environmental Information Report was published, which was prepared to enable consultees to develop an informed view of the likely significant effects of the Project.

2.3.6 The Project has developed since the 2018 Statutory Consultation and refinements to the design have been identified. Additional consultations were held to seek views on changes to the Project. These were:

a. Supplementary Consultation between January and April 2020

b. Design Refinement Consultation between July and August 2020

c. Community Impacts Consultation between July and September 2021

d. Local Refinement Consultation between May and June 2022

2.3.7 Throughout the consideration of alternatives and development of the Project design, regular and extensive engagement has been held with members of the public, local authorities, statutory environmental bodies and other relevant consultees.

2.4 Project summary

2.4.1 The A122 would be approximately 23km long, 4.25km of which would be in tunnel. On the south side of the River Thames, the Project route would link the tunnel to the A2 and M2. On the north side, it would link to the A13, M25 junction 29 and the M25 south of junction 29. The tunnel portals would be located to the east of the village of Chalk on the south of the River Thames and to the west of East Tilbury on the north side. An overview map of the Project is provided in Plate 2.1. Detailed Project drawings are provided in Figure 1 on page 11.

Main road

2.4.2 The Project route would be three lanes in both directions, except for:

a. link roads

b. stretches of the carriageway through junctions

c. the southbound carriageway from the M25 to the junction with the A13/A1089, which would be two lanes

2.4.3 In common with most A-roads, the A122 would operate with no hard shoulder but would feature a 1m wide hard strip on either side of the carriageway. It would also feature technology including stopped vehicle and incident detection, lane control, variable speed limits and electronic signage and signalling. The A122 design outside the tunnel would include emergency areas. The tunnel would include a range of enhanced systems and response measures instead of emergency areas.

Plate 2.2 Visualisation of the A13/A1089/A122 Lower Thames Crossing junction looking south

Junctions

2.4.4 There would be junctions at the following locations:

a. New junction with the A2 to the south-east of Gravesend. A visualisation is shown in Plate 3.1.

b. Modified junction with the A13/A1089 in Thurrock. A visualisation is shown in Plate 2.2

c. New junction with the M25 between junctions 29 and 30

Tunnel

2.4.5 The Project would provide a connection between the A2 and M2 in Kent and the M25 south of junction 29, crossing under the River Thames through a tunnel. An overview of the Project route is presented in Plate 2.1.

2.4.6 The A122 would be approximately 23km long, 4.25km of which would be in tunnel. The tunnel portals would be located to the east of the village of Chalk on the south of the River Thames and to the west of East Tilbury on the north side.

2.4.7 A visualisation of the northern tunnel entrance looking south is shown in Plate 2.3.

2.4.8 It is currently assumed that two tunnel boring machines (TBMs) would be used to construct the tunnel, one for each bore.

2.4.9 Emergency access and vehicle turn-around facilities would be provided at the tunnel portals. Cross-passages providing a connection between the two tunnels would be provided for emergency incident response and tunnel user evacuation. Tunnel portal structures would accommodate service buildings for control operations, mechanical and electrical equipment, drainage and maintenance operations.

2.4.10 The tunnel would have lighting to ensure appropriate visibility during day and night, as well as emergency and safety lighting. Tunnel ventilation would be provided by jet fans located at regular intervals along the entire length of the tunnel, and there would be a control building at each end of the tunnel providing facilities such as a staff office, pump rooms and power supply equipment.

Plate 2.3 Visualisation of the northern tunnel entrance approach looking south

Local roads

2.4.11 The Project would include changes to a number of local roads. Most existing local roads affected by the Project would either be reconnected or would have a reasonable alternative route made available. In most locations, the affected side roads would cross over the new road.

Highway structures

2.4.12 Approximately 50 new highway crossings would be required, comprising road bridges, underpasses, footbridges and seven green bridges. In addition, widening and other modifications of existing highways crossings would be required.

Utility works

2.4.13 To accommodate the construction and operation of the Project, it would be necessary to install and divert multiple utilities including overhead electricity powerlines, high-pressure gas pipelines and other utility networks and their associated infrastructure including cabinets, substations and maintenance compounds. New utility connections would be installed to the compounds and to the tunnels.

Earthworks

2.4.14 Earthworks for the Project would include cuttings (where the road is lowerthan the existing ground) and embankments (where the road is raised up).Where feasible, the new road has been designed to sit low in the existing environment, which makes it less visible and reduces its environmental effects. However, the design needs to take account of current ground conditions, landform and existing infrastructure such as other roads and rail lines. For example, as the road approaches the southern tunnel entrance at the River Thames it would pass into a deep cutting. However, to the north of the River Thames, the new road needs to be higher at certain locations such as where it crosses the Tilbury floodplain, railway lines, and the Mardyke floodplain.

Walkers, cyclists and horse riders

2.4.15 Walkers, cyclists and horse riders, as well as slow-moving vehicles, wouldnot be allowed to use the new road. However, where the Project would affect existing routes used by walkers, cyclists and horse riders, these would be reinstated using bridges under or over the road, or a suitable alternative route would be provided. The Project also proposes a number of new and upgraded routes for walkers, cyclists and horse riders.

User charging

2.4.16 The Project would include road user charges for vehicles using the tunnel. Automatic number plate recognition technology would be used as vehicles pass through the tunnel, and charges would be collected remotely (similar to the current Dart Charge arrangements at the Dartford Crossing). The charges would be equal to the charges at the Dartford Crossing.

Environmental mitigation and compensation

2.4.17 Design measures have been incorporated into the Project to reduce and offset its impacts on the local environment and communities. These include:

a. Green bridges to provide connections over the project for wildlife and the public. A visualisation of the Thong Lane green bridge north is shown in Plate 2.4.

b. Measures to reduce noise levels.

c. Flood storage areas, ponds and basins to reduce flood risk.

d. Habitat creation and enhancement as well as landscaping planting to address effects on wildlife. This includes hedgerow, woodland and grassland planting, wetland creation and relocation of protected species.

e. Woodland planting and ancient woodland translocation to compensate for areas of ancient woodland lost as a result of the Project.

f. Landscaping to integrate the Project into the surrounding landscape. This includes the use of recovered materials from the tunnel excavation to create two new public open spaces (Chalk Park and Tilbury Fields).

g. Creation of compensatory habitat, including woodland, to offset the effects from the deposition of nitrogen on designated sites.

h. Relocation of the Gammonfields Way travellers' site adjacent to the existing site.

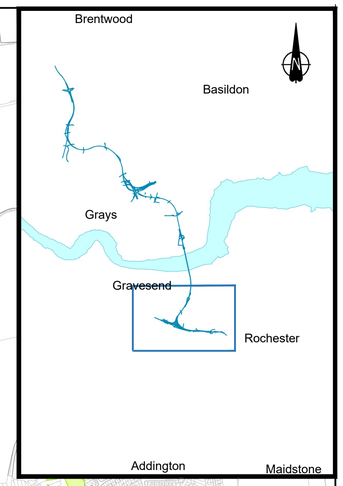
i. Provision of replacement land to compensate for the loss of open spaces and common land.

Plate 2.4 Visualisation of Thong Lane green bridge north

Figure 1 Lower Thames Crossing general arrangement drawing

Picture 2 Thong Lane green bridge north

Picture 1 M2/A2 A122 Lower Thames Crossing junction



Tunnel Entrance

Dual 3 Lanes in tunnel

Emergency access road to south portal

Dual 3 Lanes in deep cutting

Chalk Park

Thong Lane green bridge north

M2/A2/A122 Lower Thames Crossing junction

Existing east facing slip roads to be closed

Picture 2

Great Crabbles Wood SSSI

Shorne and Ashenbank Wood SSSI Shorne Woods Country Park

A2/M2 dual 4 lanes with parallel 2 lane connector roads eastbound and westbound

Dual 4 lanes M2

M2 J1

Gravesend East junction

Picture 1

New local road connecting Gravesend to the A2, A122 and A289

Thong Lane green bridge south

Westbound on slip road to A2 closed but maintained to local connection road

Shorne and Ashenbank Woods SSSI

Brewers Road green bridge

Existing slip roads exit to Brewers Road and access to eastbound connector road

Westbound off slip road relocated to the west

Cobham Hall Registered Park and Garden

Cobham Woods SSSI

Kent Downs AONB

NOTES:
1. For general arrangements at 1:5000 scale refer to sheets 1 - 10 of the General Arrangements Map book 1.

0 100 200 300 400 500 600 700 800 900 1000
SCALE METRES

PROPOSED ENGINEERING AND CONSTRUCTION
- New Carriageway
- Railway line
- Overbridge
- Underpass
- Culvert
- Traffic sign
- Gantry
- Fencing
- Lighting
- Pond
- Footpath, Cycleway or Bridleway route
- Tunnel
- Earthworks - Cutting
- Earthworks - Embankment
- Earthworks - Flood protection bund/false cutting
- Verge
- Retaining wall
- Maintenance access and hardstanding areas
- Ground protection tunnel
- Green Roof for Tunnel Buildings

UTILITIES
- Maximum length of OHL to be removed
- Realigned or modified Gas pipeline
- Realigned or modified overhead cable Gas compound or Electricity substation

BOUNDARIES
- Order Limits
- Registered park or garden
- Relocated Travellers site

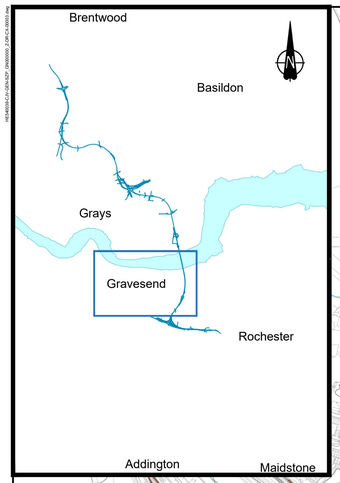
EXISTING ENVIRONMENTAL FEATURES
- Grade I listed building
- Grade II listed building
- Grade II* listed building
- Area of Outstanding Natural Beauty (AONB)
- Site of Special Scientific Interest (SSSI)
- Ancient Woodland
- Conservation Area
- Scheduled monument
- Community Forest
- SPA/Ramsar
- Watercourse

PROPOSED ENVIRONMENTAL MITIGATION
- Open space provision, replacement open space and replacement common land
- Woodland planting
- Grassland planting
- Site for ancient woodland compensation
- Receptor site for protected species
- Nitrogen deposition compensation planting
- Flood Compensation Area
- Hedgerow
- Watercourse diversion

Client: national highways

Project: LOWER THAMES CROSSING

Drawing title: GENERAL ARRANGEMENT SHEET 1



NOTES:
1. For general arrangements at 1:5000 scale refer to sheets 5 - 6 and 11 - 13 of the General Arrangements Map book 1.

0 100 200 300 400 500 600 700 800 900 1000
SCALE METRES

PROPOSED ENGINEERING AND CONSTRUCTION

- New Carriageway
- Railway line
- Overbridge
- Underpass
- Culvert
- Traffic sign
- Gantry
- Fencing
- Lighting
- Pond
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- Earthworks - Flood protection bund/false cutting
- Verge
- Retaining wall
- Maintenance access and hardstanding areas
- Ground protection tunnel
- Green Roof for Tunnel Buildings

UTILITIES

- Maximum length of OHL to be removed
- Realigned or modified Gas pipeline
- Realigned or modified overhead cable Gas compound or Electricity substation

BOUNDARIES

- Order Limits
- Registered park or garden
- Relocated Travellers site

EXISTING ENVIRONMENTAL FEATURES

- Grade I listed building
- Grade II listed building
- Grade II* listed building
- Area of Outstanding Natural Beauty (AONB)
- Site of Special Scientific Interest (SSSI)
- Ancient Woodland
- Conservation Area
- Scheduled monument
- Community Forest
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- Watercourse

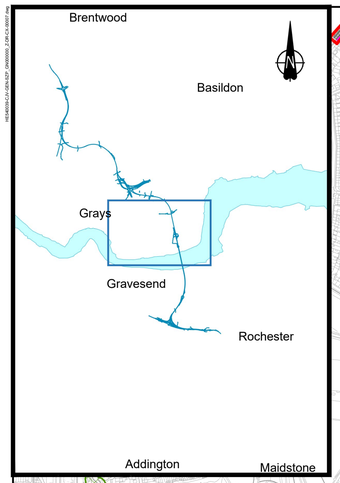
PROPOSED ENVIRONMENTAL MITIGATION

- Open space provision, replacement open space and replacement common land
- Woodland planting
- Grassland planting
- Site for ancient woodland compensation
- Receptor site for protected species
- Nitrogen deposition compensation planting
- Flood Compensation Area
- Hedgerow
- Watercourse diversion

Client: national highways

Project: LOWER THAMES CROSSING

Drawing title: GENERAL ARRANGEMENT SHEET 2




Picture 3 North Portal approach


Picture 4 Tilbury

Muckingford Road green bridge

Tilbury Viaduct

Tilbury Loop Railway

Picture 3

Picture 4

Tunnel Entrance

Emergency access road to North Portal

Tilbury Fields

Mucking Flats and Marshes SSSI

River Thames

Dual 3 lanes in tunnel

Thames Estuary and Marshes SPA and Ramsar Site

NOTES:
For general arrangements at 1:5000 scale refer to sheets 12 - 24 of the General Arrangements Map book 1.

