Lower Thames Crossing

Combined Modelling and Appraisal Report - Appendix D - Economic Appraisal Package: Appraisal Summary Table Report

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Combined Modelling and Appraisal Report - Appendix D - Economic Appraisal Package: Appraisal Summary Table Report

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1 Introduction

1.1 Purpose of this report

1.1.1 This Appraisal Summary Table Report presents the Appraisal Summary Table (AST) and supporting appraisal tables and worksheets for the A122 Lower Thames Crossing (the Project).

1.1.2 The AST summarises the economic, environmental and social benefits and the net costs to the Public Accounts of the Project.[1] The appraisal includes a mix of impacts which have been appraised in line with the Department for Transport's (DfT) Transport Analysis Guidance (TAG) (Department for Transport, a). Some impacts have been quantified and expressed in monetary terms. Others have been quantified but not monetised, while some have been qualitatively appraised.

1.1.3 The supporting appraisal tables and worksheets contain more detailed information on which the summary of impacts in the AST is based. These tables and worksheets contain appraisal outputs from the various transport, economic, environmental, social and financial models used to appraise the impacts of the Project.

1.1.4 The appraisal methodologies and results for the Project are presented in the Economic Appraisal Report (EAR). A distributional appraisal of impacts on vulnerable social groups is presented in the Distributional Impact Appraisal Report and evidence about the Project's potential to generate wider economic impacts based on variable land use is presented in the Level 3 Wider Economic Impacts Report. These three reports, along with this AST Report comprise Appendix D - Economic Appraisal Package of the Combined Modelling and Appraisal Report (ComMA) (Application Document 7.7).

1.1.5 The ComMA also provides information about the traffic data, transport model and traffic forecasts, which are used as inputs for the appraisal, in the following Appendices:

a. Appendix A - Transport Data Package - this includes the transport data collected and used as part of the evidence base for the Project appraisal.

b. Appendix B - Transport Model Package - this describes the development of the Lower Thames Area Model (LTAM) transport model.

c. Appendix C - Transport Forecasting Package - this includes LTAM's traffic forecasts upon which this appraisal is based.

1.1.6 The AST, supporting appraisal tables and worksheets included in this report present the Project's central case appraisal which is based on core traffic growth and Most Likely capital expenditure costs (CAPEX) for its construction.

1.1.7 TAG provides methods for quantifying many of the impacts of the Project and giving them a monetary value. Most impacts are estimated over a 60-year

[1] The appraisal includes benefits, disbenefits (negative benefits), revenues and costs and are collectively referred to as impacts. The net costs include scheme costs less user charge revenues.

appraisal period from Project opening except for CAPEX costs, construction carbon emissions and delays to transport users which arise during the construction period. All impacts that are expressed in monetary terms are converted into 2010 prices and discounted back to 2010 values, referred to as 2010 prices and values. The discount rates used are set by HM Treasury (HM Treasury, 2022) at:

a. 3.50% for the first 30 years from the appraisal year, 3.00% for years 31 to 75 and 2.50% for years 76 to 125 for all impacts except human health impacts;

b. 1.50% for the first 30 years from the appraisal year, 1.29% for years 31 to 75 and 1.07% for years 76 to 125 for human health impacts which are included in the appraisal of noise, air quality, accidents and physical activity impacts.

1.1.8 The DfT set 2010 as the common base year to be used in transport appraisals. The monetary values in the AST, appraisal tables and worksheets are expressed in 2010 prices and values.

1.1.9 It should be noted that, in line with the requirements of TAG, the appraisal of some impacts reported in this report and the EAR use different methodologies to those reported in the Environmental Statement (Application Documents 6.1 – 6.3). Therefore, there may be differences in the appraisal of some impacts between the EAR and AST compared to the Environmental Statement (ES).

1.1.10 Due to the summarising nature of the AST, some acronyms that appear within the AST in Table 3.1 are first defined in the worksheets.

2 The Lower Thames Crossing project

2.1 Introduction

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

2.1.2 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 entrances 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.

2.1.3 Junctions are proposed at the following locations.

a. New junction with the A2 to the south-east of Gravesend

b. Modified junction with the A13/A1089 in Thurrock

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

2.1.4 To align with National Policy Statement for National Networks (NPSNN) (Department for Transport (DfT), 2014) policy and to help the Project meet the Scheme Objectives, it is proposed that road user charges would be levied in line with the Dartford Crossing. Vehicles would be charged for using the new tunnel.

2.1.5 The Project road 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

2.1.6 In common with most A-roads, the A122 would operate with no hard shoulder but would feature a 1m 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.

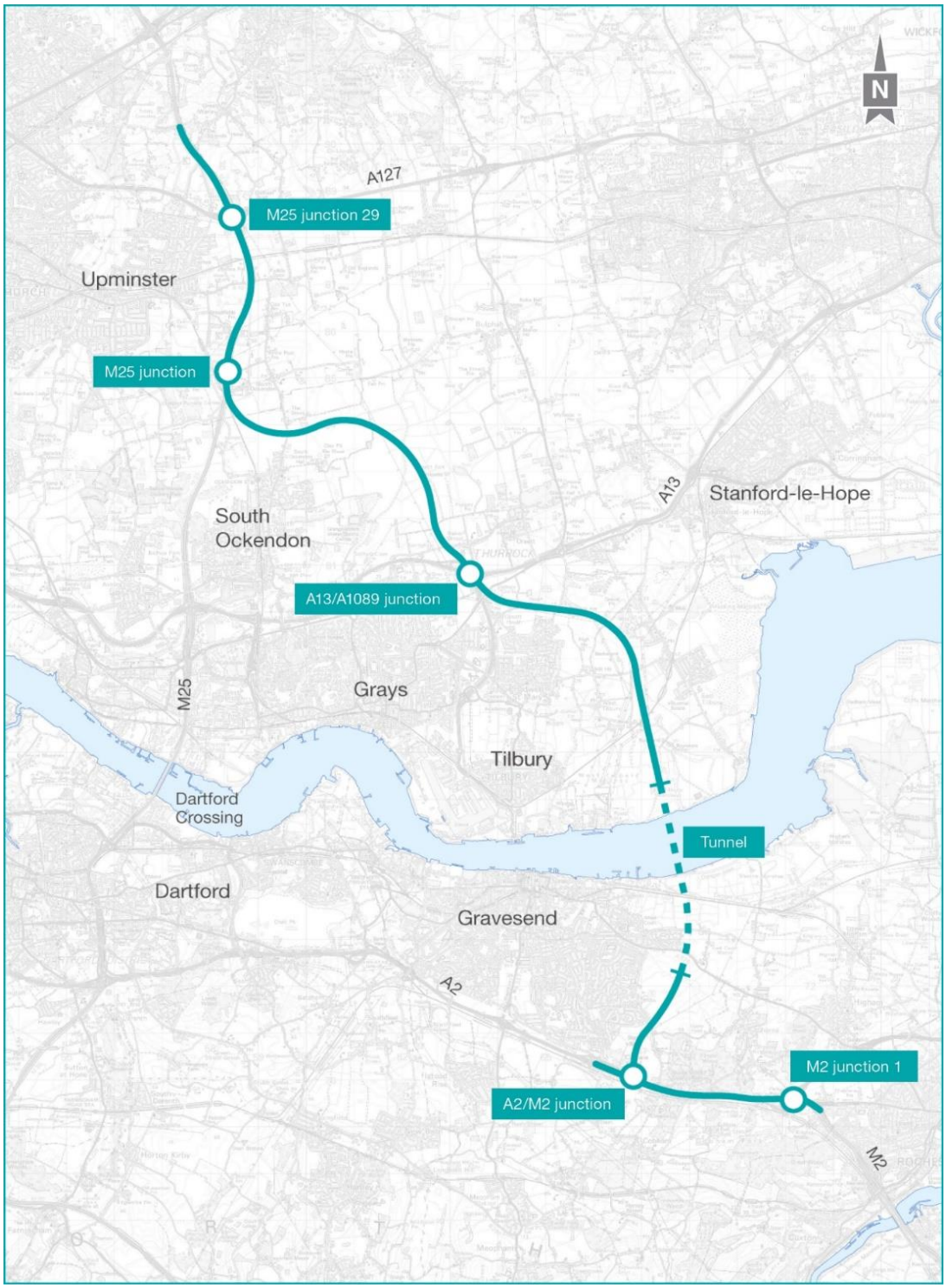
2.1.7 The A122 would be classified as an 'all-purpose trunk road' with green signs. For safety reasons, walkers, cyclists, horse riders and slow-moving vehicles would be prohibited from using it.

2.1.8 The Project would include adjustment to a number of local roads. There would also be changes to a number of public rights of way, used by walkers, cyclists and horse riders. Construction of the Project would also require the installation

and diversion of a number of utilities, including gas mains, overhead electricity powerlines and underground electricity cables, as well as water supplies and telecommunications assets and associated infrastructure.

2.1.9 The Project has been developed to avoid or minimise significant effects on the environment. Some of the measures adopted include landscaping, noise mitigation, green bridges, floodplain compensation, new areas of ecological habitat and two new parks.

Plate 2.1 A122 Lower Thames Crossing route alignment



3 Appraisal tables

3.1 Introduction

3.1.1 This chapter contains the following TAG tables for the central case appraisal of the Project:

a. Appraisal Summary Table (Table 3.1)

b. Transport Economic Efficiency table (Table 3.2)

c. Public Accounts Table (Table 3.3)

d. Analysis of Monetised Costs and Benefits Table (Table 3.4)

3.1.2 The AST summarises TAG Level 1 and 2 monetised values, quantitative appraisal information and qualitatively appraised impacts of the Project, including the distribution of some impacts on vulnerable social groups. Some additional impacts and other appraisal evidence described in the Economic Appraisal Report are not included in the AST.

3.1.3 The Transport Economic Efficiency (TEE) table summarises the impacts of the Project on the efficiency of the transport system. The TEE table reports the impacts of the Project on transport users and providers during construction and over 60 years from scheme opening during normal operation of the Project and planned maintenance periods.

3.1.4 The Public Accounts Table presents the Project's CAPEX costs and its operating, maintenance and renewals costs and user charge revenue over 60 years from scheme opening. The net effect of all costs less the user charge revenue produces the Present Value of Costs (PVC). The impact on indirect tax revenue over 60 years from scheme opening during normal operation of the Project is also reported although this is treated as a benefit of the Project.

3.1.5 The Analysis of Monetised Costs and Benefits Table presents all TAG Level 1 monetised impacts and the Initial Benefit-Cost Ratio (BCR).

Table 3.1 Appraisal summary table

Name of scheme:	A122 Lower Thames Crossing. This AST presents the central case appraisal based on Core traffic growth and Most Likely CAPEX costs.
Date produced:	October 2022
Contact Name:	Matt Palmer
Organisation:	National Highways
Role:	Executive Director (Interim)
Description of scheme:	The A122 Lower Thames Crossing would be a new all-purpose trunk road connecting to the A2 and M2 in Kent, east of Gravesend, crossing under the River Thames through two bored tunnels. To the north of the River Thames, the Project would link to the A13 and join the M25 south of junction 29 and include junction modifications to both the M25 at the northern limits of the route and on the A2 at the southern end. The A122 would be 23km long of which 4.25km would be in tunnel. It would be dual three-lane, except southbound between the M25 and A13/A1089 where it would be dual two-lane. Users of the tunnel would be charged in line with charges at the Dartford Crossing. The new road would have emergency areas and additional vehicle restrictions imposed and would be managed through signage as pedestrians, low-powered motorcycles, cyclists, horse riders and agricultural vehicles would be prohibited from using the road.

Impacts		**Summary of key impacts**	**Assessment**					
			Quantitative			**Qualitative**	**Monetary £ (NPV)**	**Distributional 7 point scale / vulnerable group**
Economy	Business users & transport providers	Journey time and vehicle operating cost savings for business travellers and freight arise due to reduced congestion and improved connectivity. Small user charge disbenefits are due to additional or rerouted cross river journeys which incur charges on both the new and existing crossing. There would be delays for existing users during construction and planned maintenance periods.	Value of journey time changes (£)	£875.1m		N/A	£1,042.9m	
			Net journey time changes (£)					
			0 to 2 min	2 to 5 min	> 5 min			
			-£13.6m	£190.8m	£697.9m			
	Reliability impact on business users	The Project would improve journey time reliability for journeys across the River Thames and on the wider road network by providing an alternative route. This would reduce the impact of incidents, the variability of travel times and diversions on to local roads.	N/A			N/A	£210.9m	
	Regeneration	Not appraised because this impact is no longer part of DfT's transport analysis guidance (TAG) (Department for Transport, a).	N/A			N/A	N/A	
	Wider impacts	The Project would effectively reduce perceived distances between businesses, boosting their productivity and economic output and would increase tax revenues as workers supply more labour.	Agglomeration	£1,374.8m		N/A	£1,516.6m	
			Output in imperfectly competitive markets	£133.4m				
			Labour supply impacts	£8.4m				
Environmental	Noise	There is a small positive monetary value due to the net change in the number of households impacted by daytime and night-time noise due to the Project. The distributional appraisal shows a net adverse impact on residential noise levels. The distribution of noise impacts against income quintiles is assessed as uneven with adverse impacts higher than expected in the most deprived (20%) income quintile groups. There is a net increase in properties with increases in noise greater than 1dB in areas with higher than average proportions of children under 16 and people aged 70 and over compared with the regional study area and England and Wales, although the net increases are lower compared with the England and Wales proportions.	For the 2045 forecast year: Households with increased daytime noise..... 6,015 Households with reduced daytime noise ..... 5,679 Households with increased night-time noise ..... 5,695 Households with reduced night-time noise 5,002			N/A	£3.4m	Income: Large Adverse Children: Large Adverse Adults aged 70 and over: Moderate Adverse

Impacts		Summary of key impacts	Assessment			
			Quantitative	**Qualitative**	**Monetary £ (NPV)**	**Distributional 7 point scale / vulnerable group**
		There is a neutral impact of changes in noise levels on schools and care homes as the majority of schools and care homes would receive no change in noise level.				
Environmental	Air quality	Overall there is an increase in NO2 and PM2.5 concentrations and emissions with the Project because of the increase in vehicle kilometers travelled. The emission factors used in the Impact Pathway Approach to calculate the change in concentrations, for both the opening year (2030) and design year (2045), have been generated using National Highways Speed Band Emission Tool version 4.3, based off DEFRA's Emission Factor Toolkit (EFT) version 11. (DEFRA, 2021) The distributional appraisal shows a beneficial air quality impact. The distribution of air quality impacts against income quintiles is assessed as uneven because the two most deprived income quintiles benefit more than the other income quintiles. There is a net decrease in NO2 in areas with higher than average proportions of children under 16, compared with both the regional study area and with England and Wales. No schools would experience a change in air quality levels.	Change in NO2 assessment score over 60 years ..... 89,786 Change in PM2.5 assessment score over 60 years 64,450	N/A	NO2 ..... -£4.3m PM2.5 ..... -£3.4m Total value -£7.8m	Income: Large Beneficial Children: Large Beneficial
	Greenhouse gases	The Project is based on a low carbon design which is forecast to increase embodied carbon emissions from its construction, maintenance and asset renewal. Carbon emissions related to corporate level operations of the Project (such as network lighting and use of traffic officer vehicles) would be net zero throughout the appraisal period There will also be increased road user tailpipe emissions due to an increase in vehicle kilometres travelled on the road network. These emissions have been appraised in line with the latest TAG guidance. The appraisal does not take account of the accelerated uptake of electric vehicles that are required as part of the Transport Decarbonisation Plan.	Change in non-traded carbon over 60 years (CO2e).....5.41m tonnes Change in traded carbon over 60 years (CO2e).....1.18m tonnes Change in CO2e emissions in 2030 (project opening year): ..... Non-traded carbon: 136,712 tonnes .....Traded carbon: 27,486 tonnes	N/A	-£527.8m	
	Landscape	The widening of the existing M2/A2 corridor, expansion of the existing A13/A1089 junction and modifications to the existing M25 corridor, together with the new A122 Lower Thames Crossing, would adversely affect the landscape character and views within the Area of Outstanding Natural Beauty (AONB), its setting and the local landscape character and views within the Green Belt, including a large adverse effect on the Higham Arable Farmland and Thurrock Reclaimed Fen local landscape character areas. However, the overall impact of the Project is Moderate Adverse due to the extensive mitigation proposals, including false cuttings, new planting, green bridges and the landscaping of new areas of open space at Chalk Park adjoining the South Portal and Tilbury Fields adjoining the North Portal.	N/A	Moderate Adverse	N/A	

Impacts		Summary of key impacts	Assessment			
			Quantitative	Qualitative	Monetary £ (NPV)	Distributional 7 point scale / vulnerable group
Environmental	Townscape	The Project route is typically located within Green Belt and along existing trunk roads including widening of the A2 and M25 corridors, and new junctions with the A2, A13, and M25. This new infrastructure would adversely affect a range of defined townscape areas due to their associations with the surrounding rural landscapes. In addition, the historic townscape character of the rural settlements at Thong, south of the River Thames, and West Tilbury, Baker Street and North Ockendon to the north of the River, would be adversely impacted due to their proximity to the Project. These settlements are designated conservation areas where there would be a major change on physical and perceptual qualities and characteristics including their setting.	N/A	Moderate Adverse	N/A	
	Historic environment	To the south of the River Thames a Moderate Adverse effect is predicted on archaeological remains and historic buildings. To the north of the River Thames a Large Adverse effect on archaeological remains, historic buildings and historic landscapes is predicted. This results from the total removal of 3 high value listed buildings, which is exceptional in NPSNN terms and the almost total removal of a high value scheduled monument which would be wholly exceptional in NPSNN terms. Overall the effects of the Project are considered to be Large Adverse.	N/A	Large Adverse	N/A	
	Biodiversity	A score of very large adverse is predicted as significant residual adverse effects remain from the direct loss and deterioration of irreplaceable habitats and Sites of Special Scientific Interest (SSSI). Although they would not affect the assessment of residual impacts, mitigation and compensation measures are proposed in accordance with the National Policy Statement for National Networks (NPSNN) to offset these adverse effects (Department for Transport, 2014). This includes the creation of over 200ha of new woodland and grassland which would increase the overall area of these habitats and strengthen resilience across the wider network of designated sites and semi-natural habitat within the wider landscape.	N/A	Very Large Adverse	N/A	
	Water environment	The Project has potential to degrade the quality of surface and groundwater bodies and change surface and groundwater levels and flow regimes. These effects may be induced by discharges of construction phase and operational runoff, earthworks, groundwater control and new crossings of watercourses and their floodplains. However, by following construction good practice and by embedding mitigation into the Project's design, effects on the water environment can be successfully avoided or reduced.	N/A	Slight Adverse	N/A	

<table>
<tr><th colspan="2" rowspan="2">Impacts</th><th rowspan="2">Summary of key impacts</th><th colspan="5">Assessment</th></tr>
<tr><th colspan="4">Quantitative</th><th>Qualitative</th><th>Monetary
£ (NPV)</th><th>Distributional
7 point scale / vulnerable group</th></tr>
<tr><td rowspan="5">Social</td><td>Commuting and other users</td><td>Journey time and vehicle operating cost savings for commuters and other users arise due to reduced congestion and improved connectivity. Small user charge disbenefits are due to additional or rerouted cross river journeys which incur charges on both the new and existing crossings. There would be delays for existing users during construction and planned maintenance periods.
Overall, there is a net beneficial distributional impact from the Project on user benefits. There are net user benefits across all income quintiles with the distribution of user benefits within 5% of the population for each income quintile and assessed as even.</td><td colspan="4">Value of journey time changes (£) £1,213.1m
Net journey time changes (£)
0 to 2 min: -£24.4m | 2 to 5 min: £225.0m | > 5 min: £1,012.5m</td><td>N/A</td><td>£788.2m</td><td>Income: Moderate Beneficial</td></tr>
<tr><td>Reliability impact on commuting and other users</td><td>The Project would improve journey time reliability for non-business journeys across the River Thames and on the wider road network by providing an alternative route. This would reduce the impact of incidents, the variability of travel times and diversions on to local roads.</td><td colspan="4">N/A</td><td>N/A</td><td>£276.2m</td><td></td></tr>
<tr><td>Physical activity</td><td>The Project includes a significant programme of active travel measures for walkers, cyclists and horse riders which comprise:
• 27km of improved footpaths, of which 5km are also cycle paths
• 40km of new footpaths, of which 14km are also cycle paths
• New and widened bridges
• New crossings
• A new car park, toilet facilities and cycle hire facility to the south of Thong village
The Active Mode Appraisal Toolkit has been used to estimate monetary values for physical activity impacts (Department for Transport 2022d)</td><td colspan="4">N/A</td><td>N/A</td><td>£21.2m</td><td></td></tr>
<tr><td>Journey quality</td><td>The change in impact across the journey quality factors of traveller care, views and stress is, on balance, likely to be beneficial and large, affecting more than 10,000 travellers per day. Improvements in traveller stress arise through reductions in congestion at the Dartford Crossing and approach roads, resulting in improved accessibility. The effect on vehicle travellers in relation to views from the road during the operation phase is likely to be positive.</td><td colspan="4">N/A</td><td>Large Positive</td><td>N/A</td><td></td></tr>
<tr><td>Accidents</td><td>There would be a net increase in the number and value of accidents due to the Project because there is an increase in vehicle kilometres driven on the road network. However, the accident rate per million vehicle km and accident costs per km would reduce with the provision of the Project. There is no distributional impact for vulnerable groups analysed which are walkers and cyclists (for A-roads), motorcyclists, under 16 year olds, 16 to 25 year old males, over 70 year olds for any location, compared with regional study area and Great Britain.</td><td colspan="4">There are forecast to be 1,667 additional accidents over 60 years from scheme opening, including 26 fatalities, 182 serious injuries and 2,464 slight injuries. However, there is a reduction in the accident rate per million vehicle km.</td><td>N/A</td><td>-£67.8m</td><td>Children: Neutral
Adults aged 70 and over: Neutral
Walkers: Neutral
Cyclists: Neutral
Motorcyclists: Neutral
Male 16-25 year olds: Neutral</td></tr>
</table>

Impacts		Summary of key impacts	Assessment			
			Quantitative	Qualitative	Monetary £ (NPV)	Distributional 7 point scale / vulnerable group
	Security	The Project is expected to have an overall neutral impact on the personal security of drivers and vehicle occupants in the tunnel, along the route and at crossing points. Personal security of walkers, cyclists and horse riders at crossing points has also been assessed as neutral – while some crossings would be improved through lighting, environment and gradient, others may require underpasses which potentially have an adverse impact on personal security.	N/A	Neutral	N/A	
	Access to services	Not appraised because TAG guidance advises that this impact relates to public transport projects (Department for Transport, a).	N/A	N/A	N/A	
Social	Affordability	Personal affordability would not be affected by the Project because the Without Scheme travel routes and operating costs would still be available. Therefore, the Project has no affordability impact for most users. Journeys by Gravesham residents to and from destinations north of the River Thames would be proportionately cheaper compared to the Without Scheme scenario because their cross-river road user charges would be reduced through a user charge discount. Around 106,900 Gravesham residents would benefit from a reduction in the cost of travel across the River Thames. The distribution of personal affordability impacts is uneven across income quintiles as there is a higher proportion of Gravesham residents within the lowest income quintiles compared with the regional study area and England and Wales.	N/A	Slight Positive	N/A	Gravesham residents: Large Beneficial
	Severance	All routes severed by the Project would be reinstated using bridges or underpasses except for Hornsby Lane in Thurrock. In net terms 49,020 walking trips per day within the LTAM transport model area are expected to experience a reduction in traffic-related severance. Overall, there is likely to be a small net decrease in traffic-related severance in a small number of locations, potentially affecting less than 1% of the population within the regional study area. The distribution of decreased traffic related severance is uneven with respect to car-ownership and there is likely to be a smaller than expected impact of traffic related severance on non-car owning households, compared with the regional study area and England and Wales. The distributions of traffic related severance on children aged under 16, people aged 70 and over and for people with a limiting long-term illness are even as they are similar to the regional study area and England and Wales.	N/A	Large Positive	N/A	Car ownership: Slight Beneficial Children under 16: Neutral People aged 70 and over: Neutral People with a limiting long-term illness: Neutral
	Option and non-use values	The Project would give road users an alternative route to cross the River Thames and allow the potential development of land close to the route.	N/A	Large Positive	N/A	

Impacts		Summary of key impacts	Assessment			
			Quantitative	**Qualitative**	**Monetary £ (NPV)**	**Distributional 7 point scale / vulnerable group**
Public Accounts	Cost to broad transport budget	There are two types of costs to the transport budget - the capital costs of construction and the subsequent operational, maintenance and renewals costs of the Project's physical and charging infrastructure. These costs are reduced in net terms by the change in operator revenue at the Dartford Crossing, revenues from the A122 Lower Thames Crossing, the change in revenue in the London Congestion Charge area and forecast receipts for the Silvertown and Blackwall Tunnels.	Investment costs ..... £3,119.6m Operating, maintenance and renewals cost ... £327.4m Operator revenue £746.8m	N/A	£2,700.2m	
	Indirect tax revenues	The Project would increase indirect tax revenue for central government due to additional traffic using the road network.	N/A	N/A	£43.5m	

Table 3.2 Transport Economic Efficiency - Central case (£, 2010 prices and values)

	All Modes		Road		Bus & Coach	Rail	Other
Non-business: Commuting			**Private cars & LGVs**		**Passengers**	**Passengers**	
User benefits							
Travel time	434,466,411		434,466,411				
Vehicle Operating Costs	-39,315,741		-39,315,741				
User charge impacts	-5,938,347		-5,938,347				
During construction and maintenance	-27,623,101		-27,623,101				
Net-non-business benefits: Commuting	**361,589,222**	***(1a)***	**361,589,222**				
Non-business: Other			**Private cars & LGVs**		**Passengers**	**Passengers**	
User benefits							
Travel time	778,642,691				778,642,691		
Vehicle Operating Costs	-290,762,717				-290,762,717		
User charge impacts	-28,443,758				-28,443,758		
During construction and maintenance	-32,778,474				-32,778,474		
Net-non-business benefits: Other	426,657,742	*(1b)*			426,657,742		

Business			**Goods vehicles**	**Business cars & LGVs**	**Passengers**	**Freight**	**Passengers**
User benefits							
Travel time	875,126,206		337,836,893	537,289,313			
Vehicle Operating Costs	280,435,441		220,772,344	59,663,096			
User charge impacts	-32,263,488		-18,268,945	-13,994,543			
During construction and maintenance	-80,375,573		-38,663,075	-41,712,498			
Sub-total	1,042,922,586	*(2)*	501,677,218	541,245,368			
Private sector provider impacts					**Freight**	**Passengers**	
Revenue							
Operating costs							
Investment costs							
Grant/subsidy		*(3)*					
Sub-total							
Other business impacts							
Developer contributions		*(4)*					
Net business impact	1,042,922,586	*(5) = (2) + (3) + (4)*					
Total							
Present Value of Transport Economic Efficiency Benefits (TEE)	1,831,169,550	*(6) = (1a) + (1b) + (5)*					
	Notes: Benefits appear as positive numbers, while costs appear as negative numbers. All entries are discounted present values, in 2010 prices and values.						

Table 3.3 Public Accounts - Central case (£, 2010 prices and values)

	All Modes		Road	Bus & Coach	Rail	Other
Local Government						
Revenue						
Operating costs						
Investment costs						
Developer subsidy						
Grant/subsidy						
Net Impact		*(7)*				
Central Government Funding: Transport						
Revenue	-746,794,048		-746,794,048			
Operating costs	327,417,000		327,417,000			
Investment costs	3,119,580,000		3,119,580,000			
Developer subsidy						
Grant/subsidy						
Net Impact	2,700,202,952	*(8)*	2,700,202,952			
Central Government Funding: Non-Transport						
Indirect Tax Revenues	-43,503,321	*(9)*	-43,503,321			
Totals						
Broad Transport Budget	2,700,202,952	*(10) = (7) + (8)*				
Wider Public Finances	-43,503,321	*(11) = (9)*				

Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers.