0 100 200 300 400 500 600 700 800 900 1000
SCALE METRES

PROPOSED ENGINEERING AND CONSTRUCTION

- New Carriageway
- Railway line
- Overbridge
- Underpass
- Culvert
- Traffic sign
- Gantry
- Fencing
- Lighting
- Pond
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- Retaining wall
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UTILITIES

- Maximum length of OHL to be removed
- DV GAS Realigned or modified Gas pipeline
- DV OH Realigned or modified overhead cable
- Gas compound or Electricity substation

BOUNDARIES

- Order Limits
- Registered park or garden
- Relocated Travellers site

EXISTING ENVIRONMENTAL FEATURES

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- Grassland planting
- Site for ancient woodland compensation
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- Nitrogen deposition compensation planting
- Flood Compensation Area
- Hedgerow
- Watercourse diversion

Client: national highways

Project: LOWER THAMES CROSSING

Drawing title: GENERAL ARRANGEMENT SHEET 3

Orset Fen viaduct

Mardyke viaduct

Green Lane green bridge

Picture 5

Picture 6

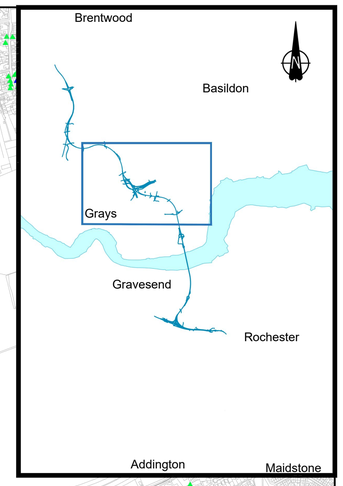
Dual 3 Lanes

Hoford Road green bridge

Muckingford Road green bridge

Tilbury loop line

Picture 5 A13/A1089/A122 Lower Thames Crossing junction



Picture 6 Orsett Cock junction

NOTES:
For general arrangements at 1:5000 scale refer to sheets 21 - 35 of the General Arrangements Map book 1.

0 100 200 300 400 500 600 700 800 900 1000
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BOUNDARIES

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- Watercourse diversion

Client: national highways

Project: LOWER THAMES CROSSING

Drawing title: GENERAL ARRANGEMENT SHEET 4

Shoeburyness Railway

2 lane J29
link road

Thames
Chase
Forest
Centre

M25
5 lanes southbound

Ockendon Road

Northbound 3 lanes

Picture 8

M25 dual 4 lanes

Southbound 2 lanes

Upminster and West Branch Railway

Picture 7

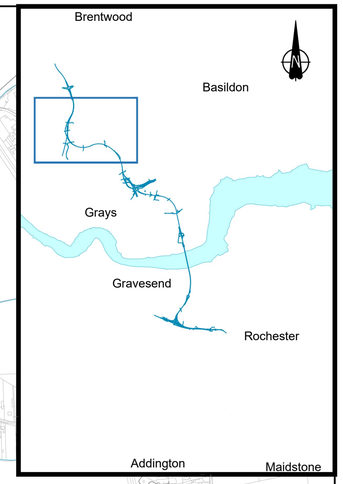
2 lanes southbound
3 lanes northbound

North Road
green bridge

Mardyke
Viaduct

Picture 8 A122 Lower Thames Crossing/M25 junction

Picture 7 North Road green bridge over A122 Lower Thames Crossing



NOTES:
For general arrangements at 1:5000 scale refer to sheets 52 - 43 of the General Arrangements Map book 1.

0 100 200 300 400 500 600 700 800 900 1000
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UTILITIES

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BOUNDARIES

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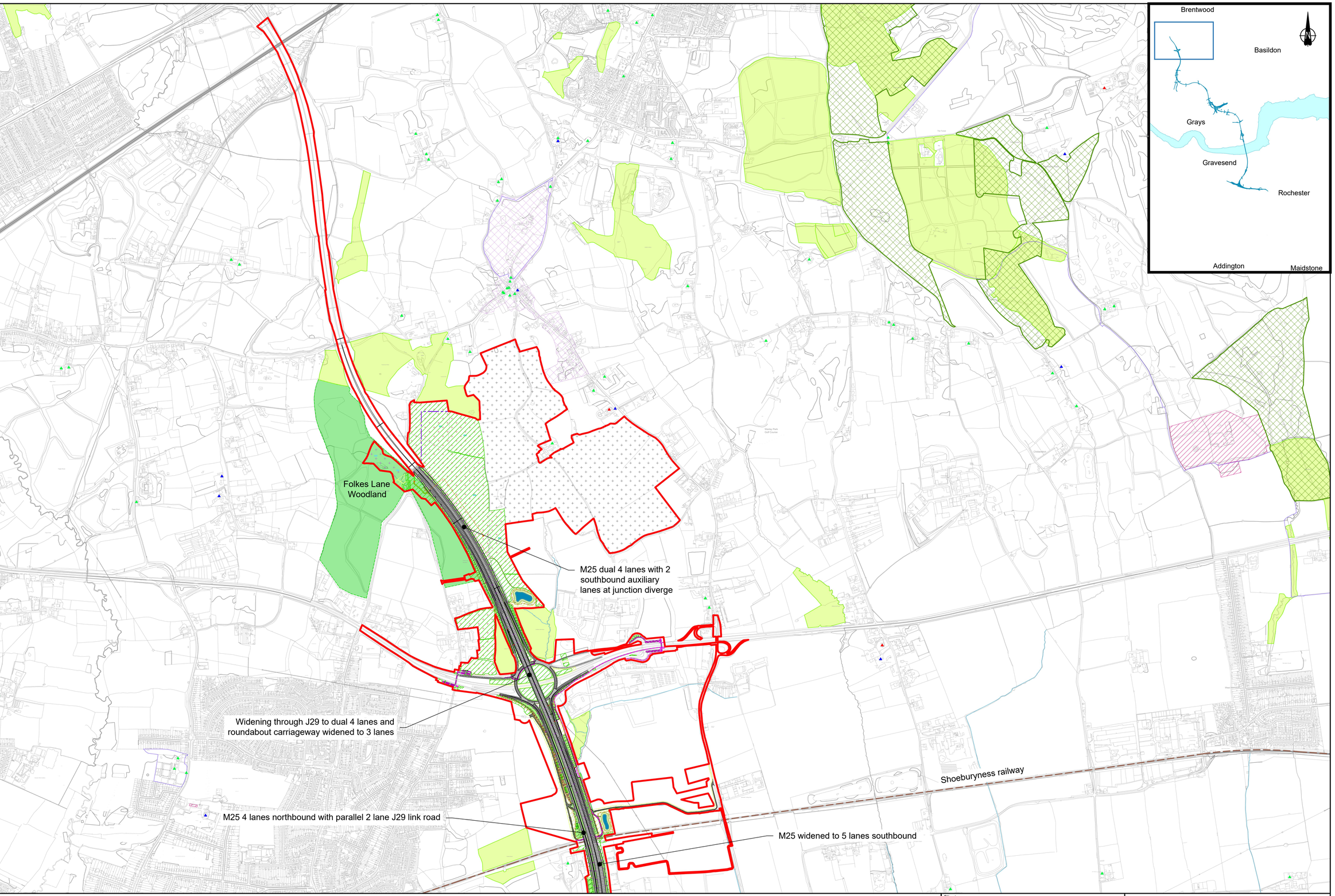
Client: national highways

Project: LOWER THAMES CROSSING

Drawing title: GENERAL ARRANGEMENT SHEET 5



NOTES:
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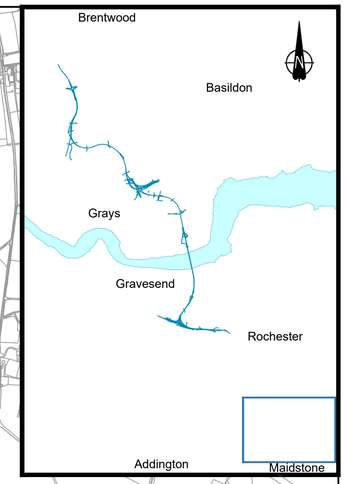

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- Grassland planting
- Site for ancient woodland compensation
- Receptor site for protected species
- Nitrogen deposition compensation planting
- Flood Compensation Area
- Hedgerow
- Watercourse diversion

Client: national highways

Project: LOWER THAMES CROSSING

Drawing title: GENERAL ARRANGEMENT SHEET 7

2.5 Construction of the Project

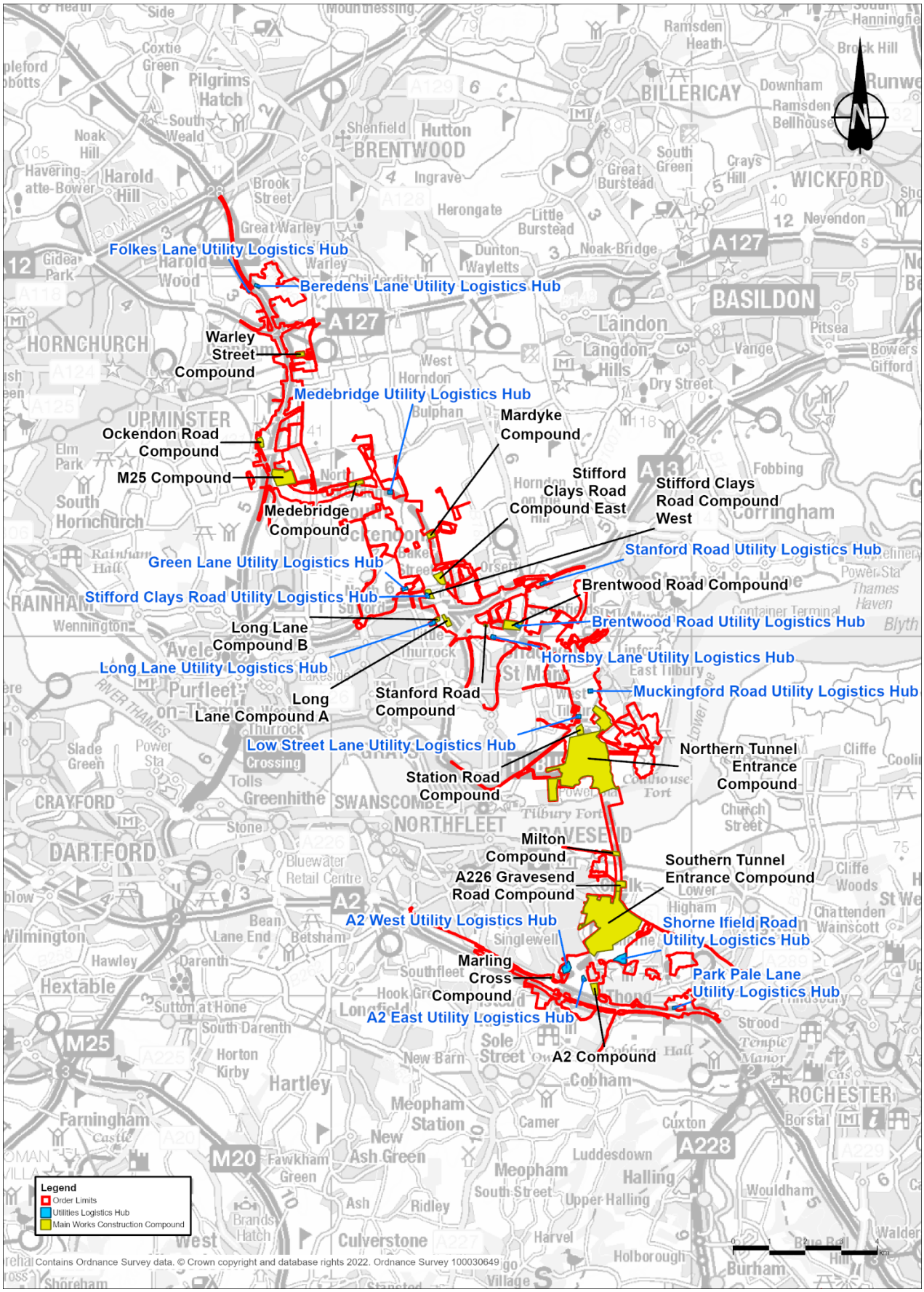
2.5.1 The DCO application has been developed with construction complete by 2030. The main construction period for the Project would start in early 2025. The road would be open for use by traffic in late 2030. Construction is anticipated to take up to six years. The construction timescale has been used consistently across the environmental assessments, transport assessments and the economic appraisal of the Project.

2.5.2 Before the main construction works start, some preparation activities would take place onsite including archaeological and ecological surveys, preparation of ecological mitigation sites, creation of some temporary construction compounds and access roads, and some of the utility diversions.

2.5.3 Main construction works would include activities to construct the new road and junctions, construction of the tunnel and the remaining utility diversions.

2.5.4 Construction of the Project would need 18 construction compounds and 15 utility logistics hubs (ULHs). The proposed locations of the compounds and ULHs are shown in Plate 2.5. The locations of construction compounds have been chosen to avoid environmental and community constraints where practical, to provide the best access for personnel and material deliveries in relation to major structures and worksites, and to meet other construction requirements of the Project. Construction compounds would be located along the Project route with large construction compounds located at each of the tunnel entrances to allow the tunnel to be constructed. ULHs would be needed to support specific utility works.

Plate 2.5 Compound and Utility Logistics Hubs



2.5.5 A ‘control plan’ (made up of a suite of documents referred to as ‘control documents’) has been prepared to provide a framework for mitigating, monitoring and controlling the effects of the Project. This includes a series of requirements to be implemented by the contractor during the construction of the Project.

2.5.6 Various temporary works would be needed during construction, including temporary topsoil storage, temporary lighting and fencing, and temporary closure and diversion of routes used by walkers, cyclists and horse riders.

2.5.7 Temporary power supply connections would be needed for the construction compounds so that there is enough power for the construction activities. Temporary connections for water, wastewater and communications would also be needed.

2.5.8 Vehicles would bring in construction equipment and materials, using main roads and avoiding use of local roads where practical. It is anticipated that the Contractors would also use the River Thames to transport some construction materials.

2.5.9 The tunnel would be built using tunnel boring machinery. The tunnelling work would start from the north and work southwards under the River Thames.

2.5.10 There are numerous types of waste and materials that could be generated throughthe construction of the Project. Where practical, materials would be reused onsite, for example concrete from demolition reused on construction roads. Material excavated during construction would be used in earthworks wherever possible.

3 Assessment of likely significant effects

Introduction

3.1.1 The Project is identified as the type and scale of development that automatically requires an EIA under the requirements of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations). An EIA has been carried out to meet the requirements of planning legislation and policy. The EIA hasconsidered construction and operation effects of the Project,with the findings presented in the ES.

Assessment methods

3.1.2 The EIA has followed industry standard methods as set out in National Highways' Design Manual for Roads and Bridges, along with topic-specific methods and guidance as appropriate. Each topic chapter of the ES has been completed by competent experts.

3.1.3 The EIA has followed a series of key steps:

a. Identification of the study area and the receptors to be assessed. Receptors range from people, properties and ecological species to the surrounding environment and its resources.

b. Information on the existing environment collected using methods such as surveys, desk-based studies, and consultationwith environmental groups and the public.

c. Potentially significant impacts identified.

d. Mitigation measures set out to avoid, reduce or offset potential adverse impacts.

e. Likely significant environmental effects identified, considering whether effects would be beneficial or adverse,permanent or temporary and taking proposed mitigation measures into account.

f. Requirements for monitoring of mitigation measures identified.

3.1.4 The ES also takes into account how and when the existing environment could change over time if the Project were not built.

Approach to environmental mitigation

3.1.5 The Project would avoid or reduce potentially significant effects on the environment, using three types of environmental mitigation:

a. Embedded mitigation: measures that are part of the engineering design and Design Principles, such as the use ofgreen bridges.

b. Good practice: standard approaches and actions typically used by construction companies to avoid or reduce effectson local communities and the environment, such as the prevention of pollution incidents.

c. Essential mitigation: specific measures needed in particular areas of the Project to avoid or reduce environmental effects,such as installation of noise barriers to reduce increases in noise levels.

3.1.6 Mitigation included within the design would be secured through commitments made within the Design Principles document (Application Document 7.5) or as features presented on the Environmental Masterplan as includedin the ES (Application Document 6.1, Figure 2.4). The Code of Construction Practice (CoCP) (Application Document 6.3, Appendix 2.2) is one of the control documents that has been prepared to provide a framework to manage construction activities. The key aims are to ensure that environmental mitigation commitments are met and that any necessary consents and licences are obtained.

3.1.7 As part of the CoCP, a Register of Environmental Actions and Commitments (REAC) has also been prepared. It identifies all good practice and essential mitigation that would be carried out prior to and during construction, and during operation of the Project. These measures are relied on in the assessments of likely significant effects presented in the ES and are secured in the draft DCO.

3.1.8 A summary of likely significant environmental effects and mitigation for each environmental topic is presented below.

3.2 Air quality

The existing environment

3.2.1 The air quality assessment considers levels of nitrogen dioxide (NO_2) and particulate matter (referred to as PM_{10} or $PM_{2.5}$ depending on the size of the particles). These levels are compared to objectives and limit values that have been set in UK legislation based on the effects of each pollutant on health and on the environment. If air quality levels are higher than the objectives or Limit Values, the term ‘exceedance’ is used.

3.2.2 A review of local authority, National Highways and Project air quality monitoring data show that there are current (existing) exceedances of NO_2 objectives at some roadside locations which are close to human receptors such as residential properties. There are however no monitored exceedances of objectives for particulate matter.

3.2.3 The Project would pass through two Air Quality Management Areas (AQMAs) which have been designated by the London Borough of Havering and Gravesham Borough Council due to exceedances of air quality objectives. Within the wider area where road traffic could be affected by the Project, there are 41 existing AQMAs. In addition exceedances of the NO_2 Limit Value are predicted based on 2018 data, by the Department for Environment, Food and Rural Affairs (Defra) on several roads which could be affected by the Project, but no exceedances are predicted for particulate matter.

3.2.4 Air quality is generally expected to improve in the future as vehicle emissions improve and the use of electric vehicles becomes more widespread.

Construction effects

3.2.5 During construction, the Project could temporarily affect air quality because of dust arising from earth movement and excavations, as well as due to emissions from construction traffic and machinery. The assessment has considered traffic flow changes as a result of traffic management and Project-related construction traffic.

3.2.6 Measures to reduce the air quality effects of construction are included in the CoCP. These would include measures to control dust, for example using water as a dust suppressant.

Applying the proposed mitigation measures means there would be no likely significant effects on air quality during construction.

Operational effects

3.2.7 The operation of the Project is predicted to improve local air quality in some areas but make it worse in others due to changes in traffic flow. The assessment has considered the change in pollutant concentrations at human receptors (such as people's homes) and the change in nitrogen deposition in designated sites close to roads.

3.2.8 Traffic changes due to the Project were forecast using a transport model and used in the air quality assessment. The model predicted a traffic increase on certain roads, such as the A228 between M20 junction 4 and M2 junction 2, and the A2 London Road, Strood, causing air quality to get worse at receptors already exceeding the air quality objective for NO_2.

3.2.9 However, the results also showed air quality improvements on other roads where the air quality objective for NO_2 is exceeded, including the A282 Dartford Crossing because of reductions in traffic and congestion. In total, 25 receptors were predicted to experience a change in air quality where pollutant concentrations exceed air quality objectives. A total of 16 receptors were predicted to experience an improvement in air quality, and nine receptors were predicted to experience a worsening of air quality where NO_2 concentrations exceed the objective.

3.2.10 Particulate matter modelling did not predict any exceedances of air quality objectives at human receptors with or without the Project.

3.2.11 The Project is not predicted to affect compliance with Limit Values for NO_2 or particulate matter.

3.2.12 The Project has a significant air quality effect on 29 designated sites after mitigation due to an increase in nitrogen deposition. A Project Air Quality Action Plan has been developed and sets out the approach to mitigating these effects which removes significant effects on seven sites.

3.3 Cultural heritage

The existing environment

3.3.1 Designated heritage assets within the study area comprise: Scheduled Monuments; Listed Buildings; Registered Parks and Gardens; and Conservation Areas. The study area also contains non-designated historic buildings including several Locally Listed buildings.

3.3.2 The study area contains a wide variety of buried archaeological remains. These include many sites identified by archaeological investigations carried out by the Applicant. The archaeological sites include Prehistoric, Roman, Early Medieval, Medieval, Post-Medieval and Modern activity. The study area also includes non-designated historic landscapes.

3.3.3 All of the topic areas mentioned above would be affected by the Project.

Construction effects

3.3.4 Predicted construction effects include temporary changes to the settings of heritage assets. Measures to reduce these effects include fencing and screening of construction compounds and other good practice construction measures.

3.3.5 Where possible, archaeological remains would be safeguarded by fencing during the construction phase. Others are deeply buried and would not be harmed during construction. However, some archaeological remains and built heritage assets would need to be permanently removed. Measures to reduce these effects include various archaeological investigations and reporting, and historic building recording to create a cultural heritage record of these assets.

3.3.6 Likely significant effects on cultural heritage during construction are predicted as follows (listed from south to north):

a. Partial removal of one high-value non-designated buried archaeological site to the south of the River Thames, resulting in a permanent adverse effect

b. Complete or partial removal of 44 medium-value non-designated buried archaeological sites to the south of the River Thames resulting in permanent adverse effects.

c. The removal of proportionately small parts of two geological deposits of archaeological interest to the south of the River Thames, resulting in permanent adverse effects.

d. Construction of the Project to the south of the River Thames would change the setting of Thong Conservation Area, resulting in a temporary adverse effect.

e. Complete or partial removal of 54 medium-value non-designated buried archaeological sites to the north of the River Thames.

f. Demolition of three listed buildings to the north of the River Thames: 1 and 2 Greys Corner Cottages; Thatched Cottage; and Murrells Cottages, resulting in permanent adverse effects.

g. Demolition of eight non-designated buildings (five of which are Locally Listed) to the north of the River Thames resulting in permanent adverse effects.

h. Removal of a large amount of the buried archaeological remains within the 'Cropmark Complex, Orsett' Scheduled Monument resulting in a permanent adverse effect.

i. Complete removal of three high-value non-designated buried archaeological sites to the north of the River Thames, resulting in permanent adverse effects.

j. Partial removal of four high-value non-designated buried archaeological sites to the north of the River Thames, resulting in permanent adverse effects.

k. Construction of the Project to the north of the River Thames would change the setting of North Ockendon, East Tilbury and West Tilbury Conservation Areas, resulting in temporary adverse effects.

l. Construction of the Project to the north of the River Thames would change the setting of eight Grade II Listed Buildings and one Grade I Listed Building, resulting in temporary adverse effects.

m. Construction of the Project to the north of the River Thames would change the setting of the Scheduled Monument 'Causewayed Enclosure and Anglo-Saxon Cemetery 500m East-North-East of Heath Place', resulting in a temporary adverse effect

Operational effects

3.3.7 The operation of the Project is predicted to result in permanent changes to the settings of heritage assets. The landscape design includes measures that would generally reduce these changes. This includes keeping woodland and other vegetation where possible, keeping existing open views where possible, planting of vegetation to screen roads and embankments where appropriate and sensitively designing features of the road such as bridges and walls.