All entries are discounted present values in 2010 prices and values.

Table 3.4 Analysis of Monetised Costs and Benefits - Central case (£, 2010 prices and values)

Noise	3,380,134	*(12)*
Local air quality	-7,763,229	*(13)*
Greenhouse gases	-527,812,613	*(14)*
Journey quality		*(15)*
Physical activity	21,204,430	*(16)*
Accidents	-67,822,899	*(17)*
Economic efficiency: consumer (commuting)	361,589,222	*(1a)*
Economic efficiency: consumer (other)	426,657,742	*(1b)*
Economic efficiency: consumer (business)	1,042,922,586	*(5)*
Wider public finances (Indirect tax revenues)	43,503,321	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*

Present Value of Benefits	1,295,858,695	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) + (11)*

Broad transport budget	2,700,202,952	*(10)*

Present Value of Costs	2,700,202,952	*(PVC) = (10)*

Overall impacts

Net Present Value	-1,404,344,258	NPV=PVB-PVC
Initial Benefit-Cost Ratio (BCR)	0.48	BCR=PVB/PVC

4 Environmental impacts

4.1 Introduction

4.1.1 This chapter contains the following environmental impact worksheets:

a. Biodiversity

b. Historic environment

c. Landscape

d. Townscape

e. Water environment

f. Noise

g. Air quality

4.1.2 These worksheets summarise the results of the environmental appraisals in line with the requirements in TAG Unit A3 (Department for Transport, 2022a).

4.1.3 The Project has been subject to an Environmental Impact Assessment (EIA), the findings of which are documented in the Environmental Statement (Application Documents 6.1 – 6.3). This provides a full assessment of the likely significant environmental impacts of the Project taking account of all committed mitigation. While the appraisals described in this report are linked to the EIA it is important to recognise that they serve a different purpose to the EIA and are intended to inform the economic appraisal for the Project rather than satisfy the requirements of EIA legislation.

4.1.4 Greenhouse gas impacts are reported in the Economic Appraisal Report.

4.2 Biodiversity

4.2.1 Each of the biodiversity areas impacted by the Project is described and appraised in terms of its:

a. Scale

b. Importance

c. Trend

d. Biodiversity and earth heritage value

e. The magnitude of the Project's impact taking account of all committed mitigation

4.2.2 Plate 4.1 and Plate 4.2 respectively show the biodiversity areas to the south and the north of the River Thames.

4.2.3 An assessment score is provided for each biodiversity area.

4.2.4 An overall Summary Assessment Score and qualitative comments are also provided. These form the basis of the biodiversity information included in the AST.

Plate 4.1 Biodiversity areas to the south of the River Thames

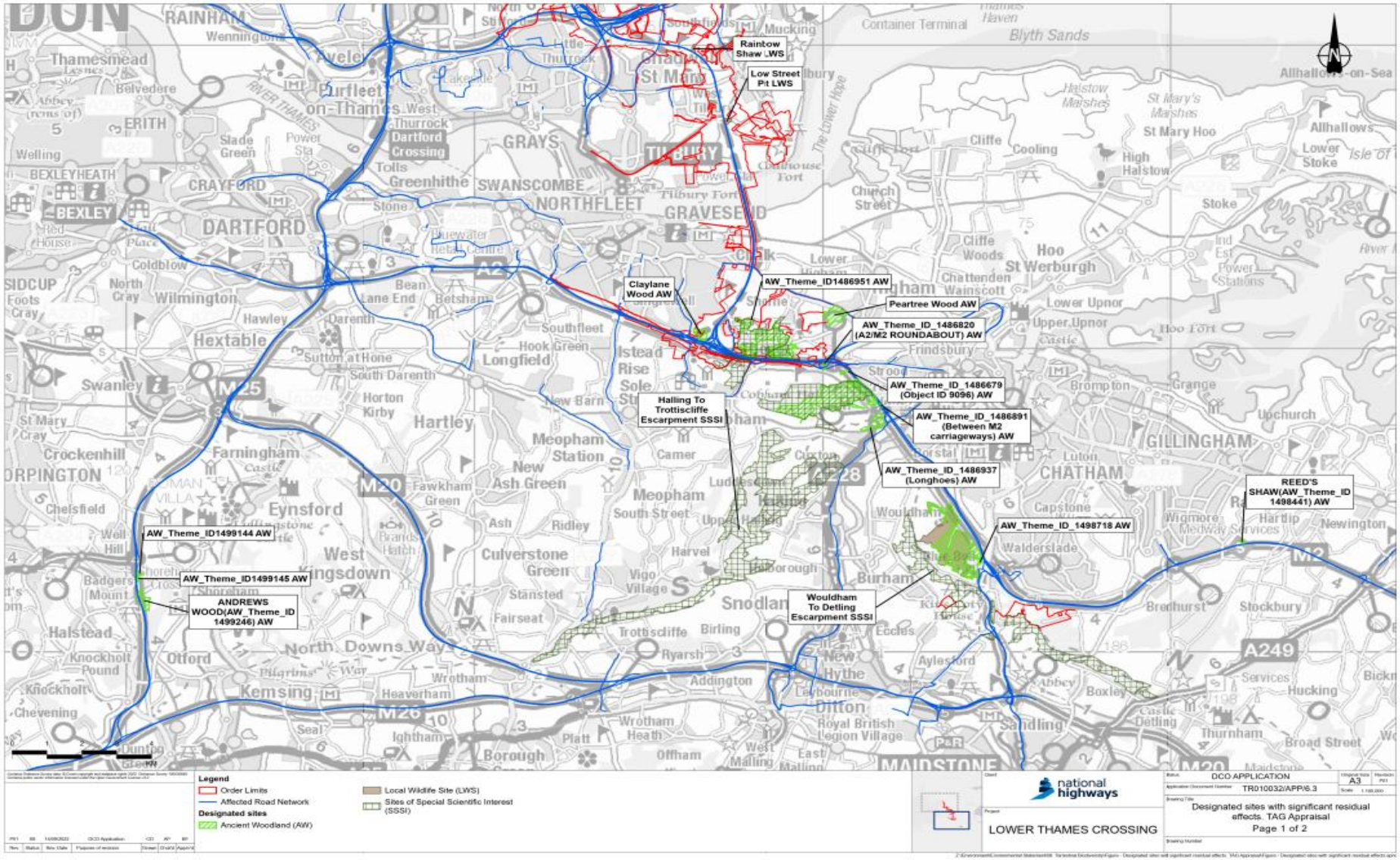


Plate 4.2 Biodiversity areas to the north of the River Thames

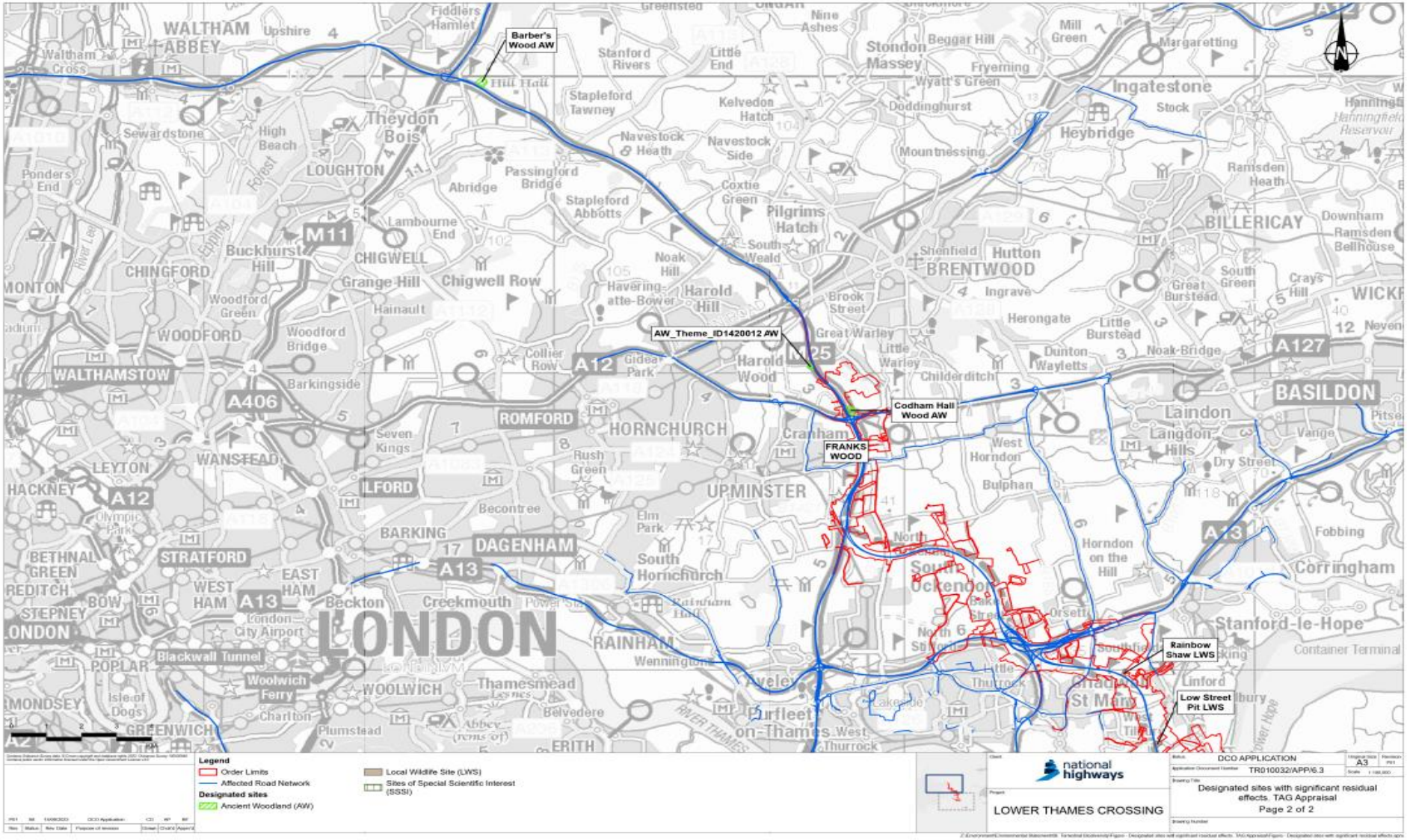


Table 4.1 Biodiversity worksheet

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
Thames Estuary and Marshes Ramsar site	Ramsar criterion 2: the site supports one endangered plant species and at least 14 nationally scarce plants of wetland habitats. The site also supports more than 20 British Red Data Book invertebrates. Ramsar criterion 5: assemblages of international importance: Species with peak counts in winter: 45,118 waterfowl (5 year peak mean 1998/99-2002/2003) Ramsar criterion 6: species/populations occurring at levels of international importance (includes species with peak counts in autumn/winter and in spring)	International	International given site designation	The overall waterbird assemblage appears stable. Macroinvertebrate and macrophyte trends are picked up in the relevant cells below.	Very high - internationally designated site	Neutral - loss of functionally linked land offset through the creation of wetland habitat at Coalhouse Point. Potential disturbance and/or mortality risks to bird assemblages considered temporary and negligible. The Statement to Inform an Appropriate Assessment concludes no adverse effect on integrity of the site. Risk of habitat degradation through increased run-off rates of rainwater into the ditch network. A full collection and management regime would be implemented before discharging to the ditch network. The flow would be regulated to ensure the discharge flow rates are managed at greenfield runoff rates. The Statement to Inform an Appropriate Assessment concludes no adverse effect on integrity of the site.	Neutral
Thames Estuary and Marshes Special Protection Area (SPA)	Article 4.1 Qualification (79/409/EEC). Over winter the area regularly supports 1% of the population in GB of Circus cyaneus Article 4.2 Qualification (79/409/EEC). Over winter the area regularly supports significant populations of a number of wading birds. On passage the area regularly supports 2.6% of the population of Charadrius hiaticula Article 4.2 Qualification (79/409/EEC): An internationally important assemblage of birds. Over winter the area regularly supports 75019 waterfowl (5 year peak mean 21/03/2000).	International	International given site designation	Although the overall waterbird assemblage appears stable, alerts have been triggered for four of the seven species assessed for the SPA: grey plover; ringed plover; redshank and knot.	Very high - internationally designated site		Neutral
North Downs Woodlands Special Area of Conservation (SAC)	The site comprises of important grasslands, shrublands and some of the UK's rarest woodland types, especially for region. In particular, the yew-	International	International given site designation	SSSI units in favourable condition although pressures exist from overall site management, recreational pressures and pollution.	Very high - internationally designated site	Positive - woodland habitat creation proposed to connect ajdacent areas to the SAC would increase resilience of the site to future pressures such as climate	Large beneficial

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
	dominated woodland is a rare habitat of European priority interest restricted to only a few areas of England and Wales, and this SAC is considered one of their best areas.					change and safeguard its conservation status.	
Epping Forest SAC	Epping Forest represents Atlantic acidophilous beech forests in the north-eastern part of the habitat's UK range. Although the epiphytes at this site have declined, largely as a result of air pollution, it remains important for a range of rare species, including the moss Zygodon forsteri, and stag beetle Lucanus cervus. The long history of pollarding, and resultant large number of veteran trees, ensures that the site is also rich in fungi and a range of dead-wood invertebrates.	International	International given site designation	The majority of the site is in either Favourable or Unfavourable recovering status, mainly as a result of a lack of appropriate management although external influences such as nutrient enrichment and recreational pressures also have negative effects.	Very high - internationally designated site	Minor negative - potential temporary impact on site as a result of increased nitrogen deposition which would not affect its integrity. The Statement to Inform an Appropriate Assessment concludes no adverse effect on integrity of the site.	Slight adverse
Epping Forest SSSI	One of a few remaining large-scale examples of ancient wood-pasture, including old grassland plains and scattered wetland. Plains include umimproved acid grassland. The area supports outstanding assemables of invertebrates, amphibian interest and an exceptional breeding bird community.	National	National given site designation	Majority of units are in Unfavourable - Recovering status. Pressures are from a lack of appropriate management, site enrichment through air pollution and fertilizer use (both within and outside the site), and recreational pressure.	High - nationally designated site	Minor negative - potential temporary impact on site as a result of increased nitrogen deposition which would not affect its integrity.	Slight adverse
Mucking Flats and Marshes Site of Special Scientific Interest (SSSI)	Botanical interest: Mudflats and Saltmarsh Wintering wildfowl and waders	National	National given site designation	Majority Favourable with small area Unfavourable Recovering status.	High - nationally designated site	Neutral - potential habitat degradation from dust deposition and water quality changes would be mitigated by good practice construction measures. Disturbance to bird assemblages and changes in groundwater levels are not predicted.	Neutral
South Thames Estuary and Marshes SSSI	Wading birds and other overwintering species (such as short-eared owl) Botanical importance supporting important	National	National given site designation	Generally Favourable to Unfavourable Recovering Status, small areas Unfavourable Declining	High - nationally designated site	Neutral - risk of habitat degradation through increased run-off rates of rainwater into the ditch network. A full collection and management regime would	Neutral

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
	invertebrate assemblage (saltmarsh, freshwater habitats and grazing marshes)					be implemented before discharging to the ditch network. The flow would be regulated to ensure the discharge flow rates are managed at greenfield runoff rates.	
Shorne and Ashenbank Woods SSSI	SSSI designated for Ancient Semi-Natural Woodland (ASNW) & associated invertebrate assemblages	National	National given site designation	Favourable to Unfavourable Recovering Status. Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	High - nationally designated site	Major negative - habitat loss (5.9ha or 2.9% of the SSSI, of which 1.0ha is designated ancient woodland), together with significant adverse effects as a result of increased nitrogen deposition on the site regarding increased nitrogen deposition. Positive - woodland habitat creation (approximately 35.1ha) in areas immediately adjacent to the SSSI would increase habitat extent and build resilience into this SSSI and the wider network, notably creating a new woodland connection to Great Crabbles Wood SSSI. National Highways is proposing to provide replacement land for the open space comprised at this site. The replacement land will be of a comparable or better quality and be no less advantageous to the public (see Appendix D of the Planning Statement (Application Document 7.2)), but an adverse assessment is reported in this context because it considers the impact on the existing ecological designation only.	Very large adverse with respect to initial habitat loss. Large beneficial with respect to habitat creation.
Great Crabbles Wood SSSI	SSSI Designated for ASNW & scarce plants.	National	National given site designation	Unfavourable Recovering Status. Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	High - nationally designated site	Minor negative - increased nitrogen deposition resulting in habitat degradation. Positive regarding 21ha of woodland habitat creation providing connection to Shorne and Ashenbank Woods SSSI.	Slight adverse with respect to increased nitrogen deposition. Large beneficial with respect to habitat creation.

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
Cobham Woods SSSI	SSSI Designated for ASNW and parkland supporting rare plant species and breeding birds.	National	National given site designation	Favourable Status. Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	High - nationally designated site	Major negative - habitat degradation as a result of increased nitrogen deposition potentially permanently affecting the integrity of the site. Habitat creation at nitrogen deposition compensation sites, creating new widlife-rich habitat which strengthens network of designated sites and habitats, proposed to fully offset project-wide significant adverse effects from nitrogen deposition.	Very large adverse
Halling to Trottiscliffe Escarpment SSSI	SSSI representative of chalk grassland in west Kent and beech woodland on the chalk, with outstanding assemblages of plants and invertebrates present	National	National given site designation	Site predominantly in favourable condition although improvement management through grazing would benefit overall condition to prevent scrub encroachment	High - nationally designated site	Intermediate negative - habitat degradation as a result of increased nitrogen deposition potentially temporarily affecting the integrity of the site. Habitat creation at nitrogen deposition compensation sites, creating new widlife-rich habitat which strengthens network of designated sites and habitats, proposed to fully offset project-wide significant adverse effects from nitrogen deposition.	Large adverse
Wouldham to Detling Escarpment SSSI	SSSI designated for varied broad-leaved and yew woodland. Yew high forest on the escarpment, with beech high forest in southern corner and ash/hazel/sweet chestnut coppice (with ancient oak) on the plateau.	National	National given site designation	Favourable status although pressures exist from recreation, management and pollution, including spread of invasive non-natives.	High - nationally designated site	Major negative - habitat degradation as a result of increased nitrogen deposition potentially permanently affecting the integrity of the site. Habitat creation at nitrogen deposition compensation sites, creating new widlife-rich habitat which strengthens network of designated sites and habitats, proposed to fully offset project-wide significant adverse effects from nitrogen deposition.	Very large adverse
Titsey Woods SSSI	SSSI an example of wet semi-natural woodland on the Gault Clay, which has a limited outcrop in Surrey. There is a diverse ground flora and also support several uncommon invertebrates.	National	National given site designation	Favourable to unfavourable - recovering. Improved management required to restore coppicing and prevent succession and invasive non-native species encroachment	High - nationally designated site	Minor negative - potential temporary impact on site as a result of increased nitrogen deposition which would not affect its integrity.	Slight adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
Westerham Wood SSSI	SSSI woodland on one of the few remaining ancient woodlands on Gault Clay in Kent. The wood has a rich ground flora and an outstanding breeding bird community.	National	National given site designation	Favourable Status. Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens.	High - nationally designated site	Minor negative - potential temporary impact on site as a result of increased nitrogen deposition which would not affect its integrity.	Slight adverse
Hangman's Wood & Deneholes SSSI and ASNW	SSSI Designated for ASNW and medieval chalk mines which provide the most important known underground hibernation site for bats in Essex.	National	National given site designation	Favourable Status. Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	High - nationally designated site	Neutral - the site is over 300m from the Project, and no adverse effects are predicted.	Neutral
Grays Thurrock Chalk Pit SSSI	SSSI Designated former chalk quarry with woodland, scrub, grassland and open water supporting rare plants and invertebrates.	National	National given site designation	Unfavourable Recovering Status. Chalk grassland is declining nationally. Open water supporting rare species can be subject to lack of appropriate management leading to eutrophication and a decline in species diversity.	High - nationally designated site	Neutral - the site is over 1km from the Project, and no adverse effects are predicted.	Neutral
Boxley Warren Local Nature Reserve (LNR)	The site is noted for its ancient woodland and internationally scarce yew woodland. The Warren supports a fascinating flora and fauna.	Regional	County given site designation	Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	Medium - locally designated site	Positive - habitat creation in areas immediately adjacent to the LNR would increase habitat extent and build resilience in the wider network of designated sites and habitats.	Moderate beneficial
Rede Common LNR	Site consists of grassland, scrub areas and woodland areas (the latter both mature woodland and developing woodland). The wildlife value lies in the mosaic of habitats and the semi-natural aspect of the site within the surrounding urban area.	Regional	County given site designation	Such sites can suffer from a lack of funding to facilitate appropriate management, potentially leading to a reduction in species diversity. However, their designation is key to recognising their value as important wildlife areas providing stepping stones between similar sites within a county, adding resilience	Medium - locally designated site	Minor negative - potential temporary impact on the sites as a result of increased nitrogen deposition which would not affect their integrity.	Slight adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
				to the wider biodiversity network.			
Claylane Wood ASNW	Area of ASNW	National	National given irreplaceable nature of ASNW habitat	Nationally ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	High - nationally important ancient woodland	Major negative - direct loss of 4.2ha (48%) of this ancient woodland site would result in a permanent adverse impact on the site's integrity. Ancient woodland compensatory planting to created new woodland habitat (approximately 43.4ha), and link retained woodland areas such as Claylane, Shorne, Brewers, Ashenbank and Jeskyns woods is proposed to offset this adverse effect. National Highways is proposing to provide replacement land for the open space comprised at this site. The replacement land will be of a comarable or better quality and be no less advantageous to the public (see Appendix D of the Planning Statement (Application Document 7.2)), but an adverse assessment is reported in this context because it considers the impact on the existing ecological designation only.	Very large adverse
Low Street Pit Local Wildlife Site (LWS)	Local wildlife site underlain by gravels supporting Thames Terrace Grassland, significant numbers of Essex Red Data List (ERDL) vascular plants and a diverse invertebrate fauna including the national BAP species hornet robberfly Asilus crabroniformis.	Regional	County given site designation	The extent of scrub cover at this site is increasing, reducing the area of acid grassland present and potentially leading to a reduction in species diversity within the site.	Medium - locally designated site	Major negative - total loss of the 3.5ha LWS as a result of the construction of the Project. Compensation proposed in the form of 63ha of new habitat creation and soil salvage from a small (1.2ha) plot of acid grassland.	Moderate adverse
Blackshot Nature Area LWS	Local wildlife site designated for rough grassland supporting an important invertebrate population and nesting habitat for ground nesting birds such as skylark Alauda arvensis.	Regional	County given site designation	Species rich grasslands are decreasing, unmanaged grassland is likely to be increasing. Nationally deciduous woodland is declining	Medium - locally designated site	Major negative - loss of 12.3ha (68%) of the habitats present resulting in a permanent effect on the site's integrity. 40ha of grassland and open mosaic habitat creation proposed to compensate for this loss. National Highways is proposing to provide replacement land for the open space comprised at this site. The replacement land will be	Moderate adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
						of a comarable or better quality and be no less advantageous to the public (see Appendix D of the Planning Statement (Application Document 7.2)), but an adverse assessment is reported in this context because it considers the impact on the existing ecological designation only.	
Rainbow Shaw LWS (and undesignated ASNW)	Local wildlife site for a small ancient woodland fragment.	National given presence of ASNW.	National given irreplaceable nature of ASNW habitat	Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	High - nationally important ancient woodland	Major negative - direct loss of 1.2ha (58%) of the LWS and undesignated ASNW. A 2ha area of compensatory planting would be created immediately adjacentto the retained woodland.	Very large adverse
South of the River Thames within the North Downs and North Kent Plains NCA, and north of the River Thames within the Greater Thames Estuary and Northern Thames Basin NCAs. Various ancient woodland sites.	South of the river: 19 ancient woodland sites. North of the river: 3 ancient woodland sites.	National	National given irreplaceable nature of ASNW habitat	Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	High - nationally important ancient woodland	Major negative - habitat degradation as a result of increased nitrogen deposition potentially permanently affecting the integrity of the ASNW sites. Habitat creation at nitrogen deposition compensation sites, creating new widlife-rich habitat which strengthens network of designated sites and habitats, proposed to fully offset project-wide significant adverse effects from nitrogen deposition.	Very large adverse
South of the River Thames within the North Downs and North Kent Plains NCA, and north of the River Thames within the Greater Thames Estuary and Northern Thames Basin NCAs. Various ancient woodland sites.	South of the river: 20 ancient woodland sites. North of the river:12 ancient woodland sites.	National	National given irreplaceable nature of ASNW habitat	Nationally, ancient woodland is being lost or degraded due to habitat loss and environmental factors such as climate change and imported tree pathogens. Ancient woodland is an irreplaceable habitat.	High - nationally important ancient woodland	Minor negative - potential temporary impact on the sites as a result of increased nitrogen deposition which would not affect their integrity	Slight adverse
South of the River Thames within the North Downs NCA. Six non-statutory designated sites.	Bridge Woods, Burham LWS. Blue Bell Hill Banks and Verges LWS. Court Wood LWS. Cuxton Pit No.3, Strood LWS. St Michael and All Angels Church LWS. Kits Coty LWS	Regional	County given site designation	In general non-statutory designated sites can suffer from a lack of funding to facilitate appropriate management, potentially leading to a reduction in species diversity. However, their designation is key to recognising their value as	Medium - locally designated site	Major negative - Bridge Woods, Burham LWS - habitat degradation as a result of increased nitrogen deposition potentially permanently affecting the integrity of the site. Minor negative - five other sites- potential temporary impact on the sites as a result of increased	Slight to Moderate adverse

Step 2		Step 3				Step 4	Step 5
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				important wildlife areas providing stepping stones between similar sites within a county, adding resilience to the wider biodiversity network.		nitrogen deposition which would not affect their integrity.	
North of the River Thames within the Greater Thames Estuary and Northern Thames Basin NCAs. Various non-statutory designated sites including Local Wildlife Sites and Sites of Interest for Nature Conservation Interest.	Barber's Wood and Lane LWS. Broom Hill SINC. Buckingham Hill SINC. Codham Hall Wood LWS. Codham Hall Wood West SINC. Curtis Plantation SINC. Folkes Lane Woodland SINC. Foxburrow Wood, Upminster SINC. Franks Wood & Cranham Brickfields SINC. Hillview SINC. Hobbs Hole Wood LWS. Linford Pit LWS. Low Well Wood, South Ockendon LWS. Lytag Brownfield LWS. Mucking Heath LWS. North Ockendon Pit SINC. Ockendon Railsides SINC. Puddledock Angling Centre SINC. Strawberry Farm Wood SINC. Thames Chase Forest Centre SINC. Tilbury Centre LWS. Tilbury Marshes LWS. Upminster Lodge Farm Horse Field SINC.	Regional	County given site designation	In general non-statutory designated sites can suffer from a lack of funding to facilitate appropriate management, potentially leading to a reduction in species diversity. However, their designation is key to recognising their value as important wildlife areas providing stepping stones between similar sites within a county, adding resilience to the wider biodiversity network.	Medium - locally designated site	Minor negative to intermidiate negative - sites affected by direct habitat loss and/or degradation in quality as a result of increased nitrogen deposition potentially permanently affecting the integrity of the site. National Highways is proposing to provide replacement land for the open space comprised at Folkes Lane Woodland SINC, Thames Chase Forest Centre SINC and Tilbury Marshes LWS. The replacement land will be of a comarable or better quality and be no less advantageous to the public (see Appendix D of the Planning Statement (Application Document 7.2)), but an adverse assessment is reported in this context because it considers the impact on the existing ecological designation only.	Slight to Moderate adverse
Ancient and veteran trees: present within the Northern Thames Basin National Character Area (NCA), the Greater Thames Estuary NCA and as this transitions into the North Kent Plain NCA.	No ancient trees affected by the Project. South of the river: three veteran trees are lost and 21 affected by increased nitrogen deposition. North of the river: three veteran trees are lost and one affected by increased nitrogen deposition.	National	National given irreplaceable nature of the resource	As with ancient woodland, ancient and veteran trees are a declining and irreplaceable resource affected by loss and woodland and developmental pressures.	High - nationally important ancient resource	Minor negative - a permanent loss of veteran trees would occur but the overall integrity of the veteran tree resource within the wider landscape would remain.	Slight to Moderate adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
Semi-natural broadleaved woodland: Habitat of Principal Importance (HOPI), priority habitat within the Kent Biodiversity Action Plan (BAP), present within the Northern Thames Basin National Character Area (NCA), the Greater Thames Estuary NCA and as this transitions into the North Kent Plain NCA.	South of the river: large areas of this habitat were identified, the majority in the vicinity of the A2. Approximately 7.7ha of this habitat would be lost as a result of the Project. North of the river: widespread across the study site with over 50 separate areas identified. Approximately 8.8ha of this habitat would be lost as a result of the Project.	Regional	County given level of conservation value and its distribution and abundance within study area. Both Northern Thames Basin and North Kent Plain NCA include strategic objectives to increase the extent of broadleaved woodland cover.	Nationally lowland mixed deciduous woodland is declining due to clearance, over-grazing, and replanting with non-native species.	Medium - habitat of principal importance for nature conservation. BAP habitat	Minor negative - the loss of this habitat would be permanent but would not impact the overall integrity of this habitat resource within the wider environment. Woodland habitat creation would, once established, result in a net increase of 95.9ha south of the river Thames, and 100.2ha north of the river Thames, and would forge strong links between retained habitats as corridors for wildlife to move and forage within.	Slight adverse
Acid grassland: HOPI, recorded north of the River Thames in the Northern Thames Basin NCA. Associated with Low Street Pit LWS (see above)	Unimproved acid grassland (approximately 0.5ha total) was identified within Low Street Pit LWS.	Regional	County given level of conservation value and its distribution and abundance within study area	General decline in areas of acid grassland, partly through direct impacts such as afforestation and agricultural improvements / grazing management, but also through changes in air quality	Medium - habitat of principal importance for nature conservation	Minor negative - the loss of this habitat would be permanent but would not impact the overall integrity of the acid grassland resource within the wider environment. Habitat creation would, once established, result in a net increase of 4.5ha of acid grassland.	Slight adverse
Calcareous grassland: south of the River Thames within the Greater Thames Estuary NCA as it transitions into the North Kent Plain NCA. Priority habitat within the Kent BAP	South of the river, approximately 2.9ha of calcareous grassland would be lost as a result of the Project. None of this habitat was recorded within the study area north of the river.	Regional	County given level of conservation value and its distribution and abundance within study area	Significant national declines primarily due to changes in agricultural practice and development pressures. Loss of habitat has knock on effects for invertebrate, bird and floral diversity.	Medium - habitat of principal importance for nature conservation. BAP habitat	Minor negative - the loss of this habitat would be permanent but would not impact the overall integrity of the calcareous grassland resource within the wider environment. Habitat creation would, once established, result in a net increase of approximately 27.9ha of calcareous grassland.	Slight adverse
Neutral grassland: HOPI, priority habitat within the Kent BAP, present within the three NCA within which the Project is situated.	South of the river: widespread across the study site. Approximately 20ha of this habitat would be lost as a result of the Project. North of the river: multiple areas of neutral grassland was recorded across the study area, approximately 60.5ha of which would be lost as a result of the Project.	Regional	County given level of conservation value and its distribution and abundance within study area	Significant national declines primarily due to changes in agricultural practice and development pressures. Loss of habitat has knock on effects for invertebrate, bird and floral diversity.	Medium - habitat of principal importance for nature conservation. BAP habitat	Minor negative - the loss of this habitat would be permanent but would not impact the overall integrity of this habitat resource within the wider environment. Neutral grassland habitat creation would, once established, result in a net increase of 104ha south and 160.7ha north of the river Thames, and would forge strong links between retained habitats as corridors for wildlife to move and forage within.	Slight adverse
Swamp and marginal vegetation: HOPI, associated principally with the Greater Thames	South of the river: two small areas of swamp were identified, with a single area of marginal vegetation also	Regional	County given level of conservation value and its distribution and abundance within study	Swamp and wet grassland areas have declines across the UK as areas have been drained for agricultural use.	Medium - habitat of principal importance for nature conservation	Minor negative - the loss of this habitat would be permanent but would not impact the overall integrity of this habitat resource	Slight adverse

Step 2		Step 3				Step 4	Step 5
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Estuary and Northern Thames Basin NCAs.	identified. A total of 0.3ha of this habitat was found within the study area and would be lost. North of the river: there were several small areas of swamp habitat present within the study area concentrated around East Tilbury and North Ockendon. One area of marginal vegetation was identified, a small reedbed to the west of North Ockendon. A total of 4ha of this habitat was found within the survey boundary, approximately 1.5ha of which would be lost.		area. Northern Thames Basin NCA includes a strategic objective to conserve riparian habitats of ecological value.	Pressures on these habitats continue.		within the wider environment. Marshy grassland habitat creation would, once established, result in a net increase of 8.4ha south and 35.1ha north of the river Thames.	
Standing water (ponds): HOPI, priority habitat within the Kent BAP, present within the three NCA within which the Project is situated.	South of the river: 21 ponds were identified within the study area, with 10 located within the Order Limits. North of the river: 57 ponds were identified within the study area, of which 24 were located within the Order Limits.	Regional	County given level of conservation value and its distribution and abundance within study area	It is currently considered that approximately half the farmland ponds within the UK have been lost in the last 50 years, with developmental pressure and agricultural intensification principal causes for this decline.	Medium - habitat of principal importance for nature conservation. BAP habitat	Minor negative - the loss of these ponds as a wildlife resource would be permanent but would not impact the overall integrity of this habitat resource within the wider environment. The Project would provide a minimum one for one replacement ratio for all ponds lost. Where ponds are recorded as supporting great crested newts, this ratio would be two new ponds for each lost.	Slight adverse
Running water: HOPI, present predominantly north of the River Thames within the Greater Thames Estuary and Northern Thames Basin NCAs.	Located across the study area north of the River Thames although high concentration around the northern portal. Approximately 2.9km of watercourse would be lost.	Regional	County given level of conservation value and its distribution and abundance within study area. North Kent Plain NCA includes a strategic objective to establish more resilient and coherent ecological networks, which such linear habitats contribute towards.	Rivers, streams and ditches have reduced in length and quality due to channelisation, culverting and pollution. Reductions in loss and improvements in water quality have stabilised this overall decline.	Medium - habitat of principal importance for nature conservation	Minor negative - the loss of running water habitat would be permanent but would not impact the overall integrity of the resource within the wider environment. Habitat reinstatement south of the river and a net increase of 0.8km of running water length north of the river Thames would, once established, provide habitats for wildlife to forage and move through.	Slight adverse
Hedgerows (native species): HOPI, priority habitat within the Kent BAP and Essex BAP, present within the three NCA within which the Project is situated.	South of the river: approximately 4.7km of hedgerows comprising native species were identified south of the river and would be lost as a result of the Project. North of the river:	Regional	County given level of conservation value and its distribution and abundance within study area. North Kent Plain NCA includes a strategic objective to	The extent of hedgerows decreased dramatically with changes in farming practice during the 20th century although that decline has been significantly reduced through the provision of	Medium - habitat of principal importance for nature conservation. BAP habitat	Minor negative - the loss of hedgerow habitat would be permanent but would not impact the overall integrity of this habitat resource within the wider environment. Species-rich hedgerow planting would, once	Slight adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
	approximately 38.2km of hedgerows comprising of native species were identified north of the river and would be lost.		establish more resilient and coherent ecological networks, which such linear habitats contribute towards.	regulations to protect the habitat.		established, result in a net increase of 7.0km south and 13.1km north of the river Thames and would forge strong links between retained habitats as corridors for wildlife to move and forage within.	
Open mosaic habitats: HOPI, priority habitat within the Kent BAP, predominantly associated within the Greater Thames Estuary NCA.	South of the river: approximately 4.4ha of open mosaic habitat would be lost as a result of the Project. North of the river: approximately 66.9ha of open mosaic habitat would be lost as a result of the Project.	Regional	County given level of conservation value and its distribution and abundance within study area. The Greater Thames Estuary NCA includes a strategic objective to maintain important habitats of this type.	Developmental pressures, particularly within the Greater Thames Estuary NCA, are seeing the loss of this dynamic habitat type.	High - habitat of principal importance for nature conservation.	Minor negative - the loss of open mosaic habitat would be permanent but would not impact the overall integrity of this habitat resource within the wider environment. New habitat creation would, once established, result in a net increase of 9.4ha south and 132.8ha north of the river Thames, which would help create stepping stones of habitat along the new A122 Lower Thames Crossing as well as linking existing pockets of similar habitats along the Thames Estuary.	Slight adverse
Lichen assemblage: principally within woodland habitats although some terricolous assemblages within Low Street Pit LWS and Mucking Heath LWS	South of the river: some notable lichen associated with the woodland habitats present, however these are common and widespread and not a qualifying feature on any site designations. North of the river: important lichen communities were located at Low Street Pit LWS, Mucking Heath LWS and within the Wilderness and the woodland to the south-west of junction 29 of the M25. The remaining assemblages were common and widespread.	Local	County given key species recorded within assemblages at specific locations within study area	Lichens are sensitive to air pollution, particularly sulphur dioxide, with species diversity and distribution reducing as levels increase. Terricolous species are sensitive to grazing pressures, with over-grazing leading to a reduction in species diversity. Similarly scrub encroachment and habitat succession reduces diversity.	Medium - key species of conservation value recorded	Minor negative - a permanent impact to areas supporting valuable lichen but the overall integrity of the resource within the wider landscape would remain. Timber supporting these lichen would be retained and relocated into adjacent woodland.	Slight adverse
Terrestrial invertebrates: key assemblages associated with open mosaic habitats and ASNW	South of the river: numerous habitats suitable for invertebrate assemblages were present, including both woodland and open successional habitats. One internationally designated site, seven nationally designated sites and ten local	Regional	Sites vary between county and national scale importance for invertebrate assemblages given the species assemblages recorded at each	Nationally there has been a significant loss in diversity and distribution of terrestrial invertebrates associated with the loss of habitat supporting them (see cells above). This trend is ongoing.	High - nationally important species assemblages recorded at a range of sites within study area	Intermediate negative - habitats supporting nationally important assemblages of terrestrial invertebrates would be lost. Although a larger area of new suitable habitat (principally open mosaic habitat) would be created, the time for this to establish into optimal condition is considered to	Large adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
	sites have terrestrial invertebrate qualifying features. North of the river: numerous habitats suitable for terrestrial invertebrates were identified, particularly the early successional habitats present immediately north of the River Thames. Five national and 28 locally designated sites included terrestrial invertebrates.					be a permanent impact on the receptor. However, in the long-term, this new habitat would provide additional resource and strong links between retained habitats within the wider landscape.	
Freshwater macroinvertebrates: Assemblages associated with ditch networks both north and south of the River Thames, although predominantly within the Greater Thames Estuary NCA	South of the river: high macrophyte diversity within the study area including several species of conservation importance. North of the river: the majority of the macrophyte interest was located in two areas: the watercourses adjacent to the River Thames and the Mardyke. These areas contained numerous notable invertebrate species.	Local	County given the species diversity and distribution within the study area	The loss and eutrophication of waterbodies, and water course pollution and loss have seen a reduction in the diversity and distribution of freshwater macroinvertebrates. The introduction of invasive non-native species add a significant threat as they outcompete native species.	Medium - key species of conservation value recorded	Minor negative - direct loss of watercourse supporting these species but these impacts would be temporary as watercourses would be reinstated and additional lengths created. Shading of retained watercourses would be permanent but would not affected the overall integrity of the resource.	Slight adverse
Freshwater macrophytes: assemblage associated predominantly with the ditch network south of the River Thames in the Greater Thames Estuary NCA	Typical assemblage of macrophyte species within the ditch network including one species of conservation interest.	Local	County given the species diversity and distribution within the study area	As with marcoinvertebrates, the loss and eutrophication of waterbodies, and water course pollution and loss have seen a reduction in the diversity and distribution of freshwater macrophytes. The introduction of invasive non-native species add a significant threat as they outcompete native species.	Medium - key species of conservation value recorded	Minor negative - direct loss of watercourse supporting these species but these impacts would be temporary as watercourses would be reinstated and additional lengths created.	Slight adverse
Fish: eel within with Mardyke ditch network north of the River Thames.	Fisheries data for the Mardyke returned eel presence, with presence presumed within ditches linked to the River Thames around the northern portal.	National	National given the level of protection assigned to eel	Listed as Critically Endangered on the IUCN Red List; on the OSPAR list of threatened and/or declining species and habitats.	High - presence of protected species within watercourses north of the River Thames. Species of principal importance for nature conservation.	Minor negative - no direct impact to this species is anticipated but there would be an impact on the network of watercourses they forage and move through as a result of habitat loss and fragmentation. These impacts would be temporary as watercourses would be reinstated and additional lengths are created.	Slight adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
Amphibians: principally associated within the standing water (ponds and ditches) network present across the Project	South of the river: four GCN metapopulations were identified; one small population, one medium and two large. Common frog, common toad, palmate newt and smooth newt were considered likely to be spread across the study area. The non-native marsh frog was identified in multiple locations. North of the river: 15 GCN metapopulations were identified - two small populations, 10 medium and three large. Common frog, common toad, palmate newt and smooth newt were considered likely to be spread across the study area. The non-native marsh frog was identified in multiple locations.	National	County given the range and size of metapopulations within the study area	Species common and fairly widespread within suitable habitats although loss of ponds / ditches, intensification of agriculture and developmental pressures still exist.	Medium - population and distribution within study area with limited potential for substitution. Species of principal importance for nature conservation.	Minor negative - habitat loss, fragmentation and degradation, as well as potential mortality could adversely impact amphibians, but with good practice mitigation, displacement through habitat manipulation and individual translocation, and habitat creation proposals, these impacts would be temporary and would not result in any conflict with the maintenance of the species at favourable conservation status.	Slight adverse
Reptiles: associated predominantly with areas of rough grassland, scrub and open mosaic habitat across the Project.	South of the river: three reptile species were identified within the study site: common lizard, slow worm and grass snake. These were found in areas of typical habitat for these species. North of the river: four reptile species were identified north of the river: common lizard, slow worm, grass snake and adder.	Regional	County given the numbers recorded, common species present, and distribution within the study area	Numbers and distribution declined during the 20th century as a result of habitat loss and fragmentation but decline now thought to have stabilised.	Medium - population and distribution within study area with limited potential for substitution. Species of principal importance for nature conservation.	Minor negative - habitat loss, fragmentation and degradation, as well as potential mortality could adversely impact amphibians, but with good practice mitigation, displacement through habitat manipulation and individual translocation, and habitat creation proposals, these impacts would be temporary. Once established, the creation of new areas of optimal foraging and refuge habitats would lead to positive benefits for this receptor.	Slight adverse
Ornithology: key area of interest within the designated sites of the Greater Thames Estuary NCA, although common species widespread across the Project	South of the river: the breeding and wintering bird assemblage was considered to be a typical assemblage for the habitats present. The South Thames and Estuary Ramsar and SPA contained a large number wetland bird species. In addition, a number of breeding Schedule 1 species were identified, including marsh harrier.	Regional	Regional based on the common species recorded and the diversity of habitats supporting these species in-land of the Greater Thames Estuary NCA. Around the designated sites within the Greater Thames Estuary, the assemblages grew in	The overall waterbird assemblage present within the Greater Thames NCA habitats appears stable although alerts have been triggered for four of the SPA species (see relevant cell above). Bird assemblages within the North Kent Plain and Northern Thames Valley NCAs have shown historic declines as the	Medium - population and distribution within study area with limited potential for substitution. Includes species of principal importance for nature conservation.	Minor negative - habitat loss, fragmentation and disturbance, as well as potential mortality could adversely impact the bird assemblages within the zone of influence of the Project. Good practice mitigation and proposals to create large areas of good quality foraging, breeding and refuge habitat would offset these temporary impacts and would maintain the integrity of the	Slight adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
	North of the river: The breeding bird assemblage of the old landfill site to the north of the River Thames was found to have a significant assemblage of red and amber listed bird species. The remaining habitats were found to have a typical breeding and wintering bird assemblage for the habitats present. The marshes around Tilbury Fort supported a significant wading bird roost. A number of breeding Schedule 1 species were identified, including multiple barn owl nests.		species diversity and bird number.	habitat diversity in these areas have decreased, principally the result of development pressures and intensification of agricultural practices.		resource. Proposals to provide alternative roost locations for barn owls over 1.5km from the new A122 Lower Thames Crossing would mitigate the risk of road mortality, which is a particular risk for this species.	
Bats: roosting within woodland as certain structures across the Project, utilising semi-natural habitats for foraging.	South of the river: three areas with moderate levels of bat foraging activity were identified, all within the woodland in the vicinity of the A2. The bat assemblage is described as typical of the habitats present. There were 11 bat roosts identified. Three of these roosts contained species that were BAP species for Kent. North of the river: Four key commuting routes were identified to the north of the River Thames. The assemblage is described as being typical of the habitats present. 15 roosts were identified, with all roosts found to contain common and widespread species.	National	County given the number of diversity of species present within the study area	Variable depending on species. Most bat species have declined significantly over recent decades. Some species such as common pipistrelle have shown signs of recovery over recent years. However several species such as brown long-eared bat and some Myotis species have continued to decline.	Medium - population and distribution within study area with limited potential for substitution. Species of principal importance for nature conservation.	Minor negative - habitat loss, fragmentation and disturbance, as well as potential mortality could adversely impact the bat resource, but with good practice mitigation, roost exclusion and removal, the provision of new roost structures and extensive habitat creation proposals, these impacts would be temporary and would not result in any conflict with the maintenance of the species at favourable conservation status.	Slight adverse
Dormouse: present within woodland and hedgerow habitats as the Greater Thames Estuary NCA transitions into the more wooded North Kent Plain NCA.	South of the river: 52 dormouse nests were found within the study area. All records were from the woodland in the vicinity of the A2. North of the river: no confirmed evidence of	National	County given the numbers recorded and the connectivity and quality of habitat supporting this species	The UK population has declined by a third since 2000 as a result of woodland loss and habitat fragmentation	Medium - population and distribution within study area with limited potential for substitution. Species of principal importance for nature conservation.	Minor negative - habitat loss, fragmentation and degradation, as well as potential mortality could adversely impact dormouse, but with good practice mitigation, displacement through habitat manipulation and individual translocation, and extensive habitat creation	Slight (habitat loss) Moderate beneficial (habitat creation and connection)

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
	dormouse was found north of the River Thames.					proposals, these impacts would be temporary and would not result in any conflict with the maintenance of the species at favourable conservation status. Potential major positive effects post landscape establishment would be achieved, providing a greater area of optimal habitats which link up existing woodland blocks and the wider dormouse population.	
Water vole: associated within the standing water (ditches) network present across the Project, predominantly within the Greater Thames Estuary NCA	South of the river: good populations of water vole were located within the watercourses adjacent to the River Thames. North of the river: water vole populations were concentrated in two areas: the watercourses adjacent to the River Thames and the Mardyke. The watercourses adjacent to the river Thames was found to have a good population, however the Mardyke was found to have a low population. In addition, a low population was found in a lake to the west of Linford.	Regional	Regional given the numbers recorded and the connectivity and quality of habitat supporting this species	The UK populations declined substantially during the 1990s, but more recent data suggest that the decline may have stabilised.	High - population density and distribution important regionally and with limited potential for substitution. Species of principal importance for nature conservation.	Minor negative - habitat loss and fragmentation would result in a permanent impact to this species, but proposals for species translocation, the control of predatory non-native species (mink) and new habitat creation, would maintain the species conservation status within this area.	Slight adverse
Otter: considered active within the standing water (ditches) network present across the Project	South of the river: a single potential otter spraint was the only record of otter within the study area. North of the river: otter signs were recorded in the vicinity of the M25 and Mardyke, with a potential sign found in a watercourse adjacent to the River Thames.	National	County given the evidence of presence and likelihood of activity within the wider catchment	The UK population saw dramatic declines during the 20th Century but persecution has significantly reduced and water quality has improved, seeing an increase in numbers and range of this species.	Medium - population and distribution within study area with limited potential for substitution. Species of principal importance for nature conservation.	Minor negative - no direct impact to this species is anticipated but there would be an impact on the network of watercourses they forage and move through as a result of habitat loss and fragmentation. These impacts would be temporary as watercourses would be reinstated and additional lengths are created.	Slight adverse
Badger: widespread across the Project	South of the river: badgers were widespread across the study area, with a total of nine main setts identified. North of the river: badger were widespread across the study area, with 19 main setts identified.	Local	Local given numbers and distribution of social groups within the study area.	Population stable within the UK	Lower - common and widespread species	Minor negative - two main setts and other lower status setts would be lost as a result of the Project. Main setts would be replaced with artificial setts to mitigate for the impact to the affected social group. Overall the loss of these setts would be	Slight adverse

Step 2		Step 3				Step 4	Step 5
Area	**Description of feature/ attribute**	**Scale (at which attribute matters)**	**Importance (of attribute)**	**Trend (in relation to target)**	**Biodiversity and earth heritage value**	**Magnitude of impact**	**Assessment Score**
						permanent but, through mitigation, the impact would not affect the integrity of the species in this area.	

Reference sources

Department for Environment, Food and Rural Affairs (Defra) Multi-Agency Geographic Information for the Countryside (MAGIC) website
Kent and Medway Biological Records Centre (KMBRC, 2022); The Essex Wildlife Trust Biological Records Centre (EWTBRC, 2022); and Essex Field Club (2022)
Local Biodiversity Action Plans (BAP) Essex Biodiversity Partnership (2011), Kent Biodiversity Partnership (2009) and Biodiversity Audits (e.g. The Thames Estuary Partnership Habitat Action Plan and Thurrock Council Biodiversity Audit).
Thames Terrace Invertebrates: A Masterplan for Landscape-scale Conservation in the Greater Thames Marshes. (Essex County Council, Buglife, University of East London and Natural England, 2013)
English Heritage (2014) Essex Grazing Marsh Project.
Natural England's ancient woodland inventory (via the MAGIC website) and the Woodland Trust's ancient tree hunt.
Natural England publications relating to the Thames Estuary and Marshes SPA, and the Thames Estuary and Marshes Ramsar site: including the SPA and SAC Natura 2000 forms, Ramsar site Data Sheet.
Natural England report 'What do we know about the birds and habitats of the North Kent Marshes' (Liley, 2011).
Map data from the RSPB.

*Summary **assessment acore***

A score of **Very large adverse** is predicted as significant residual adverse effects remain from the direct loss and deterioration of irreplaceable habitats and SSSI. Although they would not affect the assessment of residual impacts, mitigation and compensation measures are proposed in accordance with the NPSNN to offset these adverse effects including the creation of over 200ha of new woodland and grassland which would increase the overall area of these habitats and strengthen resilience across the wider network of designated sites and semi-natural habitat within the wider landscape.

Qualitative comments

This appraisal presents a summary of the final assessment of the Project's potential effects on terrestrial biodiversity. This has been informed by the available historic information and data collected during comprehensive field surveys undertaken over a number of years. As with many nationally significant infrastructure projects, the main impacts on the ecology within the Project's zone of influence occur during the construction phase as habitats are lost and fragmented, and the risks of species mortality are at their highest. Operational effects are also considered, notably those result in changes from increased nitrogen deposition on designated sites along the proposed A122 and the Affected Road Network. Where adverse effects are predicted, these are included within the worksheet above. Where negligible or no effects are predicted, these sites are omitted from the worksheet, although findings from SSSIs and Euorpean sites are included for reference. All appropriate measures to mitigate adverse impacts have been included as part of the Project, through its design, the implementation of good practice construction methods, and the provision of essential measures to lessen adverse effects, such as species translocation and the provision of suitable habitat creation to link designated sites, areas of semi-natural habitat, and to support species in the long-term. Where there is a time lag between an impact occurring and mitigation being in place, for example habitat clearance and landscape establishment, this has been taken into account as part of the assessment approach.

The Project has been designed to avoid impacts on European sites, and minimise landtake within statutory designated sites and areas of irreplaceable habitat. Key residual significant effects relate to the loss of ancient woodland habitat, an irreplaceable resource the loss of which cannot be mitigated. The approach to offsetting this impact is to create new areas of woodland planting which join up existing, retained woodland blocks and provide significantly more woodland area than that being lost. However, the significance of the habitat loss is still assessed as being very large adverse. The Project also has significant effects on non-designated wildlife sites; Low Street Pit being lost as a result of the Project. Compensation is proposed to replace the areas affected and recreate the habitats lost, but the overall loss and time lag between the impact and mitigation establishment means the significance of effect is still moderate adverse. Similarly, impacts to certain areas containing nationally significant assemblages of terrestrial invertebrates would also occur. Mitigation in the form of habitat creation at specific sites along the Project route would offset habitat loss, secure the ongoing appropriate management of these areas and help join up existing, retained habitats. In the long-term there is potential for this work to have a positive effect on the terrestrial invertebrate assemblages, but during the construction phase of the Project the effect would still be moderately adverse. However, the Project's landscape design would strengthen links between retained habitat and create more and better quality habitat which would be secured and managed appropriately in the long-term. This would strengthen the resilience of the network of designated sites, including SSSIs and ancient woodland, and have positive benefits on a range of species and groups including reptiles, amphibians, invertebrates and dormice.

4.3 Historic environment

4.3.1 The impacts of the Project on the historic environment to the south and north of the River Thames are appraised in terms of the features of the environment, which comprise:

a. Form

b. Survival

c. Condition

d. Complexity

e. Context

f. Period

4.3.2 Plate 4.3 and Plate 4.4 respectively shows the historic environment areas to the south and north of the river.

4.3.3 For each side of the river and each feature, the historic environment is described in respect of its:

a. Scale

b. Significance

c. Rarity

d. The impact of the Project and given an assessment score taking account of all committed mitigation

4.3.4 An overall Summary Assessment Score and qualitative comments are also provided. These form the basis of the historic environment information included in the AST.