3.3.8 Likely significant effects on cultural heritage during operation are predicted in terms of permanent adverse changes to the setting of the following (presented from south to north):

a. Thong Conservation Area, to the south of the River Thames

b. Scheduled Monuments to the north of the River Thames: Cropmark Complex, in Orsett; and Causewayed Enclosure and Anglo-Saxon Cemetery, 500m East-North-East of Heath Place

c. Two high-value non-designated archaeological sites and three medium-value non-designated archaeological sites, to the north of the River Thames

d. Three Conservation Areas to the north of the River Thames: North Ockendon; East Tilbury; and West Tilbury

e. Three Grade II Listed buildings to the north of the River Thames

f. Three Historic Landscapes to the north of the River Thames: reclaimed marshland; open common land and the agricultural landscape

Plate 3.1 Visualisation of the M2/A2/A122 Lower Thames Crossing junction looking north

3.4 Landscape and visual

The existing environment

3.4.1 The Project route would partially follow the line of the existing road network, along the M2/A2 corridor to the south and along the M25 corridor to the north and would connect with the existing A13 junction near Grays. Between the M2/A2 and M25, the Project route would cross a varied landscape characterised by arable and pastoral farmland to the north and south of the

Thames Estuary, open access land and the Thames Chase Community Forest within the London Green Belt. The landscape contains a network of public footpaths and recreational routes. There are many scattered rural properties and small settlements together with larger built-up areas on the urban edge of Greater London.

3.4.2 The nationally designated Kent Downs Area of Outstanding Natural Beauty (AONB) lies approximately 3.5km to the south of the River Thames, beyond low-lying reclaimed marsh and rising arable land. In the vicinity of the Project, the Kent Downs AONB encompasses the distinctive and densely wooded ridgeline of Shorne Woods Country Park and the historic parkland landscape of Cobham Hall Registered Park and Garden, separated by the existing M2/A2 corridor.

3.4.3 Where the Project route crosses the River Thames, the river forms a broad estuary. To the west of the crossing, the estuary landscape becomes industrial in character towards Tilbury and the built-up area of Gravesend extends to the south bank of the river. To the east of the proposed crossing, the landscape is predominantly rural.

3.4.4 To the north of the Thames Estuary, the landscape varies from the urban fringe landscapes of settlements such as Tilbury, East Tilbury, Chadwell St Mary, Orsett and Grays, to the former fenland landscape of Orsett Fen and the Mardyke north of the A13, the Thames Chase Forest Centre and the outskirts of Greater London and Brentwood Wooded Hills adjoining the northern part of the Project route.

Construction effects

3.4.5 Construction of the Project, including the removal of existing vegetation and utilities diversions, requiring a series of construction compounds of varying size, would result in temporary effects on landscape character including sensitive landscapes, such as Orsett Fen and the Kent Downs AONB. Construction activity would also result in temporary changes to views (‘visual effects’). The largest construction compounds would be the southern tunnel entrance compound to the east of Gravesend and the northern tunnel entrance compound to the east of Tilbury.

3.4.6 A range of measures are proposed to reduce visual effects of the Project during construction, including putting taller temporary plant and buildings within construction compounds and using temporary screens around the perimeter.

3.4.7 Significant adverse effects on landscape and views from construction activities are likely to comprise:

a. Temporary landscape effects on the Kent Downs AONB and its setting and within the Green Belt to the north of the Thames Estuary, including Orsett Fen

b. Temporary visual effects on users of recreational facilities, such as country parks, community woodlands, footpaths and trails, residents of residential properties and people travelling through the study area on the road network

Operational effects

3.4.8 The Project has been designed to avoid or reduce adverse impacts through embedded mitigation measures, such as extensive earthworks to create 'false cuttings' to help screen views of the new road and traffic using it. Other measures include the provision of green bridges to help maintain landscape connectivity across the Project route and extensive new planting, including new woodland planting at the Project's junctions with the A2, A13, and M25, to screen and soften views of the road and to help integrate it into the surrounding landscape.

3.4.9 During operation, the Project would be a new feature crossing the landscape between the M2/A2 to the south and M25 to the north. To the south of the River Thames, landscape effects within the Kent Downs AONB would include the permanent loss of woodland due to widening of the A2 corridor. Two proposed green bridges crossing the widened A2 corridor, would help to maintain landscape connectivity between the AONB to the north and south. Established woodland habitat at the nitrogen deposition compensation sites within Kent would enhance the local landscape character of the Bredhurst sub area of the Mid Kent Downs within the Kent Downs AONB and of the Shorne Wooded Slopes, within the setting of the Kent Downs AONB to the north of Shorne Ridgeway.

3.4.10 The large junction of the new Project road with the A2 and additional road lighting would be a prominent new feature within the setting of the AONB. Beyond the new M2/A2/A122 Lower Thames Crossing junction, a deep cutting would limit views of the Project on the approach to the South Portal of the proposed tunnel crossing. The proposed Chalk Park would feature a distinctive new wooded hilltop landform between the South Portal and edge of Gravesend and Chalk.

3.4.11 To the north of the River Thames, the most noticeable changes in landscape character and views would include the Tilbury Fields sculptural landscape mounding to the south of the North Portal, the Tilbury Viaduct and A13/A1089/A122 Lower Thames Crossing junction. North of the expanded A13 junction, the elevated Project road and associated viaducts would be prominent features within the flat Orsett Fen landscape. The landscape and visual effects of the Project would be less apparent where the Project route coincides with the M25.

3.4.12 Diverted overhead powerlines would not appear notably different to the existing alignments. There would be a small number of additional and/or larger pylons in some locations but these would be viewed in the context of existing pylons. Sections of removed overhead powerlines would have a beneficial effect, including the removal of overhead powerlines north of Shorne Woods Country Park and the partial removal of overhead powerlines west of East Tilbury.

3.4.13 Significant adverse effects on landscape and views during operation are likely to comprise:

a. Permanent landscape effects on the Kent Downs AONB and its setting, and to the north of the Thames Estuary within the London Green Belt. These effects would generally reduce from the opening year onwards as new planting gradually matures; however, some significant effects would remain in the design year, 15 years after opening.

b. Permanent visual effects on users of recreational facilities, such as country parks, community woodlands and footpaths and trails, residents of residential properties and people travelling through the study area. These effects would generally reduce from the opening year onwards as new planting gradually matures; however, some significant effects would remain in the design year, 15 years after opening.

3.5 Terrestrial biodiversity

The existing environment

3.5.1 The study area encompasses a large number of ecological designations including:

a. European sites comprise the Thames Estuary and Marshes Special Protection Area (SPA) and Ramsar site, North Downs Woodland Special Area of Conservation (SAC), and Peter's Pit SAC.

b. To the south of the River Thames, there are 12 statutory designated sites identified for ecological reasons, which include Cobham Wood Site of Special Scientific Interest (SSSI), Great Crabbles Wood SSSI, Halling to Trottiscliffe Escarpment SSSI, Holborough to Burnham Marshes SSSI, Shorne and Ashenbank Woods SSSI, South Thames Estuary and Marshes SSSI, Swanscombe Peninsula SSSI, and Wouldham to Detling Escarpment SSSI.

c. To the north of the River Thames there are nine statutory designated sites including Grays Thurrock Chalk Pit SSSI, Hangman's Wood & Deneholes SSSI, Mucking Flats and Marshes SSSI, and Thorndon Park SSSI.

3.5.2 There are many other sites within the study area of importance to biodiversity, including country parks, ancient woodlands, ancient semi-natural woodland, Local Wildlife Sites (LWS) and Sites of Importance for Nature Conservation (SINC). The study area supports habitats and species of importance including ancient woodland, veteran trees, great crested newts, bats, dormice, barn owls, water voles, and invertebrate assemblages of national value.

Construction effects

3.5.3 Construction of the Project would result in habitat loss including areas within designated sites and irreplaceable habitats in the form of ancient woodland and veteran trees. Other impacts include deterioration and breaking up of habitats, as well as disturbance to protected species.

3.5.4 The Project design includes encouraging or actively moving animals away from the construction area and into existing or newly created suitable habitats. Habitat creation is also proposed to compensate for impacts such as the loss of ancient woodland. Newly created habitats have been designed to maximise their biodiversity value, and would link existing semi-natural habitats and designated sites, strengthening the resilience of the network of these habitats within the wider landscape. The design also includes measures such as the

provision of seven green bridges as well as mammal passes to mitigate the potential breaking up of habitats as a result of the new road. Throughout construction, specialist Ecological Clerks of Works would be employed to supervise specific elements of the work which present disturbance risks to protected species, and to ensure compliance with all relevant protected species mitigation licences.

3.5.5 Key areas of habitat creation are around 49 hectares (ha) of ancient woodland compensation planting south of the River Thames around Shorne Wood County Park, and around 32ha of ancient woodland compensation planting north of the River Thames, including 26ha at Hole Farm. Chalk Park, south of the River Thames, would provide approximately 80ha of species-rich grassland which offers high quality habitat that would support a wide range of species. Similarly, north of the River Thames, Tilbury Fields would create around 45ha of open grassland and scrub habitats that would provide optimal habitat for invertebrates, and link into similar habitats along the Thames Estuary.

3.5.6 Likely significant effects on terrestrial biodiversity during construction are predicted as follows:

a. Permanent habitat loss at Shorne and Ashenbank Woods SSSI, including ancient woodland, located to the south of the River Thames. Ancient woodland habitat loss at Claylane Wood, Rainbow Shaw LWS, Codham Hall Wood LWS, and Codham Hall Wood West SINC. Habitat loss within local wildlife sites at Lower Street Pit LWS and Blackshots Nature Area LWS.

b. Loss of habitat supporting valuable groups of terrestrial invertebrates, and increased mortality of terrestrial invertebrate groups to the north of the River Thames.

c. Permanent loss of 6 veteran trees, three from the south and three from north of the River Thames.

Operational effects

3.5.7 The key operational effect would be the reduction in quality of designated sites following increased nitrogen deposition occurring as a result of changes in traffic volumes and speeds along roads affected by the operation of the new road. Significant adverse effects would be compensated by the creation of new areas of semi-natural habitat, predominantly woodland and grassland, which would increase the overall area of these habitats and link up similar existing habitats and designated sites, building resilience into that network. Overall, approximately 246ha of new habitat would be created to offset the significant adverse effects summarised below:

a. A reduction in habitat quality at Cobham Woods SSSI, Halling to Trottiscliffe Escarpment SSSI, Shorne and Ashenbank Woods SSSI, and Wouldham to Detling Escarpment SSSI.

b. Nineteen ancient woodland sites south of the River Thames, and three ancient woodland sites north of the River Thames would experience a leading to significant adverse effects.

c. Bridge Wood, Burnham LWS, south of the River Thames, and Codham Hall Wood LWS and Ockendon Railsides SINC north of the River Thames would also experience significant adverse effects as a result of increased nitrogen deposition.

3.6 Marine biodiversity

The existing environment

3.6.1 The study area covers three European sites of marine biodiversity importance: the Southern North Sea SAC, Thames Estuary and Marshes Ramsar site, and the Thames Estuary and Marshes Special SPA. In addition, there are five nationally designated sites including SSSIs and the Swanscombe Marine Conservation Zone.

3.6.2 The Thames Estuary overlaps with the Project and includes areas of mudflats, sandflats and saltmarsh which provide key foraging, breeding and nursery habitat for aquatic invertebrates and fish which, in turn, support bird and mammal populations.

3.6.3 The Thames Estuary is considered an important habitat for a variety of fish species including species of conservation importance such as smelt. Marine mammals are found in the Thames Estuary and include seals, harbour porpoise and bottlenose dolphin.

Construction effects

3.6.4 The construction of the Project would require discharges to the Thames Estuary of rainfall collected within construction areas and groundwater collected from the tunnels during construction.

3.6.5 These discharges would have the potential to change water flows, water quality and sediment deposition.

3.6.6 For the northern portal compound discharges, a temporary pipeline and discharge structure would be constructed from the north tunnel entrance construction compound connecting to the River Thames. The structure would be removed once construction was complete. This would result in a temporary direct loss of habitats and species in the area where the works would take place.