Plate 4.3 Historic environment areas to the south of the River Thames

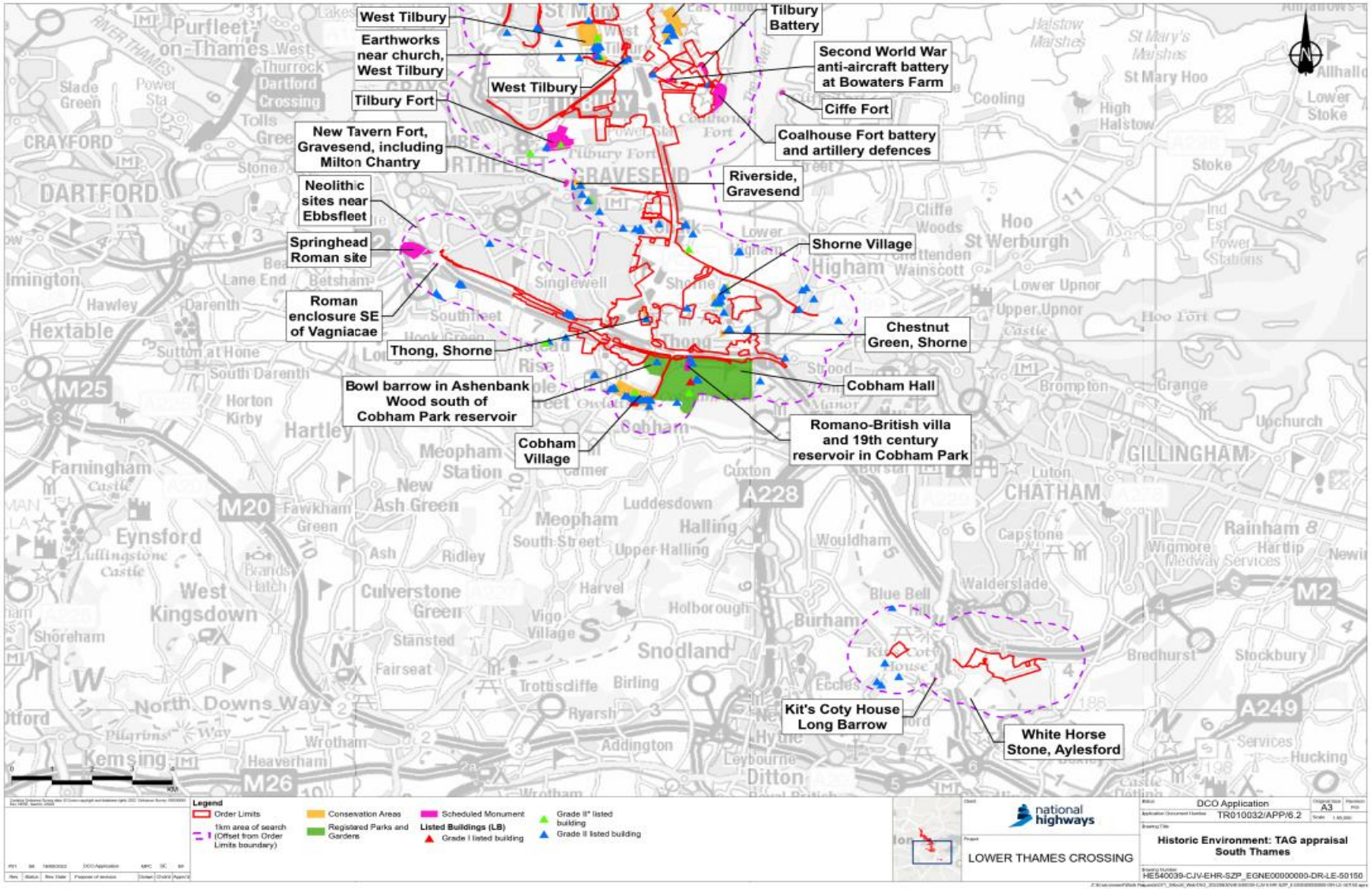

Plate 4.4 Historic environment areas to the north of the River Thames

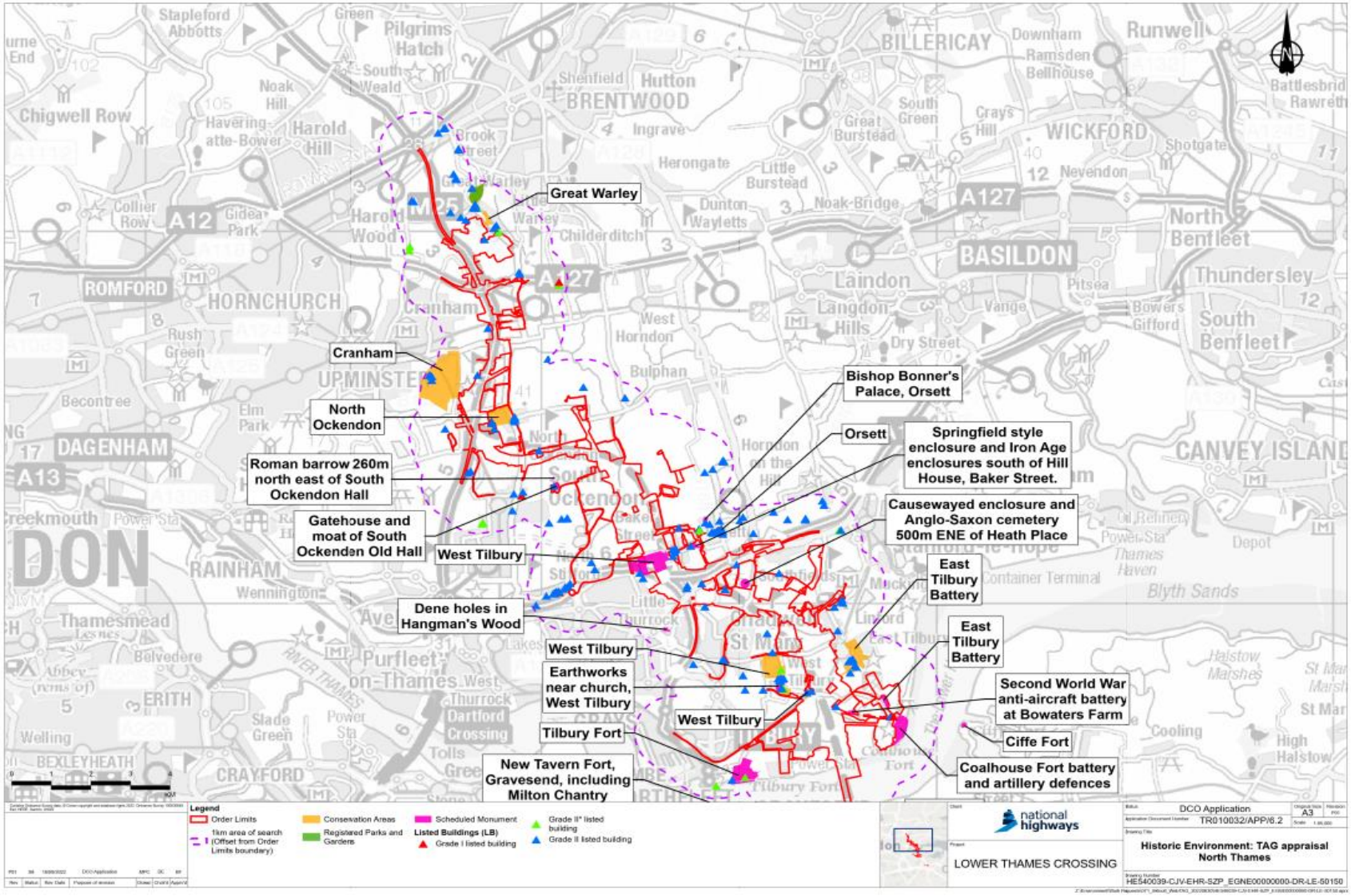

Table 4.2 Historic Environment Impacts Worksheet – south of the River Thames

Feature	Step 2	Step 3			Step 4
	Description	**Scale it matters**	**Significance**	**Rarity**	**Impact**
Form	The historic landscape within the study area is predominantly rural in character and mostly the result of Post-Medieval farming activity and reclamation of marshland. The Grade II* designed landscape of Cobham Hall registered park and garden lies within the Order Limits at the southern edge of the Project. The Order Limits south of the Thames contain two conservation areas (Cobham Village and Thong) with four in the wider study area. There is one listed building located within the Order Limits south of the Thames, Grade II, located within Cobham, Gravesham. A further 105 listed buildings of either Grade I, Grade II* or Grade II are located within the 1km study area and landscape study area. South of the river Thames, Prehistoric activity, evidenced by Neolithic funerary remains, Bronze Age settlement and funerary remains and Iron Age settlement provides evidence of early human activity. In particular, trial trenching has illustrated horizons of likely Mesolithic to Neolithic activity of high value, along peaks of the dry valley south of the A226 Gravesend Road. There is extensive Roman period activity, associated with Watling Street which followed the approximate route of the A2. These include a villa, settlement (Springhead/Vagniacis) and temple, which are scheduled monuments and non-designated settlement, agricultural and funerary remains. Trial trenching has illustrated a wider landscape of Iron Age to Roman activity, particularly south of the A226 which may hold functional relationships with the known activity around the A2. The Medieval and Post-Medieval periods are characterised by developments in the agricultural management of the landscape.	The listed buildings and conservation areas are designated heritage assets and are afforded statutory protection at a national level under the Planning (Listed Buildings and Conservation Areas) Act 1990. The designated heritage assets are a material consideration at national level in the Networks National Policy Statement (NPSNN) and the National Planning Policy Framework (NPPF). While registered parks and gardens do not have statutory protection, they are a material consideration in the planning process and are considered at a national level in the NPSNN and NPPF. The treatment of non-designated archaeological remains within the planning process is also considered at a national level in the NPPF and NPSNN even though they may be of lesser value than designated heritage assets.	Scheduled monuments, listed buildings, registered parks and gardens are typically high value assets including nationally important non-designated heritage assets. In some cases Scheduled monuments can be of very high value. Conservation areas are typically medium value, although where architectural value is illustrated, these are of high value. The non-designated archaeological remains range in value from negligible to high including a large number of medium value archaeological sites.	Grade I and Grade II* listed buildings are relatively well represented types on a national and regional level and are of moderate rarity. The two conservation areas within the Order Limits south of the Thames (historic village cores) are relatively well represented regionally and nationally. Cobham Hall registered park and garden contains considerable time depth and incorporates or is associated with a number of other high value assets and is rare on a national level.	The Project will not physically impact any listed buildings south of the Thames. The Project may impact on the settings of listed buildings within the visual envelope around the Project. The Project may also impact on the settings of Thong conservation area and Cobham Hall registered park and garden. The impacts may arise as a result of the introduction of visual severance caused by the road in what is a currently open rural landscape. The Project may also impact on the settings of the scheduled monuments in the wider study area, from the same visual impact.

Feature	Step 2	Step 3			Step 4
	Description	Scale it matters	Significance	Rarity	Impact
Form (cont'd)	There are no statutory designated scheduled monuments within the Order Limits south of the River Thames. There are 11 scheduled monuments (designated heritage assets) within the wider 1km study area (including landscape study area and professional judgement): Cliffe Fort; a Romano-British villa and 19th century reservoir; Springhead Roman site (Vagniacis); a Roman enclosure; Neolithic sites near Ebbsfleet; a WWII bombing decoy and a heavy anti-aircraft gunsite; a deserted Medieval manorial settlement; New Tavern Fort including Milton Chantry, Gravesend; and a Tudor blockhouse at Gravesend. Palaeolithic archaeological remains could be buried at depth within river terrace gravels. Paleoenvironmental remains within paleochannels (buried relict watercourses) are also potentially significant.	The scheduled monuments are also designated heritage assets and are afforded statutory protection at a national level under the Ancient Monuments and Archaeological Areas Act 1979. They are also a material consideration at national level in the NPPF and NPSNN.		The non-designated archaeological remains are of types that are well represented on a regional level and are of low rarity. Mesolithic sites and Palaeolithic remains are rare both nationally and internationally and are therefore of very high rarity. Palaeoenvironmental remains are common features in river valleys and coastal environments.	Setting impacts do not affect form, therefore there will be no change to these assets and there would be a Neutral effect. In addition, construction excavations associated with the proposed road and tunnel would impact on non-designated archaeological remains within the Project footprint through their complete or partial removal. Some of these assets are of high value,. Tunnel portal excavation may remove or truncate Palaeolithic remains. These low value deposits would undergo a less than significant impact given the scale of the deposits versus the impact of the tunnel. Palaeoenvironmental remains could be affected by removal or compression.
Survival	Within the Order Limits south of the River Thames: the survival of the listed building and the conservation areas is comparable with others in the region and is generally good. The survival of Cobham Hall registered park and garden is good. The survival of non-designated archaeological remains in the dry valleys shows good preservation of deep deposits, good preservation on the chalk plateau of near surface sites. The survival of Palaeolithic and palaeoenvironmental remains has not yet been fully determined.	The NPPF takes the survival of heritage assets into account at national level, while the NPSNN accounts for them at national and international levels.	Survival of the designated built heritage assets is of high significance as they contribute to the historic character of their localities. Survival of the non-designated archaeological remains is of high significance as surviving remains of these types are important in terms of our understanding of the human past. Survival of Mesolithic sites and Palaeolithic remains is of high significance. Palaeoenvironmental remains survival are of low significance.	Surviving Grade II listed buildings are not rare regionally or nationally, although surviving Grade I and Grade II* listed buildings are quite rare on both scales. The survival of scheduled monuments has a moderate level of rarity. Surviving non-designated archaeological remains are not rare regionally. Mesolithic sites and Palaeolithic remains are rare nationally and internationally. The survival of Palaeoenvironmental remains are common	The scheduled monuments in the 1km study area and landscape study area would not have their survival compromised (Neutral effect). The Project would affect the survival of non-designated assets within the Order Limits, as it would to Palaeolithic and palaeoenvironmental archaeology. Non-designated archaeology outside the Order Limits would be unaffected (Neutral effect).
Condition	The historic landscape is constantly evolving. At present, the condition of landscape features e.g. hedgerows, ditched boundaries, is considered to be good. Based on surveys the condition of the listed buildings and conservation areas is good; although two listed buildings in the 1km study	The NPPF takes the condition of heritage assets into account at a national level. The NPSNN takes into account asset condition at both national and international levels.	The condition of the listed buildings and conservation areas is of moderate significance as they have a beneficial effect on the character and historic environment of the study areas. The condition of	Listed buildings and conservation areas in good condition are relatively common in this region and have low rarity value. Scheduled monuments of the nature and condition of those within the study areas have a high rarity value. Non-designated archaeological remains in good	The Project would not impact on the condition of designated assets within the Order Limits south of the Thames. The Project would have no impact on the condition of designated or non-designated assets within the wider study area. Non-designated archaeology within the Order Limits would be either erased or damaged. Deeply buried Palaeolithic archaeology would be affected by the

Feature	Step 2	Step 3			Step 4
	Description	**Scale it matters**	**Significance**	**Rarity**	**Impact**
	area have been shown to either be in a poor condition or no longer extant but remain on the national heritage list. The condition of Cobham Hall registered park and garden appears to be good. The condition of the scheduled monuments south of the Thames is generally considered good. The condition of non-designated archaeological remains are considered comparitive to the general archaeological record of the region. The condition of the Palaeoenvironmental and Palaeolithic buried remains, based on current surveys is also considered good.		scheduled monuments, non-designated archaeological (inc Palaeolithic) and palaeoenvironmental remains can be of high significance. Good condition informs our understanding of past human activity.	condition are rare nationally. Palaeolithic remains are rare on an international level, given the limited work done in excavating them. Palaeoenvironmental remains in good condition are also rare on a national scale.	Project within the portal areas and elsewhere, as would palaeoenvironmental remains with negative impacts resulting in a Moderate Adverse effect.
Complexity	The listed buildings represent a mix of agricultural, residential, ecclesiastical and commercial buildings and on an individual basis their complexity is varied. Cobham Hall registered park and garden is relatively complex as it represents several phases of development. The Conservation Areas are medium complexity. Archaeological remains, both scheduled monuments and non-designated, represent activity from a number of periods and in relation to a number of industrial, settlement, funerary and agricultural processes. The level of complexity, within discrete areas, is high.	The NPPF and NPSNN takes the complexity of heritage assets into account at national and international levels.	The complexity of the historic environment resource has high significance as it represents both time-depth and can be highly informative of past human activity in a region of the UK.	The level of complexity within the historic environment resource is common in the areas covered by the Project, given the known archaeological remains. On a regional level it is perhaps of low rarity. The Mesolithic activity has the potential to be rare. Palaeoenvironmental remains are potentially complex, given locations within depositional sequences and their nature, but this is not a rare status.	The Project would not affect the complexity of designated assets within the Order Limits south of the Thames. The Project would negatively affect the complexity of non-designated assets within the Order Limits which would be erased. The impacts of this can be estimated as major negative, the same is true for palaeoenvironmental remains.
Context	The Project and study areas lies within the Greater London/Lower Thames Estuary areas and the historic environment resource within the study areas reflects this wider context. In listed building terms, the context is generally within historic village cores of local settlements, or more isolated locations in open countryside. In terms of Palaeolithic archaeology, this region is particularly significant owing to its position relative to the Pleistocene ice sheets. The changing position of the River Thames in the Pleistocene and Holocene in north Kent and its buried remains are potentially very significant in paleoenvironmental terms. The River	The NPPF and NPSNN takes the context of heritage assets into account at national and international levels.	The context of the historic environment resource is unique to the locality and its record of human activity from the Palaeolithic period onwards. It is highly significant.	The context of the historic environment resource within the Order Limits and study areas is unique.	The Project will change the context of the historic environment resource within the study areas and wider counties of Essex and Kent. The listed buildings and conservation area adjacent to the Project will be altered to differing degrees. In the case of those within the visual envelope of the Project, a moderate negative impact would result in a Moderate Adverse effect. All the non-designated archaeology and palaeoenvironmental remains within the Order Limits lie within a context of other such remains and their removal/ damage would change the context of the surviving remains outside the Project. This moderate negative impact would result in a Moderate Adverse effect.

Feature	Step 2	Step 3			Step 4
	Description	**Scale it matters**	**Significance**	**Rarity**	**Impact**
	Thames is also a historic maritime and military gateway to England.				
Period	The listed buildings and conservation areas date from the Medieval, Post-Medieval and Modern periods. The scheduled monuments within the Order Limits are of prehistoric, Romano-British, early Medieval, Medieval, Post-Medieval and Modern periods. The remaining scheduled sites date from the Neolithic to the modern period, while the non-designated archaeological remains, including Paleolithic and palaeoenvironmental, date from the early prehistoric period onwards.	The NPPF and NPSNN takes the period of heritage assets into account at national and international levels.	The wide range of periods represented within the historic environment resource is of high significance due to the potential to aid understanding the development of the region.	The range of periods represented by the historic environment resource within the study areas is common to the region and as such is of low rarity, but nevertheless rare on a national scale.	The Project would not impact on the periods represented by the listed buildings within the study area resulting in a Neutral effect. The range of periods represented by the archaeological remains is significant and the removal of part of this resource would have a minor impact on a regional level and Slight Adverse effect.

Reference Sources

DMRB LA 104, LA 106, (2020); TAG Unit A3 (May 2022); National Heritage List for England; Kent Historic Environment Record; Greater Thames Estuary Historic Environment Research Framework (2010); South East Research Framework (2019); Environmental Statement Chapter 6: Cultural Heritage (Application Document 6.1).

Step 5 Summary assessment score

Moderate adverse

Qualitative comments

The Project covers an area that is largely open and rural in character but containing urban areas that expanded during the 19th and 20th centuries. Potential impacts to the setting of the following designated heritage assets have been identified as a result of the Project: Grade II* Church of St Mary and Thong conservation area. These effects are predicted to be Slight Adverse with regard to the setting of listed building and Moderate Adverse with regard to the conservation area.

Potential deeply-buried Palaeolithic remains may exist within the river gravels and could be adversely affected by the portal excavations and tunnelling. The existence of such remains are presently unknown. Any removal of remains from enabling works activity would constitute a potential Moderate Adverse effect. Construction excavations associated with the proposed road and tunnel will have a physical impact on other non-designated archaeological remains within the Project footprint. Palaeoenvironmental remains will also be affected by enabling works and construction. Likely effects are potentially Moderate in degree.

The Project would have a Moderate Adverse effect on the cultural heritage resource within the Order Limits south of the Thames and located within the surrounding areas experiencing an impact through change to setting.

Table 4.3 Historic Environment Impacts Worksheet - north of the River Thames

Feature	Step 2	Step 3			Step 4
	Description	Scale it matters	Significance	Rarity	Impact
Form	The historic landscape within the study area is predominantly rural in character and mostly the result of Post-Medieval farming activity and reclamation of marshland. The Order Limits contain three conservation areas (West Tilbury, North Ockendon and Great Warley) with five in the wider study area. There are four listed buildings located within the Order Limits north of the Thames, all Grade II, and located within Thurrock. A further 184 listed buildings of either Grade I, Grade II* or Grade II are located within the 1km study area and landscape study area. North of the Thames there is evidence of a multi-period landscape including Neolithic ritual and funerary remains, Bronze Age settlement and funerary activity and more extensive Iron Age and Roman settlement, agricultural and funerary remains. There is also unusually extensive evidence for Early Medieval settlement and funerary activity overlying the earlier prehistoric and Roman sites. The Medieval and Post-Medieval periods are characterised by developments in the agricultural management of the landscape.	The listed buildings and conservation areas are designated heritage assets and are afforded statutory protection at a national level under the Planning (Listed Buildings and Conservation Areas) Act 1990. The designated heritage assets are a material consideration at national level in the National Networks National Policy Statement (NPSNN) and the National Planning Policy Framework (NPPF). While registered parks and gardens do not have statutory protection, they are a material consideration in the planning process and are considered at a national level in the NPSNN and NPPF. The treatment of non-designated archaeological remains within the planning process is also considered at a national level in the NPPF and NPSNN even though they may be of lesser value than designated heritage assets.	Scheduled monuments, listed buildings, registered parks and gardens are typically high value assets including nationally important non-designated heritage assets. In some cases Scheduled monuments can be of very high value. Conservation areas are typically medium value, although where architectural value is illustrated, these are of high value. The non-designated archaeological remains range in value from negligible to high including a large number of medium value archaeological sites.	Grade I and Grade II* listed buildings are relatively well represented types on a national and regional level and are of moderate rarity. East Tilbury conservation area is a rare example of a planned modernist factory town. The 3 conservation areas within the Order Limits north of the Thames (historic village cores) are relatively well represented regionally and nationally. The scheduled monuments at South Ockenden Old Hall, South Ockendon Hall, Orsett, West Tilbury and Bowaters Farm are relatively well represented type of monument and are of moderate rarity. The Scheduled Thames Forts of Tilbury Fort and Coalhouse Fort are of high rarity.	The Project will remove three Grade II listed buildings: 1 and 2 Gray's Corner Cottages, Thatched Cottage and Murrells Cottages. The Project may impact on the settings of listed buildings within the visual envelope around the Project. These high value assets would undergo a major impact, resulting in a Large Adverse effect. The Project may also impact on the settings of the North Ockendon, West Tilbury and East Tilbury conservation areas. The impacts may arise as a result of the introduction of visual severance caused by the road in what is a currently open rural landscape. The Project may also impact on the settings of the scheduled monuments in the wider study area, from the same visual impact.
Form (cont'd)	There are three statutory designated scheduled monuments within the order limits including a Second World War anti-aircraft battery at Bowaters Farm, near East Tilbury; a cropmark complex at the A13 in Orsett; and a Medieval moated site at South Ockenden Old Hall. There are 11 scheduled monuments (designated heritage assets) within the wider 1km study area (including landscape study area and professional judgement): a barrow at South Ockendon Hall; the site of a bishop's palace; a causewayed enclosure and Anglo-Saxon cemetery near Orsett Heath; Dene Holes in Hangmans Wood; Coalhouse Fort, East Tilbury Battery;	The scheduled monuments are also designated heritage assets and are afforded statutory protection at a national level under the Ancient Monuments and Archaeological Areas Act 1979. They are also a material consideration at national level in the NPPF and NPSNN.		The causewayed enclosure south of Orsett is less well represented and is of high rarity. The non-designated archaeological remains are of types that are well represented on a regional level and are of low rarity. Mesolithic sites and Palaeolithic remains are rare both nationally and internationally and are therefore of very high rarity. Palaeoenvironmental remains are common features in river valleys and coastal environments.	Setting impacts do not affect form, therefore there will be no change to these assets and there is a Neutral effect. In addition, most of the Orsett cropmark complex scheduled monument would be erased by the road. This would amount to a major impact on an asset of high value, resulting in a Large Adverse effect. Construction excavations associated with the proposed road and tunnel would impact on non-designated archaeological remains within the Project footprint through their complete or partial removal. Some of these assets are of high value, which would result in Large Adverse effect. Tunnel portal excavation may remove or truncate Palaeolithic remains. These low value deposits would undergo a less than significant impact given the scale of the deposits versus the impact of the tunnel. Palaeoenvironmental remains could be affected by removal or compression.

Feature	Step 2	Step 3			Step 4
	Description	Scale it matters	Significance	Rarity	Impact
	earthworks at West Tilbury; a Bronze Age barrow; Tilbury Fort. Palaeolithic archaeological remains could be buried at depth within river terrace gravels and the Ockendon Channel. Paleoenvironmental remains within paleochannels (buried relict watercourses) are also potentially significant.				
Survival	Within the Order Limits: the survival of the listed buildings and the conservation areas is comparable with others in the region and is generally good. The survival of the Orsett crop mark scheduled monument is poor. This designation is on Historic England's 'Heritage at Risk' Register. The survival of non-designated archaeological remains in the dry valleys shows good preservation of deep deposits and some sites truncated in Essex due to agricultural activities. There is good survival survival of palaeoenvironmental evidence, including within those deposits of Palaeolithic date.	The NPPF takes the survival of heritage assets into account at national level, while the NPSNN accounts for them at national and international levels.	Survival of the designated built heritage assets is of high significance as they contribute to the historic character of their localities. Survival of the non-designated archaeological remains is of high significance as surviving remains of these types are important in terms of our understanding of the human past. Survival of Mesolithic sites and Palaeolithic remains is of high significance. Palaeoenvironmental remains survival are of low significance.	Surviving Grade II listed buildings are not rare regionally or nationally, although surviving Grade I and Grade II* listed buildings are quite rare on both scales. The survival of scheduled monuments has a moderate level of rarity. Surviving non-designated archaeological remains are not rare regionally. Mesolithic sites and Palaeolithic remains are rare nationally and internationally. The survival of Palaeoenvironmental remains are common	The Project would seriously compromise the survival (and legibility) of the Orsett cropmark complex through the near total loss of the monument. The magnitude of impact would be major negative, resulting in a Large Adverse effect. The scheduled monuments in the wider study area would not have their survival compromised (Neutral effect). The Project would remove the three listed buildings near the A13. The Project would affect the survival of non-designated assets within the Order Limits, as it would to Palaeolithic and palaeoenvironmental archaeology. Non-designated archaeology outside the Order Limits would be unaffected (Neutral effect).
Condition	The historic landscape is constantly evolving. At present, the condition of landscape features e.g. hedgerows, ditched boundaries, is considered to be good. Based on surveys the condition of the listed buildings and conservation areas is good; although two listed buildings in the 1km study area have been shown to either be in a poor condition or no longer extant but remain on the national heritage list and East Tilbury conservation area which is on Historic England's 'Heritage at Risk' Register. The condition of the scheduled monuments is generally good, with the exception of the Orsett cropmark complex and Bowaters Farm anti-aircraft battery, the condition of which are poor. The condition of non-designated archaeological remains are considered comparitive to the general archaeological record of the	The NPPF takes the condition of heritage assets into account at a national level. The NPSNN takes into account asset condition at both national and international levels.	The condition of the listed buildings and conservation areas is of moderate significance as they have a beneficial effect on the character and historic environment of the study area. The condition of scheduled monuments, non-designated archaeological (inc Palaeolithic) and palaeoenvironmental remains can be of high significance. Good condition informs our understanding of past human activity.	Listed buildings and conservation areas in good condition are relatively common in this region and have low rarity value. Scheduled monuments of the nature and condition of those within the study area have a high rarity value. Non-designated archaeological remains in good condition are rare nationally. Palaeolithic remains are rare on an international level, given the limited work done in excavating them. Palaeoenvironmental remains in good condition are also rare on a national scale.	The Project would impact on the condition of three designated assets within the study area: three Grade II listed buildings to the west of Thurrock (1 and 2 Gray's Corner Cottages, Thatched Cottage and Murrells Cottages), which would be removed (Large Adverse effect), and the Orsett cropmark complex scheduled monument, which would be partly erased. Given the poor condition of some of the monument, the major negative impact would still result in a Large Adverse effect. The Project would have no impact on the condition of designated or non-designated assets within the wider study area. Non-designated archaeology within the Order Limits would be either erased or damaged. Deeply buried Palaeolithic archaeology would be affected by the Project within the portal areas and elsewhere, as would palaeoenvironmental remains with major negative impacts resulting in a Large Adverse effect.