3.6.7 At the southern portal, discharges to the River Thames would be actively controlled by an Environment Agency discharge permit to ensure that water quality and volume is within a level which would not damage the internationally important Thames Estuary and Marshes Ramsar Site. The discharge would be routed to the River Thames via existing ditches that form part of the Thames Estuary and Marshes Ramsar Site.

3.6.8 Other effects on the marine environment include disturbance from the construction and operation of the water inlet with self-regulating valve (or equivalent structure within the existing flood defence) at Coalhouse Point to secure a water supply for this area of habitat creation.

3.6.9 The Project design and construction methods have been developed to avoid and minimise the need for works within the River Thames, reducing the potential for effects on the marine environment. Water discharged to the River Thames would be appropriately treated before discharge. Construction activities such as those associated with the temporary pipeline and the water inlet with self-regulating valve would follow methods to reduce effects on the marine environment, such as planning works around the tides and timing works to avoid disturbance to overwintering birds.

3.6.10 With the implementation of proposed mitigation measures, no likely significant effects are predicted on marine biodiversity during construction.

Operational effects

3.6.11 During operation, noise and vibration may be caused by road traffic in the tunnel, particularly by large and heavy vehicles. Modelling of underwater noise showed that, due to the depth of the tunnel, any effects would only result in temporary localised displacement of species.

3.6.12 During the operation of the tunnel, road drainage would be treated before discharge and would be released during high tide conditions to maximise available dilution and mixing, and prevent erosion.

3.6.13 With the implementation of proposed mitigation measures, no likely significant effects are predicted on marine biodiversity during operation.

3.7 Habitats Regulations Assessment

3.7.1 In parallel with the ES, information to inform a Habitats RegulationsAssessment Screening Report and Statement to Inform an Appropriate Assessment (Application Document 6.5) has been presented to assess whether there would be any likely significant effects on the following European designated sites:

a. Thames Estuary and Marshes SPA

b. Thames Estuary and Marshes Ramsar

c. Epping Forest SAC

d. North Downs Woodland SAC

Construction effects

3.7.2 The risk of likely significant effects was identified for the Thames Estuary and Marshes SPA and Ramsar site. The construction of the Project north and south of the River Thames would result in the loss of, and disturbance within, functionally linked land associated with the Thames Estuary and Marshes SPA and Ramsar site as well as disturbance of qualifying bird features within the Ramsar site itself. Mitigation measures in the form of noise attenuation, seasonal constraints to working, visitor management and enhancements to habitat functionality would avoid and reduce the risk of likely significant effects on the European designated sites.

Operational effects

3.7.3 The risk of likely significant effects was identified for the Thames Estuary and Marshes SPA and Ramsar site and Epping Forest SAC. The Project operation would result in disturbance within functionally linked land north of the River Thames associated with the Thames Estuary and Marshes SPA and Ramsar site. The vehicle emissions associated with changes in traffic as a result of the Project would result in a change in nitrogen deposition at Epping Forest SAC, but. However, these would not result in a consequential risk of a measurable change in the habitats and so would not have an adverse effect on integrity of the SAC. Mitigation measures in the form of noise attenuation, seasonal constraints to working, visitor management and enhancements to habitat functionality would avoid and reduce the risk of likely significant effects on the European designated sites.

3.7.4 The assessment in the Habitats Regulations Assessment report concluded that there would be no adverse effects on integrity on any of the European designated sites from the Project alone (construction and operational effects) or in combination with other plans or projects.

3.8 Geology and soils

The existing environment

3.8.1 The geology underlying much of the Project area is chalk, with clay also present in areas of high ground. Close to the River Thames the chalk is overlain with large areas of gravel. Urban development and landfilling activity to the north of the River Thames mean that sections of the geology is made ground. There are locally important geological sites to the north of the River Thames, and one identified to the south of the river in the vicinity of one of the nitrogen deposition compensation sites close to Junction 3 of the M2.

3.8.2 The characteristics of the soils present, and the value of the agricultural land this supports, are influenced by the underlying geology. Land considered to be of the best agricultural value makes up approximately 55% of the land needed for the Project to the south of the River Thames and approximately 25% of the land needed to the north of the River Thames. Groundwater abstractions are present within the study area on both sides of the River Thames.

3.8.3 There are many surface water features within the study area including marshland, drainage ditches, rivers such as the River Thames, the Mardyke and their various tributaries.

3.8.4 There are historic and active landfills located within the study area including Goshems Farm and East Tilbury, near to the north tunnel entrance. There are also historic and active land uses within the study area that can cause contamination, such as a former military airport, construction compounds/ depots, railway sidings, metal recycling facility, infilled pits and petrol filling stations.

Construction effects

3.8.5 The construction of the Project would result in the permanent loss of agricultural land. Some land would also be needed temporarily during construction but then reinstated to former agricultural use.

3.8.6 During construction, there is a risk for accidental spillages of oils, cement and fuels to occur from the movement of construction traffic and the storage of materials. There is also the possibility for existing contamination within the ground to become mobilised.

3.8.7 Good practice measures, such as appropriate storing of equipment and clear soil handling, storage and re-use guidance, would be used during construction to reduce the risk of spillage or pollution. In the event an incident were to occur which resulted in localised contamination, soils would be assessed and if necessary, removed.

3.8.8 Further ground investigation will be carried out by the Contractor to gather more information to inform the detailed design for construction. Other measures proposed to reduce effects on geology and soils include using and storing excavated soils correctly to allow their sustainable re-use and reinstating agricultural land that was temporarily needed during construction.

3.8.9 Likely significant effects on geology and soils are predicted during construction due to the use of areas of good quality agricultural land, with some being temporarily used and others permanently required. There are also temporary and permanent impacts on soils supporting designated and non-designated notable habitats.

Operational effects

3.8.10 During the operation of the Project, there is a risk of the contamination of soils, surface water and groundwater from road spray and pollution incidents from the use of the new road and tunnel and from traffic accidents (for example fuel or oil spillages).

3.8.11 Good practice mitigation measures such as the assessment and removal if required of contaminated soils after pollution incidents (for example fuel or oil spillages) would be applied to prevent spread of contamination into the wider environment. Mitigation measures proposed include design of the tunnel waterproofing and barriers around excavations to reduce effects on groundwater.

3.8.12 With the implementation of proposed mitigation measures, no likely significant effects on geology and soils are predicted during operation.

3.9 Material assets and waste

The existing environment

3.9.1 There are a number of recycling, recovery and disposal waste facilities that would be suitable to manage the waste generated during the construction of the Project. In 2020 there was over 29 million cubic metres of landfill capacity and in 2022 there was over 65 million tonnes annual capacity of waste treatment and recovery within the Project study area, which includes the waste authority areas of Kent County Council, Essex County Council and the East London Waste Authority.

3.9.2 There are minerals and aggregates within the study area, which is defined by the Order Limits of the Project, that are potentially suitable for use on the Project. Some areas of mineral deposits (such as sands and gravels) are designated as safeguarded by the local authorities.

Construction effects

3.9.3 The assessment considers sources of materials including those that can be reused on site, and the use of recycled materials.

3.9.4 Materials needed for the construction of the Project would include earthworks materials and materials such as concrete and steel for new structures and asphalt for road surfacing.

3.9.5 Where possible, material would be sourced and reused on site, including excavated material, concrete from demolition and vegetation used as mulch and for habitat creation.

3.9.6 Where minerals are located within the study area, much of these are within land that would be needed temporarily to build the Project or are close to existing roads such as the M25. The construction of the Project is unlikely to limit or prevent the extraction of these materials. The Project is also unlikely to substantially constrain or prevent existing and potential future use and extraction of these materials in the wider area. Minerals excavated during construction would be prioritised for reuse on site and within the Project where feasible.

3.9.7 Not all materials can be reused on site, and the Project has the potential to generate large volumes of waste during construction, which would need to be managed off site.

3.9.8 Measures have been proposed to ensure that wastes taken off site are diverted from landfill where feasible. Wastes generated during the construction of the Project that would require disposal to landfill would reduce the landfill capacity in the study area. It is likely that some hazardous wastes are likely to arise from building demolition and the excavation of historically contaminated land.

3.9.9 Mitigation measures proposed to avoid or reduce effects include circular economy principles such as designs which minimise material use, reuse and sourcing of materials on site, and applying the waste hierarchy (prevention-reuse-recycle-recovery-disposal).

3.9.10 Commitments and targets would be included within the construction contracts to drive Contractors' performance and reduce impacts on the use of materials and waste infrastructure capacity. For example, there would be a contract commitment to ensure that 31% of imported aggregate is from recycled or secondary sources where the design allows and the Project would divert at least 70% of non-hazardous construction, demolition and excavation waste from landfill.

3.9.11 With proposed mitigation, no likely significant effects are predicted for material assets during construction. However, likely significant adverse effects are predicted for waste due to the permanent depletion of a proportion of anticipated landfill capacity.

Operational effects

3.9.12 It is anticipated that during the operational phase of the Project, maintenance works would involve significantly lower quantities of materials than during construction and would therefore have a lesser impact on mineral resources and product supply.

3.9.13 It is anticipated that minor quantities of operational materials would be used and waste would be generated from maintenance and repair activities.

3.9.14 Once construction is complete, no further effects on Mineral Safeguarding Areas or peat deposits are anticipated.

3.9.15 No likely significant effects on material assets and waste are predicted during operation.

3.10 Noise and vibration

The existing environment

3.10.1 Noise has been considered along the alignment of the new road and tunnel, the main bypassed routes and additional areas where traffic on the existing road network is predicted to change as a result of the Project.

3.10.2 Existing ambient noise levels have been established through noise surveys at 68 locations across the Study Area with the existing noise climate considered to be typical of rural/semi-rural/urban environments.

3.10.3 Within the assessment of noise, sensitive receptors are defined as residential dwellings and other sensitive receptors (OSRs). Within this scope OSRs are classified as hospitals, healthcare facilities, education facilities and community facilities. Sensitive receptors are mainly either located in the towns and villages close to the Project route or along existing roads affected by traffic changes. There are also 51 designated Noise Important Areas (NIAs) where the population is already affected by a high level of road traffic noise

Construction effects

3.10.4 Noise sensitive receptors located along the Project corridor are predicted to experience higher levels of noise temporarily during the construction phase. This is due to noise generated by the Project's construction activities, including road construction, earthworks, tunnel construction, movements on haulage routes, utilities works and construction compounds. Temporary construction noise impacts would also occur due to construction traffic on the existing highways network and from road traffic diversions when roads are closed during the night-time.

3.10.5 There is the potential for temporary adverse vibration impacts during construction where piling works are carried out on certain structures within close proximity to vibration sensitive receptors. However, ground borne noise and vibration associated with tunnel boring activities would not be expected to result in adverse impacts.

3.10.6 To control construction noise and vibration under Best Practicable Means (BPM), a CoCP and a management plan for noise and vibration would be prepared. This management plan would set out the best practice and any other specific mitigation measures to be adopted. This would be consulted on with local authorities and then signed off by the Secretary of State before the start of construction and implemented accordingly.

3.10.7 Surveys of existing noise conditions would be used to establish appropriate limits set in accordance with UK construction noise guidance, which would be adhered to by the appointed Contractors. Noise and vibration compliance monitoring would be carried out during the construction works to ensure that the BPM mitigation measures are managing construction noise effectively.

3.10.8 Likely significant effects on noise and vibration during construction are as follows:

a. Temporary significant adverse effects from construction traffic at a total of 460 noise sensitive receptors, with the affected receptors varying over the construction period.

b. Temporary significant adverse effects at a total of 391 noise sensitive receptors adjacent to diversion routes, with the affected receptors varying over the 6-year construction period.

c. Temporary significant adverse effects for up to 15 vibration sensitive receptors adjacent to structures identified to require percussive piling. This reduces to 3 vibration sensitive receptors with the implementation of vibratory piling methods.

Operational effects

3.10.9 Adverse operational impacts from the Project include increases in road traffic noise at noise sensitive receptors along the Project route, as well as along other affected existing highways where the project would change traffic flows and percentage of heavy good vehicles (HGVs); specifically, the A228, A229 and Henhurst Road.

3.10.10 Beneficial impacts in terms of road traffic noise are also predicted along the bypassed existing road network as traffic uses the Project route; specifically reductions along sections of the M25, A2 and A13.

3.10.11 The development of the Project has sought to reduce noise impacts through the iterative process of design, by considering and addressing issues such as positioning the road, as far as reasonably practicable, away from noise sensitive receptors and by locating the alignment of the Project low in the environment, through the use of cuttings and/or false cuttings/bunds. These measures all have a direct influence in reducing road traffic noise from the Project.

3.10.12 In addition to the general design principles, additional mitigation measures have been identified specifically with the function to reduce road traffic noise. These include the use of low road surfacing which minimises road traffic noise emissions, and supplementary noise barriers where identified in the study.

3.10.13 Noise from the tunnel control rooms and ventilation systems would be controlled through the setting of appropriate limits, and mitigated through design, equipment specification and by placing the machinery and equipment in locations that limit noise transmission.

3.10.14 It is concluded that based upon the balance between the level of impact and the level of mitigation implemented to control these impacts, the Project would accord with national policy principles.

3.10.15 Likely significant effects on noise and vibration during operation are as follows:

a. Permanent significant adverse effects are predicted at 1,439 noise sensitive receptors within the study area.

b. Permanent significant beneficial effects are predicted at 1,367 noise sensitive receptors within the study area.

3.11 Population and human health

The existing environment

3.11.1 The areas to the north and south of the River Thames have distinct characteristics, communities and transport networks. The study area includes towns and villages, as well as community land, recreational facilities and community assets such as parks, golf courses, outdoor sports facilities, village halls, places of worship, schools and healthcare facilities.

3.11.2 Development land and businesses have also been identified both to the north and south of the River Thames. This includes development plans which exist for the Thames Gateway to the south of the River Thames, and the expansion of the Port of Tilbury to the north of the River Thames.

3.11.3 Agricultural land use throughout the study area is mainly arable with small areas of grazing and woodland. The area is well used by walkers, cyclists and horse riders and there are many Public Rights of Way, long-distance paths and National Cycle Network routes.

3.11.4 The assessment of human health has considered the findings of relevant ES topics such as air quality and noise, as well as changes in how people access areas of green space, and impacts on road safety.

Construction effects

3.11.5 Permanent adverse effects have been identified for a number of commercial and residential properties, as a result of demolition. Other properties may be affected by changes resulting from permanent land acquisition, temporary possession of land or changes in access. Some land would be needed permanently for the Project, with other areas only needed temporarily for construction activities such as utilities diversions.

3.11.6 During construction, approximately 1,805 ha of land within agricultural landholdings would be affected, approximately 727 ha of this would be returned to agricultural use by the end of the construction phase. Compensation for affected agricultural landholdings would be payable in line with the Statutory Compensation Code. The design includes elements to reduce potential adverse effects on agricultural land through restricting construction access to agricultural land and training construction workers to reduce disturbance to agricultural activities.

3.11.7 Where feasible, construction compounds have been located away from routes such as footpaths and cycle routes used by the public. Landscaping has been designed to reduce the views of construction compounds from local residents and communities.

3.11.8 Best practice measures have been included in the CoCP to mitigate potential construction effects. Land that is only needed temporarily for construction activities would be restored to its original use, subject to certain exceptions set out in the draft Development Consent Order (Application Document 3.1).

3.11.9 A framework has been proposed to monitor uptake of accommodation and this is secured in the Framework Construction Travel Plan (Application Document 7.13). With this in place the effect on the local housing market is expected to be negligible.

3.11.10 Likely significant effects in relation to land-use and accessibility predicted during construction are as follows:

a. Permanent adverse effects on private property and housing as a result of demolition of 30 properties, permanent acquisition of land from five properties and temporary possession of land from a further property.

b. Permanent adverse effects on community land (as a result changes to usage or access characteristics) relating to Coalhouse and Tilbury Forts.

c. Temporary adverse effects relating to a number of community assets in terms of accessibility during the construction period. These include the Upminster Cemetery and South Essex Crematorium as well as schools such as Treetops and Beacon Hill-Post 16 School.

d. The site of the proposed Brentwood Enterprise Park may be impacted by the connection of the Project with the M25 and A127. The Applicant is progressing legal agreements with the promoters of Brentwood Enterprise Park to manage potential construction interfaces should both projects be under construction at the same time.

e. Permanent adverse effects on businesses as a result of demolition and permanent acquisition of land including the Depot at Henhurst Road, Cobham Service Station, Hartshill Nursery and Baylis Landscapes, and a small area of Orsett Showground.

f. Temporary adverse effects on businesses including The Inn on the Lake, as a result of temporary possession of land, enabling works, utilities works and road closures.

g. Temporary adverse effects on 41 agricultural landholdings, with 24 agricultural landholdings permanently affected.

h. Temporary adverse effects from the severance and temporary closures of Public Rights of Way, cycle routes and bridleways, resulting in changes in journey length and time. Similarly, there would be temporary adverse effects on journey times due to closures affecting minor roads.

3.11.11 Health outcomes are identified as positive, negative, neutral or uncertain. Mitigation measures for negative health outcomes during the construction phase are contained within the outline Traffic Management Plan for Construction (Application Document 7.14) and the CoCP, including a commitment to ongoing engagement with the community. Overall, the positive and negative health outcomes during construction are as follows:

a. Negative health outcomes on traffic-related severance for certain groups (namely children, older people and people with disabilities and/or long-term health conditions) as a result of changes to the local road network.

b. Negative health outcomes on access to green space and outdoor recreation for more sensitive populations due to changes in journey times and travel patterns because of diversions of Public Rights of Way or construction activities.

c. Negative health outcomes on road safety (driver stress)

d. Negative health outcomes relating to noise and vibration for sensitive populations within affected wards (notably Shorne, Cobham and Luddesdown, Riverview, Chalk, Singlewell, East Tilbury, Chadwell St Mary and Ockendon).

e. Negative health outcomes associated with the loss of private property and associated change in sense of community.

f. Positive health outcomes arising from the creation of jobs and opportunities for training and upskilling.

g. Negative health outcomes may be experienced by people in communities affected by demolition, namely Shorne, Cobham and Luddesdown, Riverview, Orsett and Upminster wards.

h. Both positive and negative health outcomes (significant) identified in relation to mental health and wellbeing. While positive outcomes may arise through access to work and training, negative outcomes may be generated as a result of anxiety and uncertainty around construction activities. Vulnerable populations such as younger and older people are present in higher proportions in certain wards, including Westcourt, Riverside and certain Thurrock wards.

Operational effects

3.11.12 The Applicant has been working with local authorities to identify replacement land, or land which could mitigate the impacts identified for areas of temporary and permanent land acquisition affecting public open space and common land. Replacement land would be provided at the following locations: Shorne Woods Country Park, Ron Evans Memorial Field, Thames Chase Forest Centre, Folkes Lane Woodland, Orsett Fen and Tilbury Green. In each case, replacement land would be equal to or greater in size than the land required for the Project and similar in terms of quality and accessibility.

3.11.13 In addition, a replacement recreational facility would be provided for the existing Gravesend Golf Centre, and a replacement for the Gammonfields Way travellers' site would be provided.

3.11.14 The Project design includes the creation of seven green bridges to maintain and enhance connectivity for walkers, cyclists and horse riders and create habitat corridors. Public Rights of Way and cycle routes would be re-linked across the new road unless better quality routes can be provided nearby. Public Rights of Way affected by the Project would be upgraded to bridleways where practicable, to enhance and improve off-road provision for walkers, cyclists and horse riders.

3.11.15 During operation, there would be limited potential effects on agricultural landholdings. Some access to land would be required for maintenance purposes relating to utilities. Access arrangements would be agreed with each affected landowner.

3.11.16 Likely significant effects in relation to land use and accessibility during operation are as follows:

a. Permanent beneficial effects on community land comprising Shorne Woods Country Park, Jeskyns Community Woodland, Michael Gardens Play Area, Folkes Lane Woodland, Thames Chase Community Forest Centre and Ron Evans Memorial Field. New areas of publicly accessible land would be created to the south of the River Thames near the southern tunnel entrance (Chalk Park) and to the north of the River Thames (Tilbury Fields).

b. Permanent beneficial effects on the potential of development land as a result of improved transport connectivity across the wider region.

c. There are likely to be permanent changes in journey length for walkers, cyclists and horse riders where Public Rights of Way, cycle routes and bridleways have been closed or diverted. All minor roads crossed by the Project would be reconnected, with the exception of Hornsby Lane.

3.11.17 Both positive and negative health outcomes have been identified during operation. These outcomes can be summarised as follows:

a. Positive health outcomes (significant) for local residents as a result of improved accessibility to a variety of services and facilities in wards across the study area.

b. Positive health outcomes (significant) for residents as a result of improved access to and provision of new areas of green space and areas for outdoor recreation.

c. Positive health outcomes (significant) for residents as a result of improvements to active travel opportunities (walking and cycling).

d. Positive health outcomes in relation to affordability.

e. Both positive and negative health outcomes for sensitive populations within wards affected by improvements to and worsening noise levels. Worsening noise levels would be experienced by wards including notably Chadwell St Mary, East Tilbury, Little Thurrock Blackshots, Ockendon, Orsett, Cuxton and Halling, Riverview, Shorne, Cobham and Luddesdown, Westcourt and Singlewell.

f. Positive health outcomes (significant) for residents arising from improved access to work and training as a result of the Project; this is particularly relevant for people in low-income households, children (due to activities within schools) and people who are economically inactive or unemployed.

g. Both positive and negative health outcomes (significant) have been identified in relation to mental health and wellbeing. Adverse outcomes may arise as people feel a loss of control over their physical environment; beneficial effects may arise through the introduction of skills and training programmes.

3.12 Road Drainage and Water Environment

The existing environment

3.12.1 The existing surface water environment consists of the River Thames, the Thames and Medway Canal, networks of ditches draining the Filborough, Shorne and Tilbury marshes, Gobions Sewer, the Mardyke and its tributaries, the River Ingrebourne, several ponds and water supply reservoirs.

3.12.2 The geology underlying much of the area is chalk which is an important source of public water supplies from groundwater. To the north of the Thames the chalk is covered by other layers of rock.

3.12.3 The River Thames flows to the North Sea and is therefore a major commercial shipping route. The River Thames floodplain is prevented from regular flooding by raised defences.

Construction effects

3.12.4 During construction several temporary watercourse crossings would be needed to allow the movement of construction equipment and materials. Watercourses would also need to be crossed as part of utilities diversions and several ponds would be lost during construction and relocated. Disturbance of watercourses as part of underground utilities diversions would be reduced by using trenchless construction methods where necessary to work beneath the watercourses.

3.12.5 Tunnelling, excavation of cuttings and other road construction activities have the potential to reduce groundwater levels and degrade groundwater quality. Tunnel design and good practice construction techniques would reduce changes to groundwater quality, levels and flows, such as at the northern tunnel entrance which would be constructed beneath groundwater using a deep barrier that would reduce saline water intrusion impacts of the chalk aquifer. Good tunnelling practice such as continuous working and installing tunnel linings immediately after excavation would also reduce risk of impacts to River Thames flood defences. Mitigation for deep cuttings includes the use of Low-permeability retaining walls or other seepage control systems to limit groundwater entering the cutting.

3.12.6 Surface water quality can be affected where watercourses receive construction work site runoff, and there are also risks to surface water and groundwater due to accidental spillages or a pollution incident caused by extreme weather conditions. The CoCP contains good practice measures to manage pollution risk, and where there is potential for contamination of runoff this would be treated before discharge to prevent pollution of surface and groundwaters.

3.12.7 Construction activities can increase the risk of flooding from rivers and the sea as the result of loss of floodplain storage, and by changing rainfall runoff rates and volumes. Compensatory flood storage would be provided to balance the volume of floodplain storage removed by the Project, avoiding flood risk impacts. Rainfall runoff from construction compounds and worksites would be managed in accordance with the good practice measures.

3.12.8 With the implementation of proposed mitigation measures, no likely significant effects on road drainage and the water environment are predicted during construction.