Feature	Step 2	Step 3			Step 4
	Description	Scale it matters	Significance	Rarity	Impact
	region. The condition of the Palaeoenvironmental and Palaeolithic buried remains, based on current surveys is also considered good.				
Complexity	The listed buildings represent a mix of agricultural, residential, ecclesiastical and commercial buildings and on an individual basis their complexity is varied. The Conservation Areas range from low complexity (Queen's Farm) to medium complexity (East Tilbury). Archaeological remains, both scheduled monuments and non-designated, represent activity from a number of periods and in relation to a number of industrial, settlement, funerary and agricultural processes. The level of complexity, especially within the scheduled areas, is likely to be high.	The NPPF and NPSNN takes the complexity of heritage assets into account at national and international levels.	The complexity of the historic environment resource has high significance as it represents both time-depth and can be highly informative of past human activity in a region of the UK.	The level of complexity within the historic environment resource is common in the areas covered by the Project, given the known archaeological remains. On a regional level it is perhaps of low rarity. Palaeoenvironmental remains are potentially complex, given locations within depositional sequences and their nature, but this is not a rare status.	The Project would affect the complexity of designated assets within the Order Limits, as the Orsett crop mark complex and associated non-designated archaeology would be largely erased. This would impact on the context and complexity of the surviving archaeology adjacent to it (in the wider study area). The Project would negatively affect the complexity of non-designated assets within the Order Limits as a whole in the same way. The impacts of this can be estimated as major negative, the same is true for palaeoenvironmental remains.
Context	The Project and study area lies within the Greater London/Lower Thames Estuary areas and the historic environment resource within the study area reflects this wider context. In listed building terms, the context is generally within historic village cores of local settlements, or more isolated locations in open countryside. In terms of Palaeolithic archaeology, this region is particularly significant owing to its position relative to the Pleistocene ice sheets. The changing position of the River Thames in the Pleistocene and Holocene in south Essex and its buried remains are significant in paleoenvironmental terms. The River Thames is also a historic maritime and military gateway to England.	The NPPF and NPSNN takes the context of heritage assets into account at national and international levels.	The context of the historic environment resource is unique to the locality and its record of human activity from the Palaeolithic period onwards. It is highly significant.	The context of the historic environment resource within the Order Limits and study area is unique.	The Project will change the context of the historic environment resource within the study area and wider counties of Essex and Kent. The listed buildings earmarked for removal and those adjacent to the Project will be altered to differing degrees. In the case of the removed buildings, the context change will amount to a Large Adverse effect. To those within the visual envelope of the Project, a moderate negative impact would result in a Moderate Adverse effect. The scheduled monument at Orsett has a context already shaped by modern transport infrastructure, and the Project would add to this (a moderate negative impact) resulting in a Moderate Adverse effect. All the non-designated archaeology and palaeoenvironmental remains within the Order Limits lie within a context of other such remains and their removal/damage would change the context of the surviving remains outside the Project. This moderate negative impact would result in a Moderate Adverse effect.
Period	The listed buildings and conservation areas date from the Medieval, Post-Medieval and Modern periods. The scheduled monuments within the Order Limits are of prehistoric, Romano-British, early Medieval, Medieval, Post-Medieval and Modern periods. The remaining scheduled sites date from the Neolithic to the modern period, while the non-	The NPPF and NPSNN takes the period of heritage assets into account at national and international levels.	The wide range of periods represented within the historic environment resource is of high significance due to the potential to aid understanding the development of the region.	The range of periods represented by the historic environment resource within the study area is common to the region and as such is of low rarity, but nevertheless rare on a national scale.	The Project would not impact on the periods represented by the listed buildings within the study area resulting in a Neutral effect. The range of periods represented by the archaeological remains is significant and the removal of part of this resource would have a minor impact on a regional level and Slight Adverse effect.

Feature	Step 2	Step 3			Step 4
	Description	Scale it matters	Significance	Rarity	Impact
	designated archaeological remains, including Paleolithic and palaeoenvironmental, date from the prehistoric period onwards.				

Reference Sources

DMRB LA 104, LA 106, (2020); TAG Unit A3 (May 2022); National Heritage List for England; Greater London Historic Environment Record; Essex Historic Environment Record; Greater Thames Estuary Historic Environment Research Framework (2010); East of England Regional Historic Environment Research Framework (2021); Environmental Statement Chapter 6: Cultural Heritage (Application Document 6.1).

Step 5 Summary assessment score

Large Adverse

Qualitative comments

The Project covers an area that is largely open and rural in character but containing urban areas that expanded during the 19th and 20th centuries. Three Grade II listed buildings (1 and 2 Gray's Corner Cottages, Thatched Cottage, both to the north-east of Grays and Murrells Cottages, south-west of the A13 junction with Stanford Road) would experience direct physical impacts through their removal. The effect of these impacts is predicted to be Large Adverse. Potential impacts to the setting of the following designated heritage assets have been identified as a result of the Project: scheduled monuments at South Ockenden Old Hall, South Ockendon Hall, south of Thurrock, West Tilbury, Coalhouse Fort and Bowaters Farm, Grade II listed buildings to the south and west of Thurrock and to the west of West Tilbury; West Tilbury, East Tilbury, North Ockendon conservation areas. These effects are predicted to be Slight Adverse with regard to the setting of listed buildings and Moderate Adverse with regard to the conservation areas and scheduled monuments.

Road construction within the scheduled area of the Orsett cropmark complex will cause a direct physical impact to these designated assets. The effects are predicted to be Large Adverse. Construction excavations associated with the proposed road and tunnel may have a physical impact on other non-designated archaeological remains within the Project footprint. Palaeoenvironmental remains will also be affected by enabling works and construction. Likely effects are potentially Moderate in degree.

The Project would have a Large Adverse effect on the cultural heritage resource within the Order Limits and located within the surrounding areas experiencing an impact through change to setting.

Step 6 Combined North & South

The Project north of the Thames covers an area that is largely open and rural in character. Road construction within the scheduled area of the Orsett cropmark complex will cause a Large Adverse effect. Three Grade II listed buildings (1 and 2 Gray's Corner Cottages, Thatched Cottage, and Murrells Cottages would experience a Large Adverse effect. Potential impacts to the setting of the following designated heritage assets have been identified as being slight adverse (for the listed buildings and moderate adverse for the conservation areas) as a result of the Project: scheduled monuments at South Ockenden Old Hall, South Ockendon Hall, south of Thurrock, West Tilbury, Coalhouse Fort and Bowaters Farm, Grade II listed buildings to the south and west of Thurrock and to the west of West Tilbury; West Tilbury, East Tilbury, North Ockendon conservation areas. South of the River Thames the Project also covers an area that is largely open and rural in character. Potential impacts to the setting of grade II* Church of St Maryof slight adverse effect and Moderate Adverse effect to the setting of Thong conservation area and works associated with the proposed road and tunnel will have a physical impact on other non-designated archaeological remains within the Project footprint. Palaeoenvironmental remains will also be affected by enabling works and construction. Likely effects are potentially Moderate in degree. Overall the effects of the Project are considered to be Large Adverse.

4.4 Landscape

4.4.1 The landscape worksheet is divided into the following sections which represent the landscape areas impacted by the Project:

a. West Kent Downs

b. Higham Arable Farmland

c. Shorne Wooded Slopes

d. Istead Arable Farm

e. Gravesend Southern Fringes

f. Shorne and Higham Marshes

g. Mucking Marshes

h. Tilbury Marshes

i. Chadwell Escarpment Urban Fringe

j. West Tilbury Urban Fringe

k. Linford Buckingham Hill Urban Fringe

l. Whitecroft/Orsett Heath Urban Fringe

m. Orsett Lowland Farmland

n. Thurrock Reclaimed Fen

o. Belhus Lowland Quarry Farmland

p. Brentwood Wooded Hill

q. Summary

4.4.2 Plate 4.5 shows these landscape areas on a map.

4.4.3 The impact of the Project on each landscape area is appraised in terms of the area's features, which comprise its:

a. Pattern

b. Tranquility

c. Cultural associations

d. Landcover

e. Summary of character

4.4.4 Each of these features is described in respect of its:

a. Scale

b. Rarity

c. Importance

d. Substitutability

e. The impact of the Project and given an assessment score taking account of all committed mitigation

4.4.5 An overall Summary Assessment Score and qualitative comments are also provided. These form the basis of the landscape information included in the AST.

4.4.6 Given the length of the Project and changes to local landscape character within the landscape study area, individual landscape worksheets have been provided for each Local Landscape Character Area (LLCA) through which the Project route passes. Although a Large Adverse landscape effect has been identified on two of these LLCAs (Higham Arable Farmland and Thurrock Reclaimed Fen), a Moderate Adverse effect has been assessed for the overall landscape effect for the Project for the reasons set out in the summary worksheet. The individual worksheets provide additional supporting information for each affected LLCA.

Plate 4.5 Landscape character areas

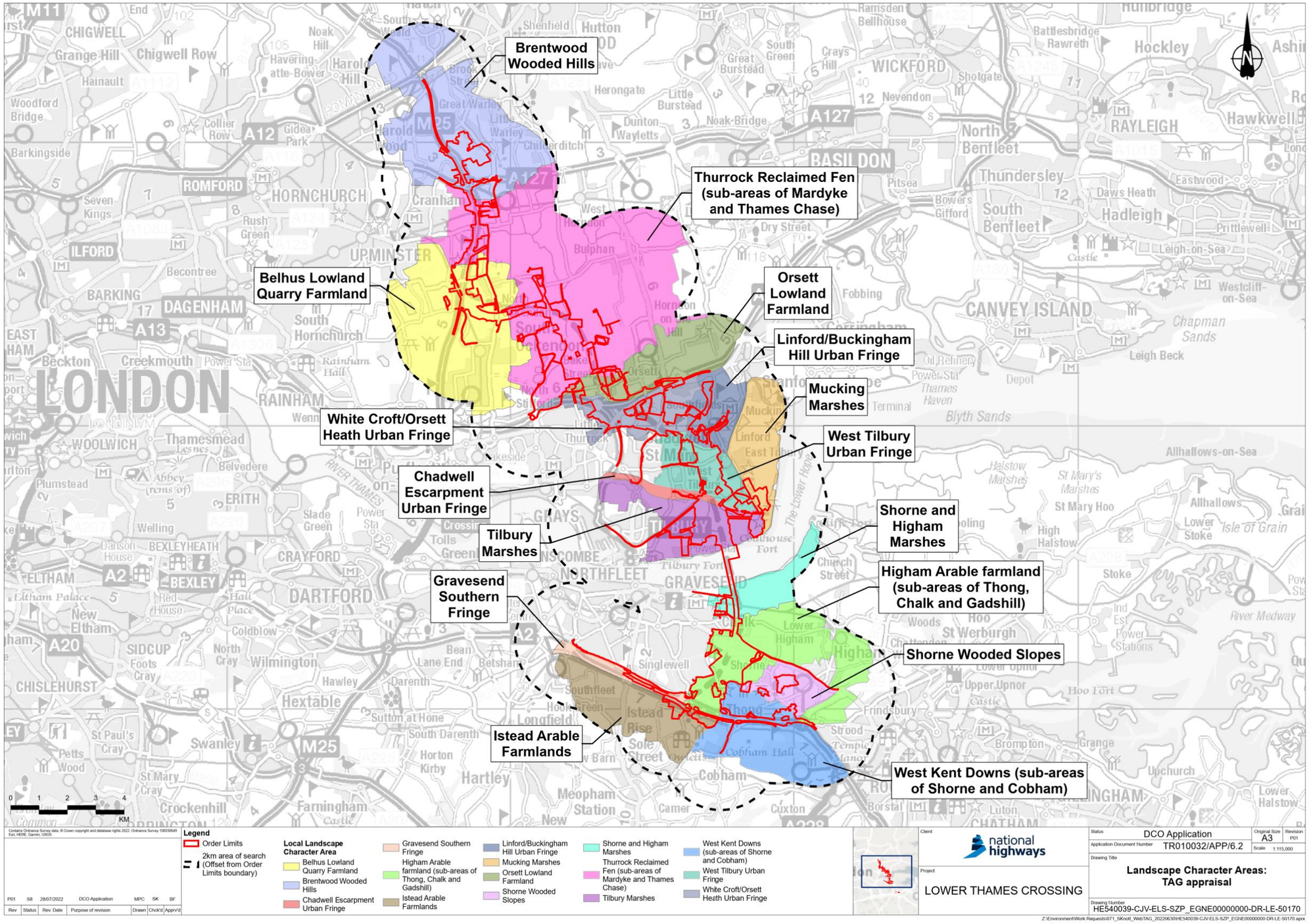

Table 4.4 Landscape – West Kent Downs

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	This description includes the Local Landscape Character Area (LLCA) sub areas of Cobham and Shorne within the West Kent Downs Landscape Character Area (LCA). Pattern is influenced by the extent of woodland which is the key distinguishing feature, in combination with the undulating landform and ridge. The significant ridge landform feature provides an attractive backdrop in views from the north. The landscape offers a moderate level of containment as a result of gently undulating topography and coverage of hedgerow trees and woodland at Cobham Hall Registered Park and Garden and Ashenbank Wood. The LLCA includes localised vantage points including the Roman Villa at West Park and Williams Hill in Cobham Hall Registered Park and Garden. Rochester and Cobham Park Golf Club offers a varied terrain of parkland setting.	Kent Downs AONB matters at the national level.	The Kent Downs AONB landscape is rare.	The Kent Downs AONB landscape is of high importance.	Kent Downs AONB is not substitutable.	Moderate adverse. The Project would have a direct impact on the landscape pattern. The A2 widening and vegetation loss within the A2 corridor would increase the existing severance of the Kent Downs AONB north and south of the A2.
Tranquillity	Primary noise sources are dominated by road traffic from the M2 and A2. A2 traffic noise also permeates into the wooded landscape of Shorne Woods Country Park. However, a sense of tranquillity is experienced further from the road corridor and within remoter pockets of the Kent Downs AONB.	Tranquillity matters at the national level.	Tranquillity is rare within the locality.	Tranquillity is of high importance at a national level.	Tranquillity is not substitutable.	Slight adverse. Although the tranquillity experienced within the existing landscape is already compromised by the existing A2 corridor, the Project would intensify the existing transport infrastructure, resulting in increased visual intrusion adjoining the A2 corridor and therefore affecting the tranquillity experienced within this area. However, there would be a beneficial impact in terms of noise levels along the A2 corridor, which would limit the adverse impacts on tranquillity.
Cultural	Cobham Hall Grade II* Registered Park and Garden has its origins as a Medieval deer park. It was designed by Humphry Repton and comprises formal gardens and pleasure grounds surrounded by wooded parkland. Cobham Hall is listed Grade I. Ashenbank Wood (to the west of Cobham Hall Registered Park and Garden) contains a range of archaeological sites including a Bronze Age burial ground and WWII bunkers.	Landscape elements associated with the scheduled monuments, historic parks and gardens and listed buildings, including their settings, matter at the national level.	The scheduled monument, Grade I listed Cobham Hall and Grade II* designed parkland are rare.	The cultural features are of high importance.	The cultural features are not substitutable.	Moderate adverse. The Project would result in direct impacts on landscape pattern and landcover on the northern boundary of the historic Cobham Hall Registered Park and Garden and setting to the north.
Landcover	The A2/HS1 corridor is flanked by woodland including Ashenbank Wood, Shorne Wood and Brewers Wood and woodland within Shorne Woods Country Park, with large areas of ancient woodland. Part of Cobham Hall Registered Park and Garden is now used as a golf course.	Ancient woodland matters at the national level.	Ancient woodland is rare.	Designated woodland is of high importance.	Ancient woodland is not substitutable.	Moderate adverse. The Project would have a direct impact on landcover through the loss of woodland, including ancient woodland within the Kent Downs AONB.
Summary of character	The landscape falls within the Kent Downs AONB. Tranquillity is affected by existing major transportation corridors, although local pockets of tranquillity are experienced within remoter parts of the landscape. Woodland cover and an enclosed landscape are	The Kent Downs AONB matters at the national level. Designations such as ancient woodland	The Kent Downs AONB and ancient woodland are rare.	The Kent Downs AONB and ancient woodland are of high importance.	The features of high importance are not substitutable.	Moderate adverse. The Project would intensify the existing transport corridor resulting in a direct impact on the pattern and landcover within the designated landscape of the Kent Downs AONB.

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
	associated with the West Kent Downs LCA within the Kent Downs AONB.	matter at the national level.				

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
Kent Downs AONB Unit (2020). Landscape Character Assessment Update, Draft.
Environmental Statement (ES) Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5 - Summary assessment score

Moderate adverse (negative) effect

Qualitative comments

Overall the Project would result in a localised adverse impact on the landscape character of the West Kent Downs LCA within the Kent Downs AONB, recognised for its quality at the national level. Impacts would result from an intensification of the busy existing A2 road corridor and the new M2/A2/A122 Lower Thames Crossing junction, that would introduce a substantial new uncharacteristic feature into the setting of the AONB.

Table 4.5 Landscape – Higham Arable Farmland

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	This description includes the LLCA sub areas of Gadshill, Thong and Chalk within Higham Arable Farmland. Open arable land of a typically regular pattern of large- to small-scale fields rising from low-lying land adjoining the Thames Estuary in the north. The settlement of Thong has a strong relationship with the open arable landscape to its west, which provides separation from Gravesend.	Pattern matters at the local level.	Pattern is commonplace.	Pattern is of medium importance.	Pattern is replaceable.	Large adverse. The Project would have a direct impact on the landscape pattern and its scale. The M2/A2/A122 Lower Thames Crossing junction and the cutting slopes of the South Portal would comprise a notable interruption of the existing landscape pattern. The deep South Portal and approach road cutting and creation of the new hilltop landform at Chalk Park would substantially alter the existing landform.
Tranquillity	Existing tranquillity within the area is affected by the frequent visible presence of the urban edge, the busy transport corridors of the A2/HS1 and A226 Gravesend Road and overhead powerlines. Background urban and traffic noise are audible in most locations.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Moderate adverse. Although the tranquillity experienced within the existing landscape is already compromised, the Project would introduce substantial new transport infrastructure, resulting in increased visual intrusion and traffic noise along the proposed corridor and adjoining the M2/A2/A122 Lower Thames Crossing junction, affecting the tranquillity experienced by users of the local Public Right of ay (PRoW) network.
Cultural	There are two designated conservation areas at Thong and Queens Farm in Shorne, with associated listed buildings. The tower of the Grade II* listed St Marys Church in the village of Chalk is a local landmark.	Landscape elements associated with the listed buildings, including their settings, matter at the national level, and landscape elements associated with conservation areas matter at the regional level.	The cultural features are rare.	The cultural features are of high importance.	The cultural features and their settings are not substitutable.	Moderate adverse. The Project would result in direct impacts on landscape pattern, tranquillity and landcover within and in the setting of the Thong conservation area.
Landcover	Open arable land, with some woodland to the south of the LLCA, including Claylane Wood ancient woodland.	Landcover matters at the local level and ancient woodland matters at the national level.	The open arable landscape is commonplace. Ancient woodland is rare.	Landcover is of medium importance.	Arable landcover is replaceable, however, ancient woodland is not substitutable.	Moderate adverse. The Project would have a direct impact on landcover through the loss of arable fields and some woodland, including ancient woodland.
Summary of character	Area of predominantly open arable land east of Gravesend and north of the A2/HS1 transport corridor, with a strong visual association to the Thames Estuary in the north and wooded skyline of Shorne Woods Country Park within the Kent Downs AONB to the south.	The Kent Downs AONB setting matters at the national level.	The setting to the Kent Downs AONB is rare, however, the open arable landscape is commonplace.	The Kent Downs AONB setting and cultural features are of high importance.	The features of high importance are not substitutable.	Large adverse. The Project would introduce a new large-scale road junction and transport corridor into the predominantly open landscape, resulting in a direct impact on the pattern and landcover within the setting of the Kent Downs AONB.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5 - Summary assessment score

Large adverse (negative) effect

Qualitative comments

Overall, the Project would substantially alter the landform and pattern of the landscape of the Higham Arable Farmland LLCA sub areas within the setting of the Kent Downs AONB. However, the visual association with the Thames Estuary to the north and wooded ridgeline to the south would be largely maintained. The largest effects would result from the M2/A2/A122 Lower Thames Crossing junction in the southern part of this area, within the Higham Arable Farmland sub area of Thong, south of Thong Lane.

Table 4.6 Landscape – Shorne Wooded Slopes

	Step 2	Step 3				Step 4
Features	**Description**	**Scale it matters**	**Rarity**	**Importance**	**Substitutability**	**Impact**
Pattern	Intricate mix of small- to large-scale arable farmland and woodland, with a ridgeline delineated by Pear Tree Lane and ribbon development.	Pattern matters at the local level.	Pattern is commonplace.	Pattern is of medium importance.	Pattern is replaceable.	Moderate beneficial. Proposed woodland habitat creation would enhance existing landscape pattern and reduce the prominence of built form within Shorne.
Tranquillity	Existing tranquillity within the area is affected by the presence of the settlement of Shorne and transport corridors of the A226 Gravesend Road and A289. Background urban and traffic noise are audible in most locations, although less perceptible from within woodland.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Neutral. The Project avoids being visually intrusive and does not have an adverse effect on the current level of tranquillity.
Cultural	Designated conservation areas at Shorne and Chestnut Green in Shorne, with associated listed buildings.	Landscape elements associated with the listed buildings, including their settings, matter at the national level, and landscape elements associated with conservation areas matter at the regional level.	The cultural features are rare.	The cultural features are of high importance.	The cultural features and their setting are not substitutable.	Neutral. The Project maintains existing association with cultural features.
Landcover	Combination of dense unmanaged young woodland and ancient woodland in Great Crabbles Wood, Peartree Wood and Starmore Wood, and arable fields.	The arable landscape matters at the local level and ancient woodland matters at the national level.	The arable landscape is commonplace. Ancient woodland is rare.	The arable landscape is of medium importance and ancient woodland is of high importance.	Arable landcover is replaceable. Ancient woodland is not substitutable.	Moderate beneficial. There would be an increase in characteristic woodland cover.
Summary of character	This is an intricate landscape with substantial areas of ancient woodland.	Typically, the farmed landscape matters at the local level. The Kent Downs AONB setting and ancient woodland matter at the national level.	The setting to the Kent Downs AONB is rare, the open arable landscape is commonplace.	The Kent Downs AONB setting, ancient woodland and cultural features, are of high importance.	The features of high importance are not substitutable.	Moderate beneficial. Existing landscape character would be enhanced by proposed woodland habitat creation to compensate for nitrogen deposition and ancient woodland loss.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment
ES Chapter 7: Landscape and Visual (Application Document 6.1)
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk

Step 5 - Summary assessment score

Moderate beneficial (positive) effect

Qualitative comments

The Project would result in a moderate beneficial effect on the landscape character of the Shorne Wooded Slopes LLCA, as a result of substantial areas of proposed woodland habitat creation to compensate for nitrogen deposition and ancient woodland loss.

Table 4.7 Landscape – Istead Arable Farmlands

Features	Step 2	Step 3				Step 4
	Description	**Scale it matters**	**Rarity**	**Importance**	**Substitutability**	**Impact**
Pattern	A gently undulating landscape, adjoining HS1 to the north. An open arable landscape, with medium- to large-scale fields of irregular pattern.	Pattern matters at the local scale.	Pattern is commonplace.	Pattern is of medium importance	Pattern is replaceable.	Slight adverse. The Project would result in a slight intensification of the existing A2 corridor and perceptible impact on the landscape due to visual intrusion from the M2/A2/A122 Lower Thames Crossing junction.
Tranquillity	Existing tranquillity within the area is affected by the presence of the Istead Rise settlement, transport corridors and overhead electricity lines. Background urban and traffic noise are audible in locations, in particular along the A2 corridor.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Slight adverse. Although the tranquillity experienced within the existing landscape is already compromised, the Project would introduce new transport infrastructure into the neighbouring Higham Arable Farmland (sub area Thong) LLCA, resulting in increased visual intrusion and traffic noise adjoining the A2 corridor and M2/A2/A122 Lower Thames Crossing junction.
Cultural	This landscape contains numerous listed buildings relating to Medieval and Post-Medieval farmsteads, churches and hamlets, connected by historic tracks and laneways.	Landscape elements associated with the listed buildings and their settings matter at the national level.	The cultural features are rare.	The cultural features are of high importance.	The cultural features and their settings are not substitutable.	Neutral. There would be no notable change to cultural features.
Landcover	A predominantly arable landscape, with small areas of woodland.	Landcover matters at the local level.	The arable landscape is commonplace.	Landcover is of medium importance.	Landcover is replaceable.	Neutral. There would be no change to existing landcover, apart from woodland planting provided to compensate for nitrogen deposition and ancient woodland loss.
Summary of character	A predominantly open arable landscape, with some woodland. Existing urban influences include Gravesend and the HS1/A2 transport corridors to the north, prominent overhead power lines crossing the landscape and the settlement of Istead Rise.	Typically, the farmed landscape matters at the local level. The Kent Downs AONB setting matters at the national level.	The setting to the Kent Downs AONB is rare, however, the open arable landscape is commonplace.	The Kent Downs AONB setting is of high importance.	The setting of the Kent Downs AONB is not substitutable.	Slight adverse. The Project avoids impact on existing landscape character and features, however, the M2/A2/A122 Lower Thames Crossing junction would be visually intrusive in the eastern part of the LLCA.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5 - Summary assessment score

Slight adverse (negative) effect

Qualitative comments

The impacts of the Project would be largely indirect and would mainly result from visual intrusion and a reduction in tranquillity from the proposed M2/A2/A122 Lower Thames Crossing junction, affecting a limited part of the Istead Arable Farmlands LLCA to the east, within the setting of the Kent Downs AONB.

Table 4.8 Landscape – Gravesend Southern Fringe

Features	Step 2	Step 3				Step 4
	Description	**Scale it matters**	**Rarity**	**Importance**	**Substitutability**	**Impact**
Pattern	A linear urban fringe recreational landscape on the southern edge of Gravesend.	Pattern matters at the local scale.	The recreational area is relatively commonplace.	Pattern is of medium importance.	The recreational landscape is replaceable.	Neutral. There would be no impact on existing landscape pattern.
Tranquillity	Existing tranquillity is affected by the frequent visible presence of the urban edge and busy transport corridor of the A2/HS1. Background urban and traffic noise are audible in most locations.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of low importance at a local level.	Tranquillity is not substitutable.	Neutral. As the tranquillity is already compromised, the Project would not adversely affect the current level of tranquillity.
Cultural	This landscape has no notable cultural associations of relevance.	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Neutral.
Landcover	A linear park including a footway and cycleway adjoins the A2 corridor. Tree screening belts are present along the A2 corridor.	Landcover matters at the local level.	Landscape features are commonplace.	Landcover is of low importance.	Features are replaceable.	Neutral. There would be no change to existing landcover.
Summary of character	Linear urban fringe landscape, incorporating a linear park and tree screening belts, dominated by the existing A2 corridor.	The recreational area matters at the local level. The Kent Downs AONB setting matters at the national level, although this LLCA provides limited positive contribution to the AONB setting.	Kent Downs AONB setting is rare, although this LLCA provides limited positive contribution to the AONB setting. The pattern and features are commonplace.	The Kent Downs AONB setting is of high importance, although this LLCA provides limited positive contribution to the AONB setting.	The features of low importance are replaceable.	Neutral. The Project would not result in any notable change in landscape character.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5 - Summary assessment score

Neutral effect

Qualitative comments

The Project would not result in any notable change in the landscape character of the Gravesend Southern Fringe LLCA

Table 4.9 Landscape – Shorne and Higham Marshes

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	Reclaimed, flat, low-lying marsh adjacent to the River Thames, drained by a dense network of drainage ditches subdividing pasture fields, with a general absence of trees and hedgerows.	Pattern matters at the local level.	The reclaimed marshes are relatively commonplace within the locality.	Pattern is of medium importance.	The reclaimed marshes are relatively replaceable.	Neutral. There would be no change to landscape pattern.
Tranquillity	Overall, the remote nature of much of the marshes and the general absence of built development away from the urban edge of Gravesend contribute to a sense of tranquillity.	Tranquillity matters at the local level.	Tranquillity is commonplace away from the urban edge.	Tranquillity is of high importance at a local level.	Tranquillity is not substitutable.	Neutral. There would be no change in the current level of tranquillity.
Cultural	The Saxon Shore Way skirts the northern margin of the area. The disused Thames Medway canal crosses the marshes. Shornemead Fort is a scheduled monument. This landscape has cultural associations with Charles Dickens.	Landscape elements associated with scheduled monuments, including their settings, matter at the national level.	The scheduled monument coastal forts along the Thames Estuary are rare.	The cultural features are of high importance.	The cultural features are not substitutable	Neutral. There would be no change to cultural features.
Landcover	Reclaimed marshland area adjacent to the Chalk settlement, also encompassing a police firing range.	Landcover matters at the local level.	The reclaimed marshes are relatively commonplace within the locality.	Landcover is of medium importance.	Features are replaceable.	Neutral. There would be no change to existing landcover.
Summary of character	Reclaimed, flat, low-lying marsh providing part of the wider setting to the Kent Downs AONB. Contains a nationally designated heritage asset and has cultural associations with Charles Dickens.	The setting to the Kent Downs AONB matters at the national level.	The Kent Downs AONB setting and cultural features are rare.	The Kent Downs AONB setting and cultural features are of high importance.	The features of high importance are not substitutable.	Neutral. There would be no change to existing landscape character.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5 - Summary assessment score

Neutral effect

Qualitative comments

The Project would not adversely impact the landscape character of the Shorne and Higham Marshes LLCA

Table 4.10 Landscape – Tilbury Marshes

Features	Step 2	Step 3				Step 4
	Description	**Scale it matters**	**Rarity**	**Importance**	**Substitutability**	**Impact**
Pattern	Large-scale, reclaimed marsh landscape in an open, exposed, flat, low-lying area adjoining the north bank of the River Thames, also containing a landfill site, the site of the demolished Tilbury Power Station and a sewage treatment works. Fields are defined by a series of ditches.	Pattern matters at the local level.	The reclaimed marshes are relatively commonplace within the locality.	Pattern is of low importance.	The reclaimed marshes are relatively replaceable.	Slight adverse. The Project would result in severance of the existing agricultural land pattern.
Tranquillity	Tranquillity within the area is affected by the extensive network of overhead electricity pylons, industrial development and settlement in neighbouring Tilbury to the west.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Slight adverse. Although the tranquillity experienced within the existing landscape is already compromised, the Project would introduce a major new transport corridor crossing the landscape.
Cultural	The historic Grade I listed Tilbury Fort lies in the south-west part of the area.	Landscape elements associated with Tilbury Fort and its setting matter at the national level.	The coastal forts along the Thames estuary are rare.	The cultural features are of high importance.	The cultural features are not substitutable.	Neutral. There would be no notable change to cultural elements.
Landcover	Arable farmland with grazing fields and reclaimed marshland, landfill and industrial land, including the site of the former Tilbury Power Station.	Landcover matters at the local level.	The reclaimed marshes are relatively commonplace within the locality.	The landcover is of low importance.	Landscape features are replaceable.	Slight adverse. There would be a limited loss and severance of existing farmland.
Summary of character	Large-scale reclaimed marsh landscape of open, exposed, flat, low-lying land adjoining the north bank of the River Thames. The agricultural landscape pattern, which is defined by ditches, comprises arable and grazing land. The landscape is also characterised by landfill, industrial land and the historic Grade I listed Tilbury Fort.	The setting to the Kent Downs AONB matters at the national level.	The Kent Downs AONB setting and cultural features are rare, however, the farmland is commonplace.	The Kent Downs AONB setting and cultural features are of high importance. The farmland is of low importance.	The features of high importance are not substitutable.	Slight adverse. The Project would result in localised impacts to landscape character and would introduce sculptural landscape mounding, designed as a landmark feature around the North Portal.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study.

Step 5 - Summary assessment score

Slight adverse (negative) effect

Qualitative comments

The Project would interrupt the pattern of the existing disturbed landscape, due to severance caused by the proposed Project route alignment. However, sculptural landscape mounding adjoining the River Thames would introduce a positive new landmark feature, contrasting with the otherwise predominantly flat, open Tilbury Marshes LLCA landscape.

Table 4.11 Landscape – Mucking Marshes

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	The large-scale landscape is flat, low-lying, exposed and windswept consisting of grazing pasture, interspersed with landfill operations. Thurrock Thameside Nature Park and Stanford Warren Nature Reserve lie within the northern part of the area. Settlement is limited to the west edge at the village of East Tilbury.	Pattern matters at the local level.	The reclaimed marshes are relatively commonplace within the locality.	Pattern is of medium importance.	The reclaimed marshes are relatively replaceable.	Neutral. The proposed ecology mitigation areas would not result in any notable change to existing landscape pattern.
Tranquillity	Tranquillity within the area is limited by landfill operations and settlement. Tranquillity increases to the north.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Neutral. The Project would avoid creating further visual intrusion and/or impacting the current level of tranquillity.
Cultural	East Tilbury/Bata conservation area, with the historic listed Coalhouse Battery and Coalhouse Fort both located at the southern end of the character area. The latter forms an important historic riverside landmark.	Landscape elements associated with the Thames Estuary cultural features and their settings matter at the regional and national level.	The coastal forts along the Thames estuary are rare.	The cultural features are of high importance.	The cultural features are not substitutable.	Neutral. There would be no change to cultural features.
Landcover	This large-scale reclaimed marshland landscape comprises a mix of grazing land, landfill sites, Thurrock Thameside Nature Park (an Essex Wildlife Trust nature reserve) and Stanford Warren Nature Reserve.	Landcover matters at the local level.	The reclaimed marshes are relatively commonplace within the locality.	Landcover is of medium importance.	Landscape features are replaceable.	Neutral. There would be no change to landcover.
Summary of character	Large-scale, open and exposed reclaimed marsh landscape, interspersed with landfill operations and adjoining settlement at East Tilbury with the historic Coal House Battery and Coalhouse Fort defining the southern extent of this area.	The setting to the Kent Downs AONB matters at the national level.	The Kent Downs AONB setting and cultural features are rare.	The Kent Downs AONB setting and cultural features are of high importance.	The features of high importance are not substitutable.	Neutral. There would be no change to existing landscape character.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study.

Step 5 - Summary assessment score

Neutral effect

Qualitative comments

The Project would not adversely impact the landscape character of the Mucking Marshes LLCA.

Table 4.12 Landscape – Chadwell Escarpment Urban Fringe

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	This is a small-scale and intimate landscape along an escarpment, interspersed with areas of scrub and irregular fields of rough grassland, pasture and arable land. Other than West Tilbury, the settlement pattern consists of a series of individual historic farmsteads.	Pattern matters at the local scale.	Pattern is commonplace.	Pattern is of medium importance.	The escarpment is not substitutable.	Slight adverse. The Project would result in localised impacts to the landscape pattern at the very edge of the escarpment but would not affect the overall pattern.
Tranquillity	Existing tranquillity is affected by the network of overhead electricity pylons crossing the escarpment, industrial development and a number of roads.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Slight adverse. Impacts to tranquillity would be localised.
Cultural	The tower of the Grade II* listed West Tilbury church (now residential) forms a local landmark within the West Tilbury conservation area. South of Church Road, the southern part of the West Tilbury Low Street conservation area lies within this character area to the east of West Tilbury.	Landscape elements associated with the listed buildings, conservation areas and their settings matter at the national and regional level respectively.	The listed landmark church tower is rare.	The cultural feature is of high importance.	The cultural feature is not substitutable.	Neutral. The Project would not adversely affect the cultural features within this area.
Landcover	Landcover comprises a mix of rough grassland, pasture and arable fields, with some industrial land.	Landcover matters at the local level.	Landcover is commonplace.	Landcover is of medium importance.	Landcover is replaceable.	Slight adverse. Localised loss of arable land.
Summary of character	The distinctive landscape encompasses a steep-sided escarpment, indented by small dry valleys, with a mix of rough grassland, pasture and arable land, which marks the edge of the lowest part of the Thames Terraces. The escarpment provides a marked contrast to the flat, low-lying landscape of Tilbury Marshes to the south.	The setting to the Kent Downs AONB matters at the national level.	The pattern and features are commonplace. The Kent Downs AONB setting and cultural features are rare.	The Kent Downs AONB setting and cultural features are of high importance.	The features of high importance are not substitutable.	Slight adverse. The Project would result in localised impacts to landscape character, where the straight alignment of the new road would cross the eastern extremity of this area.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study.

Step 5 - Summary assessment score

Slight adverse (negative) effect

Qualitative comments

The Project would cut across the eastern tip of the escarpment at a low point, with only a limited localised impact on the overall Chadwell Escarpment Urban Fringe LLCA.

Table 4.13 Landscape – West Tilbury Urban Fringe

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	The area is generally open in character with landcover consisting mostly of large-scale arable fields, with some small copses.	Pattern matters at the local scale.	Pattern is commonplace.	The general pattern is of medium importance.	The pattern is replaceable.	Moderate adverse. The Project would bisect the landscape pattern, broadly following the direction of the multiple overhead lines that also cross this landscape.
Tranquillity	Tranquillity within the area is affected by multiple overhead lines that run broadly north to south, and the urban edges of Chadwell St Mary, Linford and East Tilbury.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Moderate adverse. Although the tranquillity experienced within the existing landscape is already compromised, the Project would introduce new transport infrastructure potentially resulting in increased visual intrusion and traffic noise.
Cultural	The East Tilbury (Bata) conservation area lies on the eastern edge of the area. Part of Hoford Road, a historic protected lane, passes through this area.	Landscape elements associated with the cultural features matter at the regional level.	The cultural features are rare.	The cultural features are of high importance.	The cultural features are not substitutable.	Slight adverse. The Project would impact on certain views from the conservation area, as well as altering the alignment of Hoford Road, although mitigation planting would help restore the character of the protected lane.
Landcover	Landcover predominantly comprises arable fields, with limited tree cover including some small copses. Where hedgerows remain, they frequently occur along historic lanes and tracks. Settlement is concentrated towards the eastern boundary, which encompasses parts of East Tilbury.	Farmland matters at the local level.	Farmland is commonplace.	Farmland is of medium importance.	Farmland is replaceable.	Moderate adverse. The Project would impact on arable land, boundary hedgerows and woodland copses.
Summary of character	This urban fringe landscape is generally open in character with landcover consisting mostly of large arable fields and localised small copses.	Generally matters at the local level. Cultural features matter at the regional level.	The pattern and farmland are commonplace. Cultural features are rare.	Cultural features are of high importance.	The features of high importance are not substitutable.	Moderate adverse. The Project would have a direct impact on the landscape, it would be visually intrusive and would not be fully integrated in the longer term given its scale and position, centrally located through this arable landscape.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study.

Step 5 - Summary assessment score:

Moderate adverse (negative) effect

Qualitative comments

The Project would have an adverse impact on the landscape through the introduction of a new uncharacteristic transport corridor, interrupting the open arable West Tilbury Urban Fringe LLCA landscape.

Table 4.14 Landscape – Linford/ Buckingham Hill Urban Fringe

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	This urban fringe landscape comprises a diverse mix of settlement at Linford and adjoining industrial works surrounded by woodland, disused workings, a golf course, arable land, rough grassland and the edge of the Stanford-le-Hope settlement to the north-east, located on a locally elevated landform.	Pattern matters at the local level.	Pattern is commonplace.	Pattern is of medium importance.	Pattern is replaceable.	Neutral. There would be no change to the existing landscape pattern.
Tranquillity	Existing tranquillity within the area is affected by the existing mineral extraction, industry and landfill operations. An overhead line is a visually intrusive feature within this character area.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Neutral. There would be no notable worsening of the existing tranquillity.
Cultural	Part of Hoford Road, a historic protected lane, passes through this area.	The protected lane matters at the regional level.	The protected lane is rare.	The protected lane is of medium importance.	Hoford Road protected lane, including its sense of enclosure by adjacent hedgerows and woodland vegetation, is not substitutable.	Neutral. Reinstated hedgerows along Hoford Road protected lane would appear similar in character to existing planting and provide a similar level of enclosure.
Landcover	This landscape has a diverse range of landcover including rough grazing, mineral extraction, industry, landfill, recreation and settlement. Rainbow Wood ancient woodland lies within this LLCA.	Landcover matters at the local level. Ancient woodland matters at the national level.	Landcover is commonplace. Ancient woodland is rare.	Landcover is of medium importance. Ancient woodland is of high importance.	Landcover is replaceable. Ancient woodland is not substitutable.	Neutral. Established hedgerows along Hoford Road protected lane would appear similar in character to existing planting. There would be the permanent loss of part of Rainbow Wood ancient woodland, although large areas of woodland would be planted as compensation, including woodland habitat creation for nitrogen deposition.
Summary of character	This urban fringe landscape comprises a diverse mix of settlement, industrial works surrounded by woodland, disused workings, a golf course and mixed farmland, located on a locally distinctive area of elevated landform. Rainbow Wood ancient woodland lies within this LLCA.	Generally matters at the local level. Cultural features matter at a regional level. Ancient woodland matters at the national level.	Landscape features are typical of the locality but cultural features and ancient woodland are rare.	Typically medium importance. Cultural features and ancient woodland are of high importance.	Landscape features are replaceable but cultural features and ancient woodland are not substitutable.	Neutral. There would be very localised change to existing landscape character due to the partial loss of ancient woodland.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study.

Step 5 - Summary assessment score

Neutral effect

Qualitative comments

The Project would not adversely impact the landscape character of the Linford/Buckingham Hill Urban Fringe LLCA, apart from a very localised change due to the partial loss of ancient woodland.

Table 4.15 Landscape – Whitecroft/Orsett Heath Urban Fringe

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	This urban fringe landscape consists predominantly of gently undulating medium to large-scale fields, with smaller fields to the west of the A1089. The area is strongly influenced by the presence of transport corridors and overhead lines. Settlement comprises Southfields to the north and scattered dwellings. Orsett Golf Club occupies a substantial area in the east of the LLCA.	Pattern matters at the local scale.	Pattern is commonplace.	Pattern is of medium importance.	Pattern is replaceable.	Moderate adverse. The Project would broadly follow existing transport corridors of overhead lines, however, it would interrupt the existing landscape pattern through this arable landscape.
Tranquillity	Existing tranquillity within the area is strongly influenced by the presence of transport corridors (A13, A1013 and A1089), overhead lines and the settlement edges of Chadwell St Mary, Grays and Southfields.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Moderate adverse. Although the tranquillity experienced within the existing landscape is already compromised, the Project would introduce new transport infrastructure resulting in increased visual intrusion and traffic noise along the A13 corridor and at the A13/A1089/A122 Lower Thames Crossing junction.
Cultural	The hedgerow lined Hornsby Lane, along with the adjoining Grade II listed Heath Place and its grounds provide a sense of the former historic rural farmland landscape.	Landscape elements associated with listed buildings and their settings matter at the national level.	The cultural features are rare.	The cultural features are of high importance.	The cultural features are not substitutable.	Moderate adverse. The Project would impact on certain views into and across the area, within the setting of nearby cultural features.
Landcover	Predominantly urban fringe farmland and some settlement at Southfields. Private recreational land includes Orsett Golf Club and a public recreation area adjoining the existing A13 junction (the Ron Evans Memorial Field).	Landcover matters at the local level.	Landcover is commonplace.	The landcover is of medium importance.	Landcover is replaceable.	Moderate adverse. The Project would result in the loss of arable land and some recreational land adjoining the A13/A1089/A122 Lower Thames Crossing junction.
Summary of character	This urban fringe arable landscape is influenced by the northern urban edge of Chadwell St Mary, the eastern urban edge of Grays, the existing large A13 junction south of Baker Street and overhead lines.	Generally matters at the local level. Cultural features matter at the national level.	Typically commonplace, but cultural features are rare.	Typically medium importance. Cultural features are of high importance.	Typically replaceable, apart from cultural features that are not substitutable.	Moderate adverse. The Project would be visually intrusive and would not be wholly integrated into the surrounding landscape in the longer term given its scale.

Reference sources

Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study.

Step 5- Summary assessment score

Moderate adverse (negative) effect

Qualitative comments

The Project would adversely affect the White Croft/Orsett Heath Urban Fringe LLCA landscape due to the increased extent and scale of transport infrastructure across this relatively open landscape. While this urban fringe farmland is strongly influenced by the presence of existing settlement, transport corridors and overhead lines, new large-scale transport infrastructure would weaken the existing landscape character.

Table 4.16 Landscape – Orsett Lowland Farmland

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	The area is a low-lying, gently undulating fen edge landscape. A mix of large- to small-scale pasture and arable fields surround the historic settlement of Orsett.	Pattern matters at the local scale.	The farmland is commonplace.	The association to the Orsett Fen landscape is of medium importance.	The open arable farmland is replaceable.	Slight adverse. The Project would adversely affect the landscape pattern near to the A13/A1089/A122 Lower Thames Crossing junction.
Tranquillity	Existing tranquillity within the area is affected by the presence of the existing A13 corridor and junction, by settlement in Baker Street and Orsett, and by overhead lines.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Slight adverse. The tranquillity experienced within the existing landscape is already compromised, however, the Project would introduce new highway infrastructure to the north of the A13, further reducing existing relative tranquillity.
Cultural	The Grade II listed Baker Street windmill at the west edge of the settlement is a local landmark. There is a scheduled monument within arable fields to the west of Baker Street. Orsett and Horndon-on-the-Hill are conservation areas and the area as a whole contains a high concentration of listed buildings. The area includes considerable time depth and identifies a long history of occupation reflected in the pattern of settlement and enclosure, as well as historic sites.	Landscape elements associated with the cultural features matter at the national and regional level.	The cultural features are rare.	The cultural features are of high importance.	The cultural features are not substitutable.	Slight adverse. The Project would have an impact on the landscape within the setting of a number of cultural features near to the A13/A1089/A122 Lower Thames Crossing junction.
Landcover	Mix of pasture and arable farmland surrounding settlement at Orsett and Baker Street.	Landcover matters at the local level.	Landcover is commonplace.	The landcover is of medium importance.	Landcover is replaceable.	Slight adverse. The Project would result in the localised loss of farmland in the west of this area.
Summary of character	A low-lying, gently undulating fen edge landscape containing a mix of large- to small-scale pasture and arable fields surrounding the historic settlement of Orsett and smaller outlying settlement of Baker Street.	The farmed landscape matters at the local level, however, cultural features matter at the national and regional level.	Landscape features are typical of the locality but cultural elements are rare.	Landscape features are of medium importance but with cultural features of high importance.	Landscape features are replaceable, however, the cultural features are not substitutable.	Slight adverse. The Project would result in localised impacts on existing landscape character and the A13/A1089/A122 Lower Thames Crossing junction would be visually intrusive on the south-west edge of this landscape.

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5- Summary assessment score

Slight adverse (negative) effect

Qualitative comments

The Project would have an adverse impact on the Orsett Lowland Farmland LLCA landscape due to the increased extent and scale of transport infrastructure near to the A13. While this predominantly farmland landscape is already influenced by the presence of transport corridors and overhead lines, the Project would be perceived as an intensification of the existing highway infrastructure.

Table 4.17 Landscape – Thurrock Reclaimed Fen

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	This description includes the LLCA sub area of Mardyke and Thames Chase within the Thurrock Reclaimed Fen. Low-lying, large-scale, flat land, associated with the upper reaches of the Mardyke. It is a predominantly open, sparsely settled arable landscape with a sense of place, remoteness and tranquillity and with expansive views. The landscape is defined by features such as former fen causeways, drainage ditches and gappy field boundary hedgerows. In the north part of the area, there is extensive woodland associated with the Thames Chase Community Forest.	The open farmland matters at the local level.	The open farmland is commonplace.	The open farmland is of medium importance.	The open arable farmland is replaceable.	Large adverse. The Project would create a prominent new linear transport corridor which would impact on the pattern of the rural farmland within the open landscape.
Tranquillity	Existing tranquillity in the north part of the area is affected by the M25 and the urban edge of Upminster. Overhead lines reduce the sense of tranquillity in Orsett Fen. Away from these influences, a sense of tranquillity is experienced within the sparsely settled arable landscape.	Tranquillity matters at the local level.	Tranquillity is commonplace away from the urban edge.	Tranquillity is of high importance at a local level.	Tranquillity is not substitutable.	Large adverse. The Project would introduce new transport infrastructure resulting in reduced tranquillity from increased visual intrusion and traffic noise along the proposed route.
Cultural	The Grade II listed Ockendon Hall and nearby Mount scheduled monument lie to the north-east of South Ockendon.	Landscape elements associated with the cultural features matter at the national level.	The cultural features are rare.	The cultural features are of high importance.	The cultural features are not substitutable.	Slight adverse. The Project would have a perceptible impact on views from listed buildings such as Ockenden Hall.
Landcover	A predominantly arable landscape with large areas of woodland within the Thames Chase Community Forest to the north. The LLCA also includes The Wilderness woodland block.	The open farmland and woodland matters at the local level.	The open farmland and woodland is commonplace.	The open farmland and woodland is of medium importance.	The open arable farmland and woodland is replaceable.	Large adverse. The Project would result in some loss of farmland and a small amount of woodland within the Thames Chase Community Forest. Part of The Wilderness woodland would be permanently removed.
Summary of character	A typically large-scale, flat, open arable, sparsely settled landscape with a strong sense of place and tranquillity, with a more wooded character in the Thames Chase Community Forest to the north. There are expansive views across the area towards the rising wooded slopes within the Brentwood Wooded Hills to the north, and the Langdon Hills to the east.	Typically, the farmed landscape matters at the local level, however, association with cultural features matters at the national scale.	Typically commonplace, but cultural features are rare.	Typically of medium importance. Cultural features are of high importance.	Typically replaceable, although cultural features are not substitutable.	Large adverse. The Project would create a prominent new linear transport corridor, which would adversely impact the character and tranquillity of the former fen landscape at Orsett Fen.

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5 - Summary assessment score

Large adverse (negative) effect

Qualitative comments

The Project would have a large adverse impact on characteristic features within the landscape of the Thurrock Reclaimed Fen LLCA sub areas, including introduction of an uncharacteristic raised road corridor crossing the flat, former fen landscape, interruption of distant views across the open landscape and a reduction in tranquillity from increased noise and visual intrusion. However, there would be a lesser level of adverse impact where the Project route follows the existing M25 corridor through the Thames Chase Community Forest area.

Table 4.18 Landscape – Belhus Lowland Quarry Farmland

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	Low-lying, mixed arable and pasture landscape. This area has historically been extensively quarried for aggregate, which is evident from the concentration of lakes to the west of the M25.	Pattern matters at the local level.	The farmland is commonplace.	The pattern is of medium importance.	The landscape pattern is replaceable.	Slight adverse. The Project would create a new linear transport corridor which would interrupt the existing landscape pattern east of the M25. However, the impact on pattern along the M25 corridor and to the west would be more limited.
Tranquillity	Existing tranquillity within the area is affected by the M25, the Upminster to Grays railway line, settlement at North Ockendon and South Ockendon, and overhead lines.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Slight adverse. The tranquillity experienced within the existing landscape is already compromised, and the Project would only result in a limited reduction in the existing sense of tranquillity.
Cultural	There is a concentration of heritage assets within the north part of this area, including the conservation areas at North Ockendon and Cranham. Former parkland is also present at Belhus Woods Country Park.	Landscape elements associated with the cultural features matter at the regional level.	The cultural features are rare.	The cultural features are of high importance.	The cultural features are not substitutable.	Slight adverse. The Project could have an impact on some views from the edge of the North Ockendon conservation area.
Landcover	A mixed arable and pasture landscape, with restored mineral workings.	Landcover matters at the local level.	Landcover is commonplace.	The landcover is of medium importance.	Landcover is replaceable.	Slight adverse. The Project would result in the loss of some arable land.
Summary of character	A low-lying, mixed arable and pasture landscape, with restored mineral workings and a concentration of heritage assets within the North Ockendon and Cranham conservation areas.	Typically, the farmed landscape matters at the local level, however, the cultural features matter at the regional level.	The farmland is commonplace, however, the cultural features are rare.	Typically medium importance, with cultural features of high importance.	Landcover is typically replaceable, however, the cultural features are not substitutable.	Slight adverse. The Project would create a new linear transport corridor, which would adversely impact the existing landscape character east of the M25. However, the impact on character would be more limited where the Project route broadly follows the M25 corridor.

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5 - Summary assessment score

Slight adverse (negative) effect

Qualitative comments

The Project would have an adverse impact on the Belhus Lowland Quarry Farmland LLCA landscape due to broadening of the M25 corridor to accommodate the Project's slip roads and introduction of a new transport corridor into the rural farmland landscape to the east of the M25. However, where the Project route broadly follows the existing M25 corridor, there would be a reduced level of impact on this LLCA.

Table 4.19 Landscape – Brentwood Wooded Hills

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	Rural pasture and arable landscape with frequent blocks of woodland. The area is bisected by the M25.	Pattern matters at the local level.	The farmland pattern is commonplace.	The farmland pattern is of medium importance.	The landscape pattern is replaceable.	Slight beneficial. Proposed woodland habitat creation would enhance existing landscape pattern and reduce the prominence of the M25.
Tranquillity	Existing tranquillity within the area is affected by the presence of the M25 corridor and other transport corridors and the urban edge of Upminster.	Tranquillity matters at the local level.	Tranquillity is rare within the locality.	Tranquillity is of medium importance at a local level.	Tranquillity is not substitutable.	Slight beneficial. Proposed woodland habitat creation would improve existing tranquillity near to the M25.
Cultural	There is a conservation area at Great Warley.	Landscape elements associated with the cultural features matter at the regional scale.	The cultural features are rare.	The cultural features are of high importance.	The cultural features are not substitutable	Slight beneficial. Proposed woodland habitat creation would enhance the historic landscape context of cultural features.
Landcover	A well-treed undulating rural pasture and arable landscape incised by small watercourses with frequent blocks of woodland. This landscape has a number of ancient woodlands, including that adjoining the M25 at junction 29 (Codham Hall Wood).	Farmland matters at a local scale. Ancient woodland matters at the national scale.	The typical landcover is commonplace, however, ancient woodland is rare.	The landcover is of medium importance. Ancient woodland is of high importance.	Landcover is replaceable, however, ancient woodland is not substitutable.	Slight adverse. The Project would have a limited localised impact on the edge of Codham Hall Wood ancient woodland. However, there would be a substantial increase in woodland cover from proposed woodland habitat creation to compensate for nitrogen deposition.
Summary of character	Rural pasture and arable landscape interspersed with frequent woodland blocks and influenced by the presence of the existing M25 corridor and junction 29, other transport corridors such as the A127 and settlement edges.	Typically, the farmed landscape matters at the local level, however, association with cultural features matters at the regional level, and ancient woodland matters at the national level.	Typically commonplace but with rare features.	Typically medium importance, with cultural features and ancient woodland of high importance	Typically replaceable. However, ancient woodland and cultural features are not replaceable.	Slight beneficial. Existing landscape character would be enhanced by proposed woodland habitat creation to compensate for nitrogen deposition, which would increase characteristic woodland cover and help integrate the M25 corridor into the landscape.