Operational effects

3.12.9 The design and mitigation have considered the potential for water quality, flows and levels of groundwater and surface water to be affected by road drainage during operation making allowance for projected climate change effects. Mitigation measures embedded within the design include provision for the collection and treatment of waters from road runoff and the tunnel drainage system to prevent pollution; designing drainage systems to avoid increasing flood risk and to allow continued passage for fish and eels; and creating flood relief channels to prevent embankments forming barriers to floodplain flow.

3.12.10 To the south of the River Thames the Project is not at significant risk of flooding. However, to the north of the River Thames there would be a risk to the Project if flood defences were breached or from watercourses overtopping. Flood protection, including providing areas of floodplain storage and appropriate drainage systems, is therefore part of the design to protect the new road. In some locations there would be beneficial effects on flood risk as a result of providing additional capacity in the new drainage systems and through wetland restoration proposed as part of the Project in Orsett Fen in the Mardyke catchment.

3.12.11 The design and mitigation considered the potential for change of water levels causing groundwater flooding or drying areas of nature conservation or water use. Good practice design and mitigation measures include reducing potential barrier effects beneath groundwater and designing the highway drainage infiltration basins so that the water table would not be caused to rise to ground level. Design mitigation to prevent groundwater lowering during operation includes reduced leakage through the permanent tunnel lining of the tunnel beneath Thames Estuary and Marshes Ramsar site.

3.12.12 With the implementation of proposed mitigation measures and allowance for projected climate change effects, no significant adverse effects on road drainage and the water environment are predicted during operation. Some localised moderate beneficial effects on flood risk and land drainage are predicted in the Mardyke West Tributary catchment. These effects were assessed to be significant.

Water Framework Directive compliance

3.12.13 Alongside the EIA, a Water Framework Directive (WFD) Assessment has been carried out to consider whether the Project could impact current and future targets of the WFD and change the WFD status (condition) of water bodies. The assessment considered water bodies such as the Thames Middle, Mardyke, Tilbury Main, and several groundwater bodies, as well as protected areas, including the Thames Estuary and Marshes Ramsar site.

3.12.14 The Project is designed to prevent deterioration in the WFD status of water bodies, and good practice measures in the construction phase would reduce any short-term construction effects. The WFD compliance assessment concludes that the Project would not have a significant effect on the WFD status of water bodies in the region or prevent them from achieving targets in the future. The Project therefore complies with the requirements of the WFD.

3.13 Climate

The existing environment

GHG emissions

3.13.1 The traffic on the existing road network (as defined by the Project's transport model) generates greenhouse gas (GHG) emissions. The assessment compares GHG emissions on the existing road network without the Project against a scenario with the Project. A comparison is made for 2016 (which is defined as the base year for the Project's transport model), 2030 (opening year), 2045 (design year) and over a 60-year appraisal period.

3.13.2 It was estimated that GHG emissions on the existing road network, without the Project, were approximately 9 million tonnes of carbon dioxide equivalent (tCO2e) in 2016. The forecast for the 2030 opening year, without the Project, shows a similar level of emissions as the 2016 estimate and just under 7 million tCO2e for the 2045 design year. This forecast accounts for increases in traffic and associated congestion and assumes a slower decarbonisation of the vehicle fleet than envisaged in the Government's policies.

Vulnerability of the Project to climate change

3.13.3 Climate observations for the study area indicate that there has been a gradual increase in air temperatures since 1970, with a decrease in average yearly rainfall. Climate predictions for the future suggest an increase in average summer and winter air temperatures, while rainfall rates are expected to become more seasonal, with more rain (or snow) expected in winter and less in summer.

3.13.4 In addition, the projections for changes to the frequency of severe weather events indicate that there is likely to be an increase in the average annual frequency of heatwaves, prolonged periods with no rainfall and days when precipitation is greater than 25mm per day.

Construction effects

GHG emissions

3.13.5 The assessment indicated that a maximum of approximately 1.763 million tCO2e (worst-case scenario) would be emitted during the construction phase of the Project. The materials used during construction are the biggest source of construction phase GHG emissions.

3.13.6 To reduce GHG emissions associated with material use, local sources of materials would be prioritised, and materials would be reused where possible.

3.13.7 Construction activities would also contribute to GHG emissions from electricity and fuel consumption by vehicles and machinery. The treatment, disposal and transport of waste material from the Project can also contribute to GHG emissions and would need to be carefully managed to reduce this.

3.13.8 Site clearance, such as the removal of vegetation, would result in losses of carbon sinks (the natural environment's ability to absorb GHG emissions). Trees, shrubs and hedgerows planted as part of the landscape design would absorb some of the GHG emissions .

3.13.9 The aim is to construct the Project for the lowest practicable level of GHG emissions. A separate document has been prepared (Carbon and Energy Management Plan, Application Document 7.19) that describes how GHG emissions will be reduced further through innovation and best practice carbon management during the construction phase. The mechanisms set out in the Carbon and Energy Management Plan would facilitate the Project's ambitions to deliver an industry leading carbon position to go substantially beyond the requirements of today's policy.

Vulnerability of the Project to climate change

3.13.10 The Project has been designed to reduce its vulnerability to climate change through a range of design and material specification measures, including drainage systems designed to cope with extreme weather events and the use of construction materials to withstand fluctuating temperatures.

3.13.11 The climate assessment concluded that there would be no likely significant residual effects as a result of construction of the Project.

Operational effects

GHG emissions

3.13.12 The climate assessment indicated that in 2030 annual road user GHG emissions in the area, defined by the Project's transport model, would be approximately 1% higher with the Project than without it, and approximately 1.2% higher in 2045 with the Project than without it. This increase is due to the increase in the overall vehicle distance travelled as a result of the Project, while assuming a slower decarbonisation of the vehicle fleet than envisaged in the Government's policies.

Comparison against the UK carbon budgets

3.13.13 Both the construction and operational GHG emissions were compared to the relevant UK carbon budgets. The assessment has established that during the period when GHG emissions from the Project would be at their highest, most intense level (short-term construction activity in the period 2025-2027), the Project construction emissions would represent 0.058% of the fourth carbon budget (2023-2027) of 1,950 million tCO2e. The Project's impact reduces to 0.053% and 0.048% for the fifth (2028-2032) and sixth (2033-2037) carbon budgets respectively. These contributions represent a maximum (worst-case) level of impact on carbon budgets for the construction and operation phase. Successful implementation of the Project's Carbon and Energy Management Plan and the Government's plans to decarbonising transport are expected to result in emissions below these levels.

3.13.14 It is concluded that these contributions to the UK carbon budgets would not have a material impact on the Government's ability to comply with its carbon reduction targets.

Vulnerability of the Project to climate change

3.13.15 Climate change can result in damage due to increased flooding, high temperatures, increased slope instability, damage and disruption to power supplies, and increased pollution from road runoff. Measures proposed to reduce the vulnerability of the Project to climate change during operation include various flood risk measures, including an allowance in the drainage design for climate change flood events. Regular maintenance would be carried out on the drainage system during the operational phase so that measures remained effective.

3.13.16 The assessment concluded that there would be no likely significant residual effects as a result of operation of the Project.

3.14 Cumulative effects

The existing environment

3.14.1 Cumulative effects are where two or more types of effect combine to cause impacts on the environment. These could be 'intra-project effects' where a receptor or location would experience more than one effect as a result of the Project (such as both noise and air quality effects during construction), or 'inter-project effects' where there would be effects from the Project in combination with other nearby projects which are either planned or are already in construction.

Intra-project effects

3.14.2 The intra-project cumulative effects assessment considered where the Project could result in more than one effect on the same group of people or communities during its construction or operation.

3.14.3 The assessment reviewed all predicted effects for the various environmental topics on locations likely to be affected by the Project. This concluded that multiple effects are likely to combine throughout the Project during construction and operation phases to result in likely significant effects on residential areas. Locations of likely significant effects during construction and operation are shown in Table 3.1.

Table 3.1 Locations of likely significant inter-project effects

Location	Likely significant intra-project effects on receptors during construction	Likely significant intra-project effects on receptors during operation
Shorne, Cobham and Luddesdown ward	• In the area immediately around the M2/A2/A122 Lower Thames Crossing junction • On the eastern edge of Gravesend • Along Thong Lane and Thong village • To the west and south-west of Shorne • Along A226 Gravesend Road	• On the eastern edge of Gravesend • In and around Thong village • South of the A2 around Henhurst
Higham ward	• On the western edge of Strood and east of the M2 junction 1	• On the western edge of Strood and east of the M2 junction 1
Singlewell ward	• On the southern edge of Gravesend, close to the existing A2	• On the southern edge of Gravesend close to the existing A2
Riverview ward	• On the eastern edge of Riverview Park	• Along Thong Lane
Westcourt ward	• Along and around Thong Lane	• Along the eastern edge of Gravesend and on Thong Lane
Chalk ward	• Along the eastern side of Chalk, Lower Higham Road and Church Lane	• N/A
East Tilbury ward	• To the west of East Tilbury and Linford • On the southern edge of East Tilbury • On the eastern edge of West Tilbury • Around Church Road	• Along the southern edge of East Tilbury • Along the western edge of East Tilbury and Linford • Along the eastern edge of West Tilbury • Along and around Muckingford Road • Near Low Street Lane

Location	Likely significant intra-project effects on receptors during construction	Likely significant intra-project effects on receptors during operation
Tilbury Riverside and Thurrock Park ward	• Around Ferry Road, Calcutta Road and Dock Road	N/A
Chadwell St Mary ward	• On the northern and north-eastern edge of Chadwell St Mary • To the north of Orsett Heath • Along High House Lane	• On the northern and north-eastern edge of Chadwell St Mary • To the north of Orsett Heath • Along High House Lane
Little Thurrock Blackshots ward	• On the northern and eastern edge of Grays	N/A
Orsett ward	• In and around Baker Street • Along Stanford Road • Along Stifford Clays Road • Along Hornsby Lane • At the Whitecroft • At the western edge of Orsett • To the north of the ward	• In and around Baker Street • Along Hornsby Lane • At the Whitecroft • At the western edge of Orsett • Along Stifford Clays Road • To the north of the ward
Ockendon ward	• Around the northern edge of South Ockendon • Around North Road and Dennis Road	• Around the northern edge of South Ockendon
Upminster ward	• Along Ockendon Road • In and around North Ockendon • Along St Marys Lane	• Around St Marys Lane and around the A122 Lower Thames Crossing/M25 junction and Ockendon Road
Cranham ward	• On the northern and eastern edge of Cranham	N/A
Surrounding wards within Medway: • Cuxton and Halling • Strood South • Strood North • Strood Rural	N/A	• Along the A228 in Cuxton and Halling ward
Surrounding wards within Gravesham: • Woodlands • Riverside • Northfleet South • Istead Rise • Painters Ash	N/A	• In Painters Ash ward
Wards south of the Project in Maidstone District and Tonbridge and Malling District:	‘N/A	• Along the A228 and A229 in and around Aylesford North and Walderslade

Location	Likely significant intra-project effects on receptors during construction	Likely significant intra-project effects on receptors during operation
• Boxley • Aylesford North and Walderslade • Burham and Wouldham • Aylesford South • Ditton • Larkfield South • West Malling and Leybourne Ward • Downs and Mereworth Ward • Wrotham, Ightham and Stansted Ward • Snodland East and Ham Hill Ward		ward and Snodland East and Ham Hill ward

Inter-project effects

3.14.4 209 nearby projects were shortlisted and considered in the inter-project effects assessment.

3.14.5 The inter-project effects assessment considered the potential for combined effects from the Project and other developments. No additional mitigation measures beyond those proposed in the topic chapters for this Project are proposed.