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.

Step 5- Summary assessment score

Slight beneficial (positive) effect.

Qualitative comments

The Project would result in a slight beneficial impact to the landscape character of the Brentwood Wooded Hills LLCA as a result of substantial proposed woodland habitat creation to compensate for nitrogen deposition.

Table 4.20 Landscape – summary

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Pattern	Pattern is influenced by the Thames Estuary and its associated reclaimed marsh, the chalk geology which provides notable landform features to the north and south of the river and the former fenland to the north, extending as far as the Brentwood Hills. The special components, characteristics and qualities of the Kent Downs Area of Outstanding Natural Beauty (AONB) also contribute to the landscape pattern. To the south of the Thames Estuary the landscape rises to a wooded ridgeline within the Kent Downs AONB. The slopes are gently undulating with medium-scale open arable fields. Golf and sports facilities form a notable element within this landscape. The A2 and High Speed 1 (HS1) comprise a major existing transport corridor to the south. To the north of the estuary, beyond the distinctive Chadwell escarpment, the landscape is open, with medium size arable fields with scattered farmsteads and occasional industrial buildings, interspersed with operational and former clay pits. The A13 and M25 form major transport corridors.	Kent Downs AONB matters at the national level. The open farmland at the urban edge and reclaimed marshland areas matter at the local level.	Kent Downs AONB is rare. However, the open farmland and reclaimed marshes are commonplace within the locality.	Kent Downs AONB is of high importance. The open farmland and reclaimed marshes are of mainly medium importance.	Kent Downs AONB is not substitutable. The open farmland and reclaimed marshes are replaceable.	Moderate adverse. The M2/A2 widening would increase the scale of the existing road corridor and the new M2/A2/A122 Lower Thames Crossing junction would substantially change the existing landscape pattern locally. To the north of the A2, the route would create a new linear corridor with large-scale earthworks and structures, including the deep chalk cutting of the South Portal approach road, new bridges and viaducts, which would interrupt the pattern of the rural and urban fringe landscape. The provision of a number of green bridges would help maintain a degree of landscape continuity across the Project road.
Tranquillity	Existing tranquillity is affected by the frequent visible presence of the urban edge, busy transport corridors, overhead powerlines and occasional industrial buildings, clay pits and landfill sites. A sense of tranquillity is experienced within occasional remoter pockets of the rural landscape within the Kent Downs AONB, parts of the Thames Estuary reclaimed marsh and the former fen landscape. Background urban and traffic noise are audible in most locations.	Tranquillity in the Kent Downs AONB matters at the national level. Elsewhere, tranquillity matters at the local level.	Tranquillity is rare, except in remoter pockets of the Kent Downs AONB, the reclaimed marshes south of the River Thames and the former fen landscape.	Tranquillity is of high importance in the Kent Downs AONB, the remoter pockets of the reclaimed marshes and former fen landscape. Elsewhere it is generally of medium importance.	Tranquillity is not substitutable.	Moderate adverse. Although the tranquillity experienced within the existing landscape is already compromised, the Project would introduce new transport infrastructure resulting in increased visual intrusion and traffic noise along the proposed corridor, thereby reducing some local tranquillity.
Cultural	The Project route corridor is interspersed with cultural features. There are several conservation areas (seven within or immediately adjacent to the Project) with associated listed buildings and a number of listed churches which form local landmarks. To the south, Cobham Hall and deer park is on the Register of Parks and Gardens of Special Historic Interest. To the south of the River Thames, the former marshes and settlement of Chalk have a historic association with Charles Dickens and to the north of the river, Tilbury has a historic association with Queen Elizabeth I. The River Thames, having historically been an important gateway to London, has a range of historic military defences, including scheduled monuments from the Second World War (WWII) era. Iron Age, Roman and Anglo Saxon sites are found on the north side of the river, along with Medieval halls.	Landscape elements associated with scheduled monuments, historic parks and gardens, listed buildings and their settings matter at the national level. Landscape elements associated with conservation areas and their settings matter at the regional level.	The cultural elements of high importance are rare. Grade II listed buildings occur frequently in the surrounding landscape.	There are a number of cultural features of high importance.	The cultural features of high importance are not substitutable.	Moderate adverse. The Project would result in direct impacts on landscape pattern, tranquillity and landcover within the setting of a number of the cultural features, including a historic park, scheduled monuments, listed buildings and conservation areas from the introduction of new transport infrastructure. This includes the setting to Cobham Hall Grade II* Registered Park and Garden and Thong conservation area.

Features	Step 2	Step 3				Step 4
	Description	Scale it matters	Rarity	Importance	Substitutability	Impact
Landcover	The landcover is typically arable farmland with pockets of pasture. The fields are typically bounded by hedgerows of varying condition. Other linear belts of vegetation are associated with the main transport corridors which cross the area and linear shelter belts in the environs of South Ockendon Hall. Woodland is sporadic and is typically associated with recreational areas, such as the Thames Chase Community Forest in the north and the AONB in the south. Some of the woodland cover is ancient woodland which is an irreplaceable habitat. Other notable tree cover is associated with golf courses.	Ancient woodland matters at the national level. Other landcover matters at the local level.	Ancient woodland is rare. Elsewhere landcover is commonplace.	Ancient woodland is of high importance. Elsewhere landcover is generally of medium importance.	Ancient woodland is not substitutable. Elsewhere landcover is replaceable.	Moderate adverse. The Project would result in a notable loss of open farmland and a limited loss of ancient woodland. It would also result in the loss of woodland, including within Thames Chase Community Forest. However, substantial areas of woodland planting would in time help to mitigate the removal of existing trees and woodland to facilitate construction of the Project.
Summary of character	The landscape character is strongly influenced by the Thames Estuary. To the north, beyond the Chadwell escarpment and open arable land, the landscape is influenced by former fenland. Tranquillity is typically affected by adjacent urban areas, major transportation corridors and overhead power lines, although a sense of tranquillity is experienced within the remoter parts of the landscape. Occasional golf courses contrast with the typically open arable landscape. Woodland cover with a more enclosed character is associated with the Thames Chase Community Forest in the north and the Kent Downs AONB in the south.	The Kent Downs AONB and its setting, together with the setting of cultural features and ancient woodland, matter at the national level.	The Kent Downs AONB, the military defences of the River Thames and ancient woodland are rare.	The Kent Downs AONB and its setting, the setting of cultural features, and ancient woodland are of high importance.	The features of high importance are not substitutable.	Moderate adverse. The widening of the M2/A2 would reduce the extent to which the existing road corridor is integrated into the Kent Downs AONB landscape and the M2/A2/A122 Lower Thames Crossing junction would have some indirect impact on the landscape character of the AONB. To the north of the A2, the Project would introduce a major new transport corridor resulting in a direct impact on the pattern, tranquillity and landcover of the non-designated landscape within the setting of the AONB and further to the north. The impact on landscape character would be most apparent within the flat, open landscape of Orsett Fen, where the new road would contrast with the existing landscape. To the north, the change in landscape character would be less apparent where the Project route follows the existing M25 motorway corridor and where the frequency of existing woodland helps to integrate the new road into the landscape.

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
Kent County Council covering area of Dartford Borough Council (2004). The Landscape Assessment of Kent.
Kent Downs AONB Unit (2020). Landscape Character Assessment Update, Draft.
ES Chapter 7: Landscape and Visual (Application Document 6.1).
Natural England (2013). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study.

Step 5 - Summary assessment score

Moderate adverse (negative) effect

Qualitative comments

The Project would impact on nationally, regionally and locally valued features. Initially, the Project would follow the existing M2/A2, resulting in an intensification of the existing busy road corridor within the Kent Downs AONB. The new M2/A2/A122 Lower Thames Crossing junction would introduce a substantial new uncharacteristic feature into the setting of the AONB, beyond which the Project route would continue in deep cutting across the chalk farmland, thereby limiting some wider impacts on landscape character. The proposed Chalk Park adjoining the South Portal and associated new wooded hilltop landform would provide an attractive area of open space on the eastern edge of Gravesend. Impact on the reclaimed marshland south of the River Thames would be avoided by placing the route in a tunnel, emerging on the north side of the river at Tilbury Marshes. A new open space around the North Portal would include landmark sculptural landscape mounding on the north bank of the river. To the north of the North Portal, the Project route would cross urban fringe landscape between East Tilbury and Chadwell St Mary to a new junction with the A13, which would notably increase the scale of the existing junction. Beyond the new A13/A1089/A122 Lower Thames Crossing junction, the Project route would continue on embankment, in contrast with the flat, low-lying landscape of Thurrock Reclaimed Fen, before joining the existing M25 corridor. The Project would result in some intensification of the existing M25 motorway corridor near to North Ockendon and the Thames Chase Forest Centre, although the impacts on landscape character would be mainly beneficial to the north of junction 29 of the M25. Although the Project would result in some large to moderate localised impacts, the extensive mitigation proposals, including false cuttings, new planting, green bridges and restoration of land used temporarily during construction, would help to mitigate effects by screening views of the new road and traffic using it and by reinstating features removed to facilitate construction wherever practicable, in order to integrate the new road into the surrounding landscape. The overall impact of the Project would therefore be Moderate Adverse.

4.5 Townscape

4.5.1 The townscape worksheet is divided into the following sections which represent the urban areas impacted by the Project:

a. Thong

b. Riverview Park

c. Low Street

d. Baker Street

e. North Ockendon

f. Summary

4.5.2 Plate 4.6 shows these urban areas on a map.

4.5.3 The impact of the Project on each urban area is appraised in terms of the area's features, which comprise its:

a. Layout

b. Density and mix

c. Scale

d. Appearance

e. Human interaction

f. Cultural

g. Summary of character.

4.5.4 Each of these features is described in respect of its:

a. Geographical Scale

b. Rarity

c. Importance

d. Substitutability

e. Changes in Without Scheme case

f. The impact of the Project and given an assessment score taking account of all committed mitigation.

4.5.5 An overall Summary Assessment Score and qualitative comments are also provided. These form the basis of the townscape information included in the AST.

Plate 4.6 Townscape areas

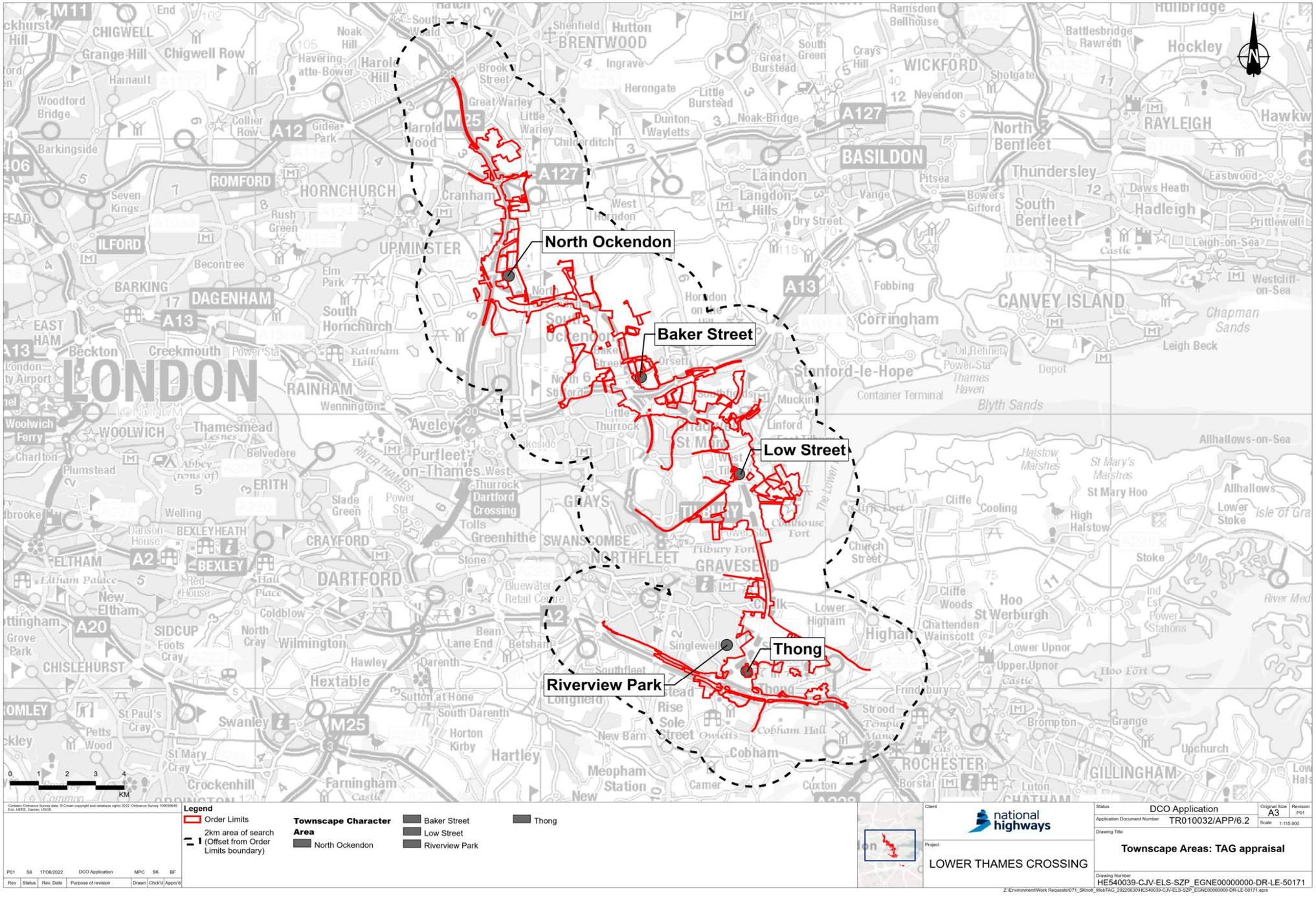

Table 4.21 Townscape – Thong

Features	Step 2	Step 3					Step 4
	Description	**Geographical scale**	**Rarity**	**Importance**	**Substitutability**	**Changes in Without Scheme case**	**Impact**
Layout	This townscape area is characterised by ribbon development along a rural lane.	Matters at the regional scale	Layout is rare	Layout is important at the regional scale	Layout is replaceable	Potential change due to pressure of modifications to historic built form and new development	Moderate adverse. While the Project would not impact the layout of the townscape area it would be visually intrusive from the edge adversely affecting the setting of this rural settlement.
Density and mix	Low density (rural) residential development along Thong Lane. Occasional medium density in the form of agricultural barns/sheds and farmhouses.	Matters at the local scale	Density and mix is rare	Density and mix residential important at the local scale	Density and mix residential replaceable	Potential change due to pressure of modifications to historic built form and new development	Moderate adverse. While the Project would not impact the density of the townscape area it would be visually intrusive from the edge adversely affecting the setting of this rural settlement.
Scale	Typically small scale two/three storey dwellings fronting Thong Lane with limited front curtilage, and a narrow rural lane, however this is set within an open landscape.	Matters at the regional scale	Scale is rare	Scale is important at the regional scale	Scale is replaceable	Potential change due to pressure of modifications to historic built form and scale of settlement	Moderate adverse. While the Project would not impact the density of the townscape area it would be visually intrusive from the edge adversely affecting the setting of this rural settlement.
Appearance	A locally distinctive mix of rural residential buildings. Developed around three historic farmhouses and their agricultural buildings and yards, it extends to include a historically and architecturally interesting planned early 20th century smallholding settlement. Seen from the wide, flat, windswept arable fields to the west, the backs of the village buildings and enclosures, strung out along the road and of varying degrees of visual complexity and attractiveness, seem almost ‘islanded’ in a wider landscape.	Matters at the regional scale	Appearance is rare	Appearance is important at the regional scale	Appearance is not replaceable	Potential change of appearance due to weakening of defined edge from wider landscape or damage to existing facades/built form with lack of maintenance	Large adverse. While the Project would not impact the density of the townscape area it would be visually intrusive from the edge adversely affecting the setting of this rural settlement.
Human interaction	Two PRoWs cross Thong Lane, however human interaction is typically limited due to the lack of pedestrian access to and from Thong Village, and the nature of the winding road and vehicular priority.	Matters at the local scale	Human interaction is commonplace	Human interaction is of low importance at the local scale	Human interaction is replaceable	Potential change to the human interaction through removal of traffic from rural lane	Slight beneficial. The Project would positively impact human interaction with the settlement with improvement to access from the north, however there would be damage through the loss of PRoW connections to the west.

Features	Step 2	Step 3					Step 4
	Description	**Geographical scale**	**Rarity**	**Importance**	**Substitutability**	**Changes in Without Scheme case**	**Impact**
Cultural	This comprises a designated conservation area (Thong) with a Grade II listed building – White Horse Cottage	Matters at the regional scale	Cultural is rare at a local level	Cultural features are important at the regional scale	Cultural features are not replaceable	No change	Large adverse. The Project would adversely affect the setting of this conservation area.
Summary of character	A locally distinctiveness mix of rural residential buildings and ribbon development along Thong Lane. This forms a Conservation Area and is observable from the surrounding undulating arable fields to the west, which forms part of its setting.	Scale typically matters at the local level	Typically rare	Townscape character is of importance at the regional scale	Townscape character is typically replaceable	N/A	Large adverse to Slight beneficial

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
Google Maps satellite photography.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
Kent County Council covering area of Dartford Borough Council (2004). The Landscape Assessment of Kent.
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Natural England (2013a). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
Natural England (2013b). NCA 81 Greater Thames Estuary.
Natural England (2013c). NCA 111 Northern Thames Basin.
Natural England (2013d). NCA 119 North Downs.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study

Step 5- Summary assessment score

Large adverse (negative) effect

Qualitative comments

The Project route is located within Green Belt with the new junction at the A2, located to the south-west. This new infrastructure would adversely affect the townscape due to its associations with the surrounding rural and the setting of the Conservation Area where there would be a major change on physical and perceptual qualities and characteristics, including their setting.

Table 4.22 Townscape – Riverview Park

Features	Step 2	Step 3					Step 4
	Description	Geographical scale	Rarity	Importance	Substitutability	Changes in Without Scheme case	Impact
Layout	This townscape area is characterised by suburban estate style development of the mid-20th century.	Matters at the local scale	Layout is commonplace	Layout is important at the local scale	Layout is replaceable	No change	Neutral. The Project would not impact the layout of the townscape area.
Density and mix	Low to medium density (suburban) residential development.	Matters at the local scale	Density and mix is rare	Density and mix residential important at the local scale	Density and mix residential replaceable	No change	Neutral. The Project would not impact the density of the townscape area.
Scale	Typically small scale two/three storey dwellings.	Matters at the regional scale	Scale is rare	Scale is important at the regional scale	Scale is replaceable	No change	Neutral. The Project would not impact the scale of the townscape area.
Appearance	Typically ordinary quality architecture with a limited sense of place. Local features of good quality such as the surrounding landscape setting and wooded ridgeline within the Kent Downs Area of Outstanding Natural Beauty (AONB) provide local interest.	Matters at the regional scale	Appearance is rare	Appearance is important at the regional scale	Appearance is not replaceable	No change	Moderate adverse. The Project would not impact the appearance of the townscape area, however, it would significantly weaken its setting with loss of arable farmland and introduction of new infrastructure within the setting of the Kent Downs AONB.
Human interaction	High levels of human interaction, especially around key services, including local shops and the Cascades leisure centre/Southern Valley Golf Course, with good pedestrian access to and from the surrounding rural landscape through a series of PRoWs.	Matters at the local scale	Human interaction is commonplace	Human interaction is of low importance at the local scale	Human interaction is replaceable	No change	Neutral. The Project would impact human interaction with the settlement with loss of east-west connections and recreational features, however there would be new open space and improvements to pedestrian access along Thong Lane to access the Kent Down AONB.
Cultural	N/A	N/A	N/A	N/A	N/A	No change	Neutral
Summary of character	A typically indistinctiveness mix of mid-20th century suburban estate style residential buildings.	Scale typically matters at the local level	Typically rare	Townscape character is of importance at the regional scale	Townscape character is typically replaceable	N/A	Slight Adverse

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2022a). TAG Unit A3 Environmental Impact Appraisal.
Google Maps satellite photography.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
Kent County Council covering area of Dartford Borough Council (2004). The Landscape Assessment of Kent.
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Natural England (2013b). NCA 81 Greater Thames Estuary.
Natural England (2013c). NCA 111 Northern Thames Basin.
Natural England (2013d). NCA 119 North Downs.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study

Step 5 – Summary assessment score

Slight Adverse

Qualitative comments

The Project route is located within Green Belt including the new junction at the A2 located to the south-east, and the South Portal and approach cutting slopes to the east. This new infrastructure would adversely affect the townscape due to its associations with the surrounding rural landscape where there would be a major change on physical and perceptual qualities and characteristics, including new landforms.

Table 4.23 Townscape – Low Street

Features	Step 2	Step 3					Step 4
	Description	Geographical scale	Rarity	Importance	Substitutability	Changes in Without Scheme case	Impact
Layout	This is a rural settlement within a historic rural agricultural setting, with farm buildings and cottages nucleated around the road junction of Church Road with Low Street Lane. Low Street Lane is now closed to vehicles at the north edge of the Conservation Area.	Matters at the regional scale	Layout is rare	Layout is important at the regional scale	Layout is replaceable	Potential change due to pressure of modifications to historic built form and new development	Moderate adverse. While the Project (and viaduct structure) would not impact the layout of the townscape area it would be visually intrusive from the edge adversely affecting the setting of this rural settlement.
Density and mix	Low density (rural) residential settlement compromising a mix of typologies and aged properties. Occasional medium density in the form of agricultural barns/sheds and farmhouses.	Matters at the local scale	Density and mix is rare	Density and mix residential important at the local scale	Density and mix residential replaceable	Potential change due to pressure of modifications to historic built form and new development	Moderate adverse. While the Project (and viaduct structure) would not impact the density of the townscape area it would be visually intrusive from the edge adversely affecting the setting of this rural settlement.
Scale	Typically small scale two/three storey dwellings.	Matters at the regional scale	Scale is rare	Scale is important at the regional scale	Scale is replaceable	Potential change due to pressure of modifications to historic built form and scale of settlement	Moderate adverse. While the Project (and viaduct structure) would not impact the density of the townscape area it would be visually intrusive from the edge adversely affecting the setting of this rural settlement.
Appearance	The built form is of high quality comprising a mix of 17th, 19th and 20th century farmhouses, buildings and cottages of timber and brick materials. There are wide views to and from the former marshes to the south and west and from the north and east across the agricultural land. The church tower and trees around the churchyard are an important silhouette and landmark from all directions.	Matters at the regional scale	Appearance is rare	Appearance is important at the regional scale	Appearance is not replaceable	Potential change of appearance due to damage to existing facades/built form with lack of maintenance	Large adverse. While the Project (and viaduct structure) would not impact the density of the townscape area it would be visually intrusive from the edge adversely affecting the setting of this rural settlement.
Human interaction	Human interaction is typically limited due to the lack of pedestrian access to and from West Tilbury, however the presence of the Green and the Great Common Field and Public House provides local features of particular benefit.	Matters at the local scale	Human interaction is commonplace	Human interaction is of low importance at the local scale	Human interaction is replaceable	Potential change to the human interaction through removal of traffic from rural lanes	Neutral
Cultural	This comprises a designated conservation area (Low Street – West Tilbury) which forms part of the larger West Tilbury Conservation Area. West Tilbury has a well-chronicled association with Elizabeth I. There is a scheduled	Matters at the regional scale	Cultural features are rare at a local level	Cultural features are important at the regional scale	Cultural features are not replaceable	No change	Large adverse. The Project would adversely affect the setting of this conservation area.

Features	Step 2	Step 3					Step 4
	Description	Geographical scale	Rarity	Importance	Substitutability	Changes in Without Scheme case	Impact
	monument and there are a number of listed buildings.						
Summary of character	A locally distinctiveness nucleated settlement comprising a mix of rural residential buildings and cottages. This forms a Conservation Area and is observable from the surrounding marshland landscape.	Scale typically matters at the local level.	Typically rare	Townscape character is of importance at the regional scale	Townscape character is typically replaceable	N/A	Moderate adverse

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2019). TAG Unit A3 Environmental Impact Appraisal.
Google Maps satellite photography.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
Kent County Council covering area of Dartford Borough Council (2004). The Landscape Assessment of Kent.
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Natural England (2013d). NCA 119 North Downs.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study

Step 5 – summary assessment score

Moderate adverse

Qualitative comments

The Project route is located within Green Belt with the new junction Tilbury Viaduct a visually prominent feature located to the east within the setting of the West Tilbury Conservation Area. This new infrastructure would adversely affect the townscape due to its associations with the surrounding rural and the setting of the Conservation Area where there would be a major change on physical and perceptual qualities and characteristics.

Table 4.24 Townscape – Baker Street

Features	Step 2	Step 3					Step 4
	Description	Geographical scale	Rarity	Importance	Substitutability	Changes in Without Scheme case	Impact
Layout	This townscape area is characterised by ribbon development along a semi-rural/urban edge road.	Matters at the local scale	Layout is commonplace	Layout is important at the local scale	Layout is replaceable	Potential change due to pressure of new development	Moderate adverse. The Project would impact the southern edge of the townscape area, resulting in direct impacts to the layout with removal of built form and introduction of a visually intrusive structure above Baker Street.
Density and mix	Low density (rural) residential development along Baker Street. Occasional medium density in the form of agricultural buildings and farmhouses.	Matters at the local scale	Density and mix is commonplace	Density and mix residential important at the local scale	Density and mix is replaceable	Potential change due to pressure of new development	Moderate adverse. The Project would impact the southern edge of the townscape area, resulting in direct impacts to the density of development with removal of built form and introduction of a visually intrusive structure above Baker Street.
Scale	Typically small scale two/three storey dwellings fronting Baker Street.	Matters at the local scale	Scale is rare	Scale is important at the regional scale	Scale is replaceable	Potential change due to pressure of new development	Slight adverse. The Project would impact the southern edge of the townscape area, resulting in direct impacts to the scale with the introduction of a visually intrusive structure above Baker Street, although this is of similar nature to the A13 structures.
Appearance	A locally distinctive mix of urban edge residential buildings.	Matters at the local scale	Appearance is rare	Appearance is important at the regional scale	Appearance is not replaceable	Potential change due to pressure of new development	Moderate adverse. The Project would impact the southern edge of the townscape area, resulting in direct impacts to the appearance with removal of built form and introduction of a visually intrusive structure above Baker Street.
Human interaction	Assumed typically low levels of pedestrian activity along Baker Street, although the Stables, Public House and connection to the PRoW network to the east is likely to result in some degree of interaction.	Matters at the local scale	Human interaction is commonplace	Human interaction is of low importance at the local scale	Human interaction is replaceable	Potential change due to pressure of new development	Moderate adverse. The Project would impact the southern edge of the townscape area, resulting in increased lengths of sub-structures walkers would pass through travelling south.
Cultural	This includes a Grade II listed mill on Baker Street, which is a local landmark. There is a scheduled monument within arable fields to the west of Baker Street.	Matters at the regional scale	Cultural is rare at a local level	Cultural features are important at the regional scale	Cultural features are not replaceable	No change	Moderate adverse. The Project would impact the western edge of the setting of this designated asset.