3.14.6 The following significant cumulative inter-project adverse effects have been identified:

a. Permanent and temporary cumulative effects on the setting of designated cultural heritage assets during construction and operation. In particular on Tilbury Fort scheduled monument, Causewayed Enclosure and Anglo-Saxon Cemetery 500m east-north-east of Heath Place scheduled monument, West and East Tilbury Conservation Areas, and listed buildings located within and near these conservation areas.

b. Permanent cumulative effects on archaeology and historic landscapes, due to a greater proportion of the archaeological resource being removed during construction and increased change to the nature of the historic landscape during construction and operation.

c. Permanent and temporary cumulative effects on landscape character and visual receptors during construction and operation. In particular the Thames Estuary, the River Thames, Higham Arable Farmland (sub area Chalk) Local Landscape Character Area (LLCA), Tilbury Marshes LLCA and Thurrock Reclaimed Fen (sub area Mardyke) LLCA.

d. Permanent cumulative loss of reptile and terrestrial invertebrate habitat.

e. Permanent cumulative loss of agricultural land.

f. Permanent cumulative reduction in regional landfill capacity.

g. Potential temporary cumulative effects in relation to access to services and facilities during construction.

h. Potential temporary cumulative effects on human health in relation to environmental changes, including noise, visual impact and other factors.

3.14.7 The following cumulative inter-project beneficial effects have also been identified:

a. Permanent cumulative beneficial effects on flood risk for receptors on the defended floodplain of the River Thames during operation.

b. Potential temporary cumulative beneficial effects in relation to employment creation during construction.

c. Permanent cumulative beneficial effects in relation to new employment sites and potential increased accessibility for businesses and employment during operation.

4 Summary of likely significant effects

4.1.1 In summary of the assessments undertaken, the following table collates the likely significant effects reported for the construction and operational phases of the Project for eachenvironmental topic.

Topic	Likely significant effects	
	Construction	**Operation**
Air quality	No likely significant effects	No likely significant effects in relation to human health and compliance with Limit Values. The Project is considered to have a significant effect on designated sites for ecology because of an increase in nitrogen deposition.
Cultural heritage	• Permanent adverse effects from removal of buried archaeological remains within a Scheduled Monument • Permanent adverse effects from demolition of three Listed Buildings and eight non-designated buildings (five of which are Locally Listed) • Permanent adverse effects from complete or partial removal of 106 non-designated archaeological assets • Permanent adverse effects from the partial removal of two geological deposits of archaeological interest • Temporary adverse effects on the setting of a Scheduled Monument and six non-designated archaeological features • Temporary adverse effects on the setting of a Scheduled Monument, nine listed buildings and four Conservation Areas	• Permanent adverse changes to the setting of two Scheduled Monuments, four Conservation Areas, three Grade II Listed Buildings, three non-designated historic landscapes and five non-designated archaeological assets.
Landscape and visual	Temporary adverse landscape effects on the landscape character of the Kent Downs AONB and Green Belt. Temporary adverse visual effects on users of recreational facilities, residents and people travelling through the study area	Permanent adverse landscape effects on the landscape character of the Kent Downs AONB and Green Belt. Effects would reduce by design year, 15 years after the opening year as planting mitigation matures Permanent adverse visual effects on users of recreational facilities, residents and people travelling through the study area. Effects would reduce by design year, 15

Topic	Likely significant effects	
	Construction	**Operation**
		years after the opening year as planting mitigation matures
Terrestrial biodiversity	• Permanent habitat loss within a nationally important Site of Special Scientific Interest, as well as locally designated sites of county value resulting in adverse effects. • Permanent habitat loss of irreplaceable habitat: ancient woodland and six veteran trees resulting in adverse effects. • Temporary adverse effects on terrestrial invertebrates as a result of habitat loss.	Permanent adverse effects through the degradation of designated sites and habitats including SSSI, ancient woodland, and local designations.
Marine biodiversity	No likely significant effects	No likely significant effects
Geology and soils	• Temporary and permanent use of areas of good quality agricultural land resulting in an adverse effect. Temporary and permanent impacts on soils supporting designated and non-designated notable habitats resulting in an adverse effect.	No likely significant effects
Material assets and waste	Permanent depletion of a proportion of anticipated landfill capacity resulting in an adverse effect.	No likely significant effects
Noise and vibration	Temporary adverse effects from construction traffic at a total of 460 noise sensitive receptors, with the affected receptors varying over the construction period. Temporary adverse effects at a total of 391 noise sensitive receptors adjacent to diversion routes, with the affected receptors varying over the construction period. Temporary adverse effects for up to 15 vibration sensitive receptors adjacent to structures identified to require percussive piling. This reduces to 3 vibration sensitive receptors with the implementation of vibratory piling methods.	Permanent adverse effects are predicted at 1,439 noise sensitive receptors within the study area. Permanent beneficial effects are predicted at 1,367 noise sensitive receptors within the study area.
Population	• Demolition of 30 residential properties, permanent acquisition of land from five properties and temporary possession of land from	• Permanent beneficial effects on community land and development land

Topic	Likely significant effects	
	Construction	**Operation**
	a further property resulting in adverse effects. • Temporary changes to usage or access characteristics at Coalhouse and Tilbury Forts resulting in adverse effects. • Ongoing engagement with Brentwood Enterprise Park to manage potential temporary construction interfaces. • Permanent loss of businesses as a result of demolition and permanent acquisition of land resulting in adverse effects. • Temporary adverse effects on businesses due to temporary possession of land, enabling works, utilities works and road closures • Permanent adverse effects on agricultural landholdings • Temporary adverse effects from the severance and temporary closures of Public Rights of Way, cycle routes and bridleways • Temporary adverse effects on Brewers Road, Ockendon Road and Baker Street	• Permanent beneficial changes in journey length for walkers, cyclists and horse riders where Public Rights of Way, cycle routes and bridleways have been closed or diverted. Changes in journey length have been noted as beneficial due to the recreational nature of the routes created.
Human health - Human health outcomes which are positive, negative, and significant are shown here.	• Negative significant health outcomes relating to the topics of noise and vibration, and mental health and wellbeing. • Positive health outcomes relating to work and training, and mental health and wellbeing.	• Negative health outcomes relating to the topics of noise and vibration, and mental health and wellbeing • Positive health outcomes for the topics of accessibility, access to green space and outdoor recreation, active travel, noise and vibration, work and training, and mental health and wellbeing.
Road drainage andwater environment	• No likely significant effects	• Localised permanent beneficial effects on flood risk and land drainage
Climate	• No likely significant effects	• No likely significant effects
Cumulative effects	Intra-project effects • Shorne, Cobham and Luddesdown ward - – Very large adverse significant effects for some residential	Intra-project effects • Shorne, Cobham and Luddesdown Ward –

Topic	Likely significant effects	
	Construction	**Operation**
	receptors in two locations in the ward – Large adverse significant effects for some residential receptors in three locations in the ward • Higham ward - Moderate adverse significant effects for some residential receptors in one location in the ward • Singlewell ward – Large adverse significant effects for some residential receptors in one location in the ward • Riverview ward – Large adverse significant effects for some residential receptors in one location in the ward • Westcourt ward – Large adverse significant effects for some residential receptors in one location in the ward • Chalk ward - Moderate adverse significant effects for some residential receptors in one location in the ward • East Tilbury ward – – Large adverse significant effects for some residential receptors in three locations in the ward – Moderate adverse significant effects for some residential receptors in one location in the ward • Chadwell St Mary ward - Large adverse significant effects for some residential receptors in three locations in the ward • Little Thurrock Blackshots ward – Moderate adverse significant effects for some residential receptors in one location in the ward • Orsett ward – – Very large adverse significant effects for some residential	– Large adverse significant effects for some residential receptors in two locations in the ward – Moderate adverse significant effects for some residential receptors in one location in the ward • Higham ward - Moderate adverse significant effects for some residential receptors in one location in the ward • Singlewell ward - Moderate adverse significant effects for some residential receptors in one location in the ward • Riverview ward - Moderate adverse significant effects for some residential receptors in one location in the ward • Westcourt ward - Moderate adverse significant effects for some residential receptors in one location in the ward • East Tilbury ward – – Large adverse significant effects for some residential receptors in one location in the ward – Moderate adverse significant effects for some residential receptors in four locations in the ward • Chadwell St Mary ward – Large adverse significant effects for some residential receptors in three locations in the ward • Orsett ward – – Large adverse significant effects for some residential receptors in three locations in the ward – Moderate adverse significant effects for some residential receptors in three locations in the ward • Ockendon ward – Large adverse significant effects for some

Topic	Likely significant effects	
	Construction	**Operation**
	receptors in three locations in the ward – Large adverse significant effects for some residential receptors in three locations in the ward – Moderate adverse significant effects for some residential receptors in one location in the ward • Ockendon ward – – Large adverse significant effects for some residential receptors in one location in the ward – Moderate adverse significant effects for some residential receptors in one location in the ward • Upminster ward – – Very large adverse significant effects for some residential receptors in one location in the ward – Large adverse significant effects for some residential receptors in one location in the ward – Moderate adverse significant effects for some residential receptors in one location in the ward • Cranham ward – Moderate adverse significant effects for some residential receptors in one location in the ward Inter-project effects • Temporary cumulative effects on the setting of designated cultural heritage assets during construction. In particular on Tilbury Fort scheduled monument, Causewayed Enclosure and Anglo-Saxon Cemetery 500m east-north-east of Heath Place scheduled monument, West and East Tilbury Conservation Areas, listed	residential receptors in one location in the ward • Upminster ward – Moderate adverse significant effects for some residential receptors in one location in the ward • Surrounding wards within Medway – Moderate adverse significant effects for some residential receptors in one location in the wards • Surrounding wards within Gravesham – Moderate beneficial significant effects for some residential receptors in one location in the wards • Wards south of the Project in Maidstone District and Tonbridge and Malling District – Moderate adverse significant effects for some residential receptors in one location in the wards Inter-project effects • Permanent cumulative effects on the setting of designated cultural heritage assets during operation. In particular on Tilbury Fort scheduled monument, Causewayed Enclosure and Anglo-Saxon Cemetery 500m east-north- east of Heath Place scheduled monument, West and East Tilbury Conservation Areas, listed buildings located within and near these conservation areas. • Permanent cumulative effects on archaeology and historic landscapes, due to increased change to the nature of the historic landscape during operation. • Permanent cumulative effects on landscape character and visual receptors during operation. In particular the Thames Estuary, the River Thames, Higham Arable Farmland (sub area

Topic	Likely significant effects	
	Construction	**Operation**
	buildings located within and near these conservation areas. • Permanent cumulative effects on archaeology and historic landscapes, due to a greater proportion of the archaeological resource being removed during construction and increased change to the nature of the historic landscape during construction. • Temporary cumulative effects on landscape character and visual receptors during construction. In particular the Thames Estuary, the River Thames, Higham Arable Farmland (sub area Chalk) Local Landscape Character Area (LLCA), Tilbury Marshes LLCA and Thurrock Reclaimed Fen (sub area Mardyke) LLCA. • Permanent cumulative loss of reptile and terrestrial invertebrate habitat during construction. • Permanent cumulative loss of agricultural land. • Permanent cumulative reduction in regional landfill capacity during construction. • Potential temporary cumulative effects in relation to access to services and facilities during construction. • Potential temporary cumulative effects on human health in relation to air quality changes and changes in noise levels during construction. • Potential temporary cumulative beneficial effects in relation to employment creation during construction.	Chalk) Local Landscape Character Area (LLCA), Tilbury Marshes LLCA and Thurrock Reclaimed Fen (sub area Mardyke) LLCA. • Permanent cumulative beneficial effects on flood risk for receptors on the defended floodplain of the River Thames during operation.

5 What happens next?

5.1.1 The Planning Inspectorate, on behalf of the Secretary of State, will manage the planning process once the DCO application has been submitted.

5.1.2 Members of the public can register with the Planning Inspectorate as Interested Parties which will entitle them to make written representations and participate in the examination process. Information on how to register can be found on the PlanningInspectorate's website: https://infrastructure.planninginspectorate.gov.uk/projects/south-east/lower-thames-crossing/

5.1.3 The Planning Inspectorate will appoint an Examining Authority to undertake the examination of the DCO application. Through the course of the examination, careful consideration is given by the Examining Authority to all the important and relevant matters. This includes the representations made by Interested Parties, any supporting evidence submitted and answers provided to the Examining Authority's questions in writing or at hearings.

5.1.4 The examination is expected to last up to six months.

5.1.5 The Planning Inspectorate then has three months to prepare its report recommendation on the application. This is then passed tothe Secretary of State for Transport, who will have three months todecide whether or not to grant the DCO.

5.1.6 Granting the DCO would give the Applicant the necessary legal powers to proceed with the Project.

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