Features	Step 2	Step 3					Step 4
	Description	Geographical scale	Rarity	Importance	Substitutability	Changes in Without Scheme case	Impact
Summary of character	A locally distinctive mix of urban edge residential buildings, including the Grade II listed mill on Baker Street, which is a local landmark.	Scale typically matters at the local level	Typically rare	Townscape character is of importance at the regional scale	Townscape character is typically replaceable	N/A	Moderate adverse. The Project would impact the southern edge of the townscape area, resulting in direct impacts with removal of built form and introduction of a visually intrusive structure above Baker Street.

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2019). TAG Unit A3 Environmental Impact Appraisal.
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Thurrock Council (2005). Thurrock Landscape Capacity Study

Step 5 – summary assessment score

Moderate adverse (negative) effect

Qualitative comments

The Project route is located within Green Belt with the new highway located immediately to the west and modification to the A13, with new slip roads and structures, located to the south. This new infrastructure would adversely affect the townscape due to its proximity, demolition of built form and impacts on the setting of the listed building.

Table 4.25 Townscape – North Ockendon

Features	Step 2	Step 3					Step 4
	Description	Geographical scale	Rarity	Importance	Substitutability	Changes in Without Scheme case	Impact
Layout	North Ockendon is one of the few remaining villages in Havering which has not been extended or engulfed by nearby urban areas. The impression of rural isolation has contributed to the quality of the setting of the seven listed buildings, particularly those in the Church Lane area; the church, St Mary Magdalene, is a Grade I listed building. The historic pattern of development – two hamlets linked by an old trackway across fields – and the atmosphere of rural calm gives the area its special character.	Matters at the regional scale	Layout is rare	Layout is important at the regional scale	Layout is replaceable	Potential change due to pressure of modifications to historic built form	Slight adverse. The Project would impact the southern and western edge of the townscape area, resulting in direct impacts to the setting of the arable fields.
Density and mix	The Grade I listed church and Grade II listed rectory and the adjoining housing development form a separate nucleated group, close to the moat and Grade II listed garden wall which are the only remains of 16th century North Ockendon Hall.	Matters at the local scale	Density and mix is rare	Density and mix residential important at the local scale	Density and mix residential replaceable	Potential change due to pressure of modifications to historic built form	Slight adverse. The Project would impact the southern and western edge of the townscape area, resulting in direct impacts to the setting of the arable fields.
Scale	Typically small scale two/three storey dwellings.	Matters at the regional scale	Scale is rare	Scale is important at the regional scale	Scale is replaceable	Potential change due to pressure of modifications to historic built form and scale of settlement	Slight adverse. The Project would impact the southern and western edge of the townscape area, resulting in direct impacts to the setting of the arable fields.
Appearance	A locally distinctiveness rural settlement. The Conservation Area is surrounded by mainly open farmland, with scattered farms down narrow tracks.	Matters at the regional scale	Appearance is rare	Appearance is important at the regional scale	Appearance is not replaceable	Potential change of appearance due to weakening of defined edge from wider landscape or damage to existing facades/built form with lack of maintenance	Moderate adverse. The Project would impact the southern and western edge of the townscape area, resulting in direct impacts to the setting of the arable fields.
Human interaction	The impression of rural isolation has contributed to the quality of the setting of the seven listed buildings, particularly those in the Church Lane area; the church, St Mary Magdalene, is a Grade I listed building. Trackways and several PRoWs link through the townscape area.	Matters at the local scale	Human interaction is commonplace	Human interaction is of low importance at the local scale	Human interaction is replaceable	Potential change to the human interaction through removal of traffic from rural lane	Neutral

Features	Step 2	Step 3					Step 4
	Description	Geographical scale	Rarity	Importance	Substitutability	Changes in Without Scheme case	Impact
Cultural	The listed buildings within the Conservation Area at Grade II are: Russell Cottage, Kilbro, The Old Bakehouse, No.7 Castle Cottages, The Forge and The Rectory. The Church of St Mary Magdalene is listed Grade I.	Matters at the regional scale	Cultural is rare at a local level	Cultural features are important at the regional scale	Cultural features are not replaceable	No change	Moderate adverse. The Project would impact the western edge of the setting of this designated asset.
Summary of character	A locally distinctive rural settlement comprising a Conservation Area with listed buildings, surrounded by mainly open farmland.	Scale typically matters at the local level	Typically rare	Townscape character is of importance at the regional scale	Townscape character is typically replaceable	N/A	Moderate adverse. The Project would impact the southern and western edge of the townscape area, resulting in direct impacts to the setting of the arable fields.

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2019). TAG Unit A3 Environmental Impact Appraisal.
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Natural England (2013d). NCA 119 North Downs.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study

Step 5 – summary assessment score

Moderate adverse (negative) effect

Qualitative comments

The Project route is located within Green Belt with the new junctions with the M25 located to the south within the setting of the North Ockendon Conservation Area. This new infrastructure would adversely affect the townscape due to its associations with the surrounding rural landscape and the setting of the conservation area where there would be a change on perceptual qualities and characteristics.

Table 4.26 Townscape – summary

Features	Step 2	Step 3					Step 4
	Description	Geographical scale	Rarity	Importance	Substitutability	Changes in Without Scheme case	Impact
Layout	Urban edge/rural settlements	Regional/local	Slightly rare	Important at regional scale	Generally replaceable	Some change due to pressure of new development	Slight adverse
Density and mix	Low/medium	Local	Rare	Important at local scale	Important at local scale	Some change due to pressure of new development	Moderate adverse
Scale	Small scale two/three storey dwellings	Regional/local	Rare	Important at regional scale	Replaceable	Some change due to pressure of new development	Moderate adverse
Appearance	Variable but generally locally distinctive	Regional	Rare	Important at regional scale	Not replaceable	Some change due to pressure of new development	Moderate adverse
Human interaction	Variable but generally low	Local	Commonplace	Low importance	Replaceable	Some change due to pressure of new development	Neutral
Cultural	Some conservation areas and listed buildings	Regional	Rare at a local level	Important at regional scale	Not replaceable	Some change due to pressure of new development	Moderate adverse
Summary of character	Mostly locally distinct	Local	Rare	Important at regional scale	Replaceable	N/A	Moderate adverse

Reference sources

Alison Farmer Associates (2016). Land of the Fanns Landscape Character Assessment.
Department for Transport (2019). TAG Unit A3 Environmental Impact Appraisal.
Google Maps satellite photography.
Gravesham Borough Council (2009). Gravesham Landscape Character Assessment.
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Natural England (2013a). Multi-Agency Geographic Information for the Countryside (MAGIC). Magic.gov.uk.
Natural England (2013b). NCA 81 Greater Thames Estuary.
Natural England (2013c). NCA 111 Northern Thames Basin.
Natural England (2013d). NCA 119 North Downs.
OS Maps.
Thurrock Council (2005). Thurrock Landscape Capacity Study

Step 5 – summary assessment score

Moderate adverse (negative) effect

Qualitative comments

The Project route is typically located within Green Belt and along existing trunk roads including road widening to the A2 and M25 corridors, and new junctions with the A2, A13 and M25. This new infrastructure would adversely affect a range of defined townscape areas due to their associations with the surrounding rural landscapes. This has been discussed within impacts on landscape character. In addition, the historic townscape character of the rural settlements at Thong to the south of the River Thames, and West Tilbury, Baker Street and North Ockendon to the north of the River would be adversely impacted due to their proximity to the Project, and that these settlements are designated conservation areas where there would be a major change on physical and perceptual qualities and characteristics including their setting. Overall the effects of the Project are considered to be Moderate Adverse

4.6 Water environment

4.6.1 The water environment worksheet is divided into the following sections which represent the areas impacted by the Project:

a. River Thames

b. Mardyke

c. Minor watercourses and drainage ditches at the Thames Estuary and Marshes Ramsar site and South Thames Estuary and Marshes Site of Special Scientific Interest (SSSI)

d. Watercourses and drainage ditches north of the River Thames (including the West Tilbury Main system and Gobians Sewer – Environment Agency Main Rivers)

e. Lakes and ponds

f. Groundwater and Groundwater Dependent Terrestrial Ecosystems (GWDTEs) north of the River Thames

g. Groundwater and GWDTEs south of River Thames

h. River Thames Flood Zone 2/3 and associated defences

i. Mardyke Flood Zone 2/3 and associated defences

Floodplains and riparian zones surrounding Main Rivers, Ordinary Watercourses, land drains and ditches, and areas of wetland

4.6.2 Plate 4.7 shows these areas on a map.

4.6.3 The impact of the Project on each water environment receptor is appraised by assigning importance (value), after consideration of the receptors:

a. Features

b. Quality

c. Scale

d. Rarity

e. Substitutability

4.6.4 The magnitude of the impact of the Project is given an assessment score taking account of all committed mitigation. The overall significance of the impact is assigned.

4.6.5 An overall Summary Assessment Score and qualitative comments are provided. These form the basis of the water environment information included in the AST.

Plate 4.7 Water environment areas

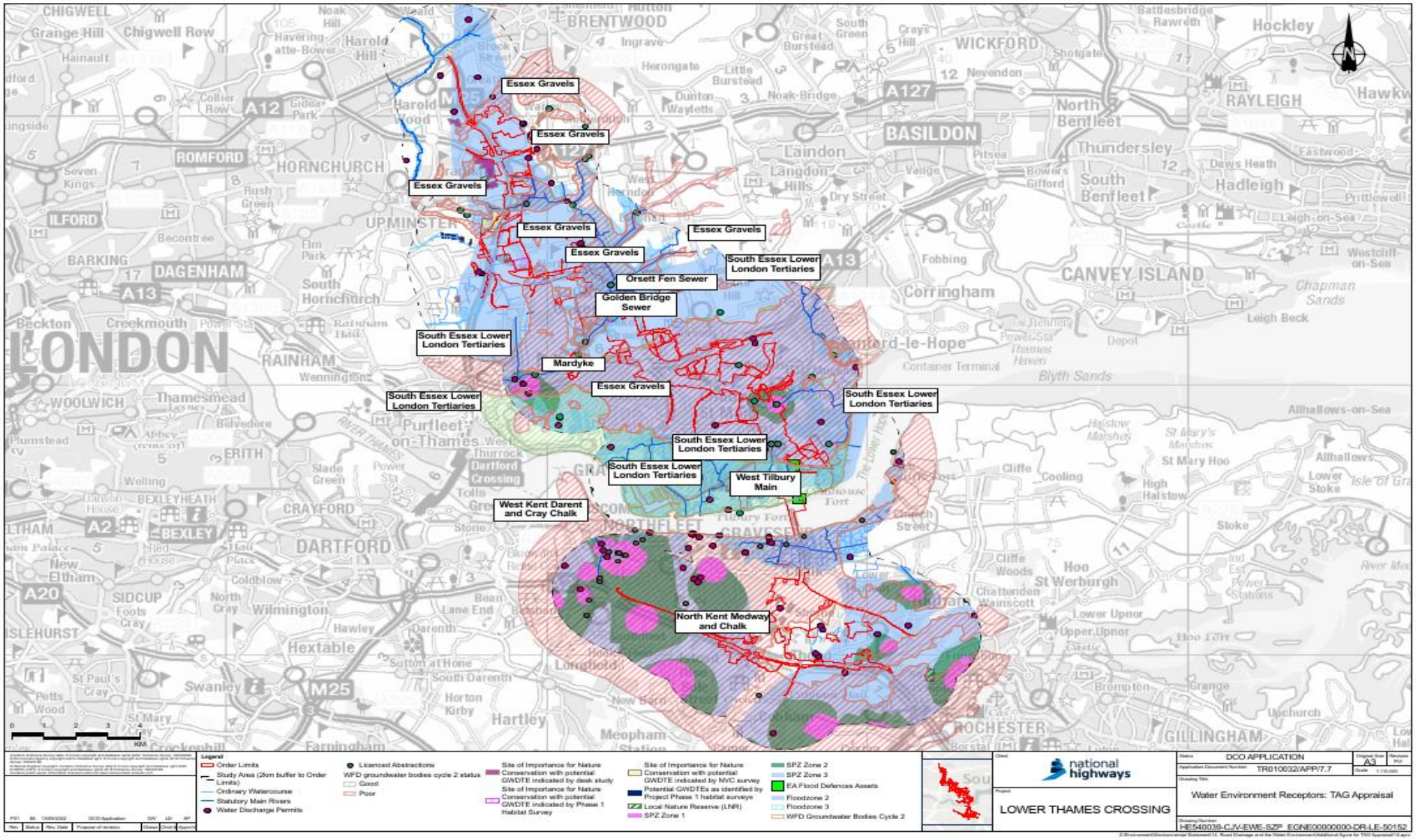


Table 4.27 Water Environment worksheet

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
Study area: River Thames									
Potential Impacts: Morphological and hydrodynamic changes to the River Thames due to discharge pipes/outfalls and a tidal gate structure.	River Thames Estuarine / transitional waters (Water Framework Directive (WFD) Waterbody Thames Middle) ID No: GB530603911402.	Water supply / biodiversity / transport / dilution of waste products / recreation / aesthetics / cultural heritage / value to economy / navigation.	High - Marine Conservation Zone upstream of Project crossing location. Heavily modified water body at Moderate ecological potential and failing chemical status. Important river of national significance with commercial and social value, including depository for effluent discharges, abstraction of water supply, recreation and navigation. South Thames Estuary and Marshes SSSI and Ramsar site to south.	Regional / National (excludes biodiversity considerations) .	Rare.	Not feasible.	Very High.	Negligible scour protection is not required for the tunnels due to design incorporating significant depth of cover between the tunnel crest and riverbed, outfalls discharging mid channel and very small footprint of the new tidal gate structure.	Low significance.
Receipt of discharges from North Portal groundwater control operations at the northern tunnel entrance construction compound and from the surface water drainage system at the southern tunnel entrance construction compound.								Negligible Assuming appropriate treatment of effluents prior to discharge.	Insignificant.
Study area: Mardyke									
Potential Impacts: Morphological and hydrodynamic changes to the Mardyke and associated watercourses due to crossings, viaducts, embankments and other structures in the flood plain.	Mardyke WFD water body ID GB106037028200 and its Main River tributaries (Orsett Fen Sewer and Golden Bridge Sewer).	Water supply / biodiversity / transport & dilution waste products / recreation.	High – water body included in Thames River Basin Management Plan (RBMP) (currently at Moderate ecological status and Failing chemical status). Water available for abstraction licensing, subject to limitations (Roding Beam Ingrebourne and Mardyke Abstraction Licencing Strategy). Q95 flow of > 0.01 m3/s but less than 1 m3/s.	Regional (ref WFD water body status).	Moderately Rare	Not feasible.	High.	Minor Adverse Crossing with viaduct (clear span) and losses of floodplain storage compensated for. No requirement for diversion or culverting.	Insignificant.
Potential Impacts: Discharge of routine runoff and spillage risk during operation of the new road.								Negligible Highways England Water Risk Assessment Tool (HEWRAT) assessment results confirm the proposed treatment measures for road drainage are effective, all outfalls achieve Environmental Quality Standards (EQS) compliance and pass for sediments and chronic pollution. Risk of an accidental spill causing pollution is within the acceptable threshold.	Insignificant.

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
Potential Impacts: Morphological and hydrodynamic changes to the Mardyke West Tributary and associated watercourses due to crossings, viaducts, embankments and other structures in the flood plain.	Mardyke West Tributary WFD water body ID GB106037028080.	Water supply / biodiversity / transport & dilution waste products / recreation.	Medium – water body included in Thames RBMP currently at Moderate ecological potential, with a failing chemical status. Water available for abstraction licensing, subject to limitations (Roding Beam Ingrebourne and Mardyke Abstraction Licensing Strategy). Q95 flow >0.001m3/s but <0.01m3/s.	Regional (ref WFD water body status).	Moderately Rare.*	Not feasible.	Medium.	Minor Adverse Widening of an existing bridge and one new crossing required. Crossings of suitable design and compensation provided for floodplain storage loss.	Insignificant.
Potential Impacts: Discharge of routine runoff and spillage risk during operation of the new road.								Negligible - HEWRAT assessment results confirm that the proposed treatment measures for road drainage are effective, all outfalls achieve EQS compliance and pass for sediments and chronic pollution. Risk of an accidental spill causing pollution is within the acceptable threshold.	Insignificant
Study area: Minor watercourses and drainage ditches at the Thames Estuary and Marshes Ramsar and South Thames Estuary and Marshes SSSI sites (excluding the River Thames and Medway canal)									
Potential Impacts: Morphological and hydrological changes to minor watercourses and drainage networks.	Minor watercourses and drains of Shorne, Eastcourt, Great Clane Lane and Filborough Marshes. South Thames Estuary and Marshes SSSI and Thames Estuary and Marshes Ramsar site, including the Denton New Cut.	Biodiversity / recreation / amenity / water supply.	High - support rare and notable macroinvertebrates and macrophytes.	Local.	Rare.	Limited feasibility.	High.	Negligible Modelling studies demonstrate that the bored tunnel section has no impact on surface watercourses or the hydrological regime that supports the Thames Estuary and Marshes Ramsar site and SSSI.	Insignificant.
Potential Impacts: Discharge of routine runoff and spillage risk during operation of the new road via infiltration drainage features.								Negligible Modelling studies demonstrate that infiltration of highway runoff to ground represents a low pollution risk to surface waters.	Insignificant.
Study area: Watercourses and drainage ditches north of the River Thames (including Tilbury Main system and Gobians Sewer - EA Main Rivers)									
Potential Impacts: Morphological changes to drainage networks due to new crossings and diversions.	Watercourses and drainage ditches at East Tilbury Marshes.	Biodiversity / flow conveyance and storage.	Medium - supports macro-invertebrate communities assigned county level value, minor coarse fish species and eel. Relatively large catchment draining to the River Thames via West Tilbury Main and the Bowaters Sluice.	Local.	Common	Limited feasibility.	Medium.	Minor Adverse New crossing (culvert) and diversions would be constructed in accordance with best practice design standards. Removal of existing culverts to the benefit of biodiversity and flow conveyance.	Insignificant.
Potential Impacts: Discharge of routine runoff and spillage risk during operation of the new road.								Negligible HEWRAT assessment results confirm the proposed treatment measures for road runoff are effective, all outfalls achieve	Insignificant.

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
								Environmental Quality Standards (EQS) compliance and pass for sediment and chronic pollution. Risk of an accidental spill causing pollution is within the acceptable threshold.	
Study area: Lakes and Ponds									
Potential Impacts: Loss of or other physical impact on standing water bodies.	Standing water features (natural and manmade) on land to north and south of the River Thames including ponds and lakes and standing water in marsh areas.	Biodiversity / recreation / amenity / water supply (storage reservoirs supporting agricultural irrigation systems).	Low to Medium - some water bodies support protected ecological species and some support agricultural water supplies.	Local.	Common.	Feasible to reprovide.	Medium.	Negligible Where a natural pond would be removed as part of the construction of the Project, this would be replaced on a 1:1 ratio (except ponds providing habitat for great crested newts where a 2:1 ratio would be applied.	Insignificant.
Potential Impacts: Routine runoff and spillage risk during operation of the new road.								Negligible There would be no discharges of highway drainage to standing waters, in accordance with best practice.	Insignificant.
Study area: Groundwater and GWDTEs north of River Thames									
Potential Impact: Impact on groundwater quality from potentially polluting surface activities/highway drainage to infiltration basins and swales. Potential for saline intrusion. Potential impact on groundwater flow from temporary dewatering of cuttings, deep soil mixing, tunnels and North/South Portals during construction and permanent dewatering/drainage of these features (if required), temporary or permanent changes to groundwater recharge quantities/patterns, disruption to natural groundwater flow by	South Essex Thurrock Chalk (GB40601G401100).	Water Framework Directive (WFD) water body status; water supply/ resources; groundwater dependent ecosystems; groundwater flow/quality.	High - Poor overall WFD water body status. Source Protection Zones 2 and 3 (Linford East Tilbury) and local commercial/industrial /agricultural licenced supplies. The Abstraction Licencing Strategy indicates that no water is available for further abstraction (Environment Agency 2019).	Regional (ref WFD water body status).	Rare (restricted water availability).	Not feasible.	High (based on resource availability, WFD target status of Good).	Hydrogeological modelling shows Minor Adverse to Negligible effects with a suite of mitigation measures in place and saline intrusion potentially induced by dewatering at the North Portal could be managed to limit any changes to a negligible magnitude. No drainage to ground is proposed.	Low significance.
	Essex gravels (GB40503G000400).	WFD water body status; water supply / resources; groundwater dependant ecosystems; groundwater flow/quality.	Medium - WFD water body status (current poor, target good). Local commercial /industrial/agricultural licenced supplies.	Regional (ref WFD water body status.	Moderate	Not feasible.	Medium.	Negligible to Minor Adverse At grade road would not significantly impact groundwater and cuttings (particularly at the M25) have been demonstrated by groundwater modelling, to cause a minor impact on the groundwater regime subject to groundwater control measures embedded in the M25 cutting design. No drainage to ground is proposed. No exposure of this formation at Thames crossing.	Insignificant.

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
underground structures. Long term impacts from mobilisation of leachates from contaminated land / old landfill.	South Essex Lower London Tertiaries (G16) (GB40602G401000).	WFD water body status; water supply / resources; groundwater dependant ecosystems; groundwater flow / quality.	High - Good WFD water body status.	Regional (ref WFD water body status.	Moderate.	Not feasible.	Medium.	Negligible Little exposure of this formation Detailed assessment confirms a low risk of pollution associated with drainage to ground via infiltration basins and swales.	Insignificant.
	Shallow groundwater in alluvium, gravels and other superficial deposits (non WFD water bodies).	Groundwater dependant ecosystems (biodiversity); local water supply (agriculture).	Low.	Local.	Common.	Not feasible.	Low.	Minor to Moderate Adverse. Hydrogeological risk assessment concludes minor impacts on groundwater flows/levels supporting GWDTEs. Drainage to ground provided with treatment measures in accordance with best practice. Any contaminated land or leachate disturbed by the Project would be subject to appropriate management/ remediation.	Insignificant.
Study area: Groundwater and GWDTEs south of River Thames									
Potential Impact: Impact on groundwater quality from potentially polluting surface activities / and highway drainage to infiltration basins and swales. Potential for saline intrusion. Potential impact on groundwater flow from temporary dewatering of cuttings, tunnels and North/South Portals during construction and permanent dewatering/drainage of these features (if required), temporary or permanent changes to groundwater recharge quantities/patterns or disruption to natural groundwater flow by underground structures, ground treatment to allow tunnel boring machine interventions and	North Kent Medway Chalk WFD water body ID GB40601G500300.	WFD water body status; water supply/resources; groundwater dependant ecosystems; groundwater flow/quality.	Medium - WFD water body status (current poor, target good). Local commercial / industrial / agricultural licenced supplies.	Regional (ref WFD water body status).	Rare (Abstraction Licencing Strategy shows restricted water availability).	Not feasible.	High (based on resource availability, WFD target).	South Portal relocated further south and upgradient, compared to the design presented at the Section 42 Statutory Consultation, so excavation below the water table not required. Minor Adverse with mitigation, such as lining the tunnels to achieve a specified maximum leakage rate, groundwater modelling predicts a very minor drawdown in the confined Chalk aquifer during construction and negligible drawdown during operation and no movement of the saline interface. Drainage to ground to be managed in accordance with best practice.	Low significance.

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
improve ground stability.									
Reduction of water supply (quantity) to the Thames Estuary and Marshes Ramsar site and SSSI.	Shallow groundwater (terrace gravels/ alluvium) feeding South Thames Estuary and Marshes Ramsar site and SSSI.	Groundwater dependant ecosystems (biodiversity); local water supply (agriculture).	Low - (Ramsar site / SSSI covered by biodiversity).	Local (National /international value covered by biodiversity).	Common.	Not feasible.	Low.	Minor Adverse Ditches and shallow soils and aquifers beneath the Ramsar site, are largely separated from the confined Chalk aquifer due to the generally silty-clayey alluvial sediments that overlie the Chalk aquifer. Evidence for this has been gathered through ground investigations. A water balance assessment indicates that the main input to the shallow water system that sustains the designated interest features of the Ramsar site is rainfall. Detailed modelling has demonstrated there would be no water quality detriment due to treated discharges of highway drainage to ground.	Insignificant.
Study area: River Thames Flood Zone 2/3 and associated defences									
Potential Impacts: Direct risk of flooding to highway from watercourse or tidal source (River Thames).	River Thames crossing route.	Transport link - improves efficiency of existing network.	High.	Regional.	Moderate.	Feasible (alternative crossing locations).	High.	Minor Adverse – North and South Portals and approaches (located in the defended floodplain) protected by integrated defences. Tunnel crossing closures due to flood conditions very unlikely.	Low significance.
Potential impacts: Impedance of flood flows in River Thames channel due to crossing resulting in obstruction to flow.	River Thames channel.	Conveyance of flood flows.	High - managed watercourse draining large upstream catchment.	Local (immediate vicinity of crossing and City of London upstream).	Moderate.	Not feasible.	High.	Negligible (bored tunnel would not interact with River Thames channel flows).	Insignificant.
Potential Impacts: Loss of flood storage volume (including loss through impedance of flood flows) due to the development (e.g. embankments, cuttings) or permanent spoil disposal sites leading to increased flood risk.	River Thames floodplain.	Conveyance and storage of flood flows: Mostly defended floodplain at present in vicinity of proposed route. TE2100 Policy P4 implies improved defences in the future would ensure the route remains in the	Medium - significant potential storage volume but not currently used for flood storage as the natural floodplain is defended.	Local.	Moderate.	Feasible: Loss of (defended) floodplain storage substitutable.	Medium (not currently used for flood storage).	Minor Adverse: Compensation is provided for within the Project design for any temporary or permanent loss of floodplain storage within defended River Thames floodplain.	Insignificant.

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
		defended floodplain.							
Potential impacts: Increase in flood risk by affecting existing flood defence or by preventing future flood defence development (e.g. actions under Thames Estuary TE2100 planning).	River Thames flood defences.	Protection of property/ assets from flooding.	High – defences generally provide high protection for large urban area. Reach of defence near Coalhouse Point in poor condition and will not be maintained in the future.	Local.	Moderate.	Not feasible: Unlikely to be substitutable.	High.	Minor Adverse: appropriate monitoring of existing flood defences during construction phase and remedial actions would be implemented as necessary.	Insignificant.
Study area: Mardyke Flood Zone 2/3 and associated defences									
Potential Impacts: Direct risk of flooding to highway from watercourses (Mardyke and tributaries).	Mardyke crossing the route.	Transport link - improves efficiency of existing network.	High.	Regional.	Common.	Feasible (viaduct crossing option).	High.	Minor Adverse the Project alignment is largely elevated on a viaduct over the Mardyke and its floodplain, resulting in no direct risk of flooding of the highway from watercourses. This is evidenced by flood modelling, as detailed in the Flood Risk Assessment.	Low significance.
Potential Impacts: Loss of flood storage volume (including loss through impedance of flood flows) due to the development (e.g. embankments, cuttings) or temporary spoil disposal sites leading to increased flood risk.	Mardyke floodplain.	Conveyance and storage of flood flows: Defended floodplain at present in vicinity of proposed route representative of a flapped outfall preventing ingress of tidal Thames floodwaters. TE2100 Policy P4 implies improved defences in the future would ensure the route remains in the defended floodplain.	Medium - potential flood storage shown in vicinity of route (EA flood Map) but shown as defended flood plain.	Local.	Common.	Feasible: Loss of (defended) floodplain storage substitutable.	Low.	Minor Adverse with mitigation - viaducts spanning floodplain to minimise losses, provision of a drainage channel to maintain floodplain connectivity and hydraulically linked compensation storage for any floodplain losses that do result from construction of the Project,	Low significance.
Potential Impacts: Risk of afflux flooding (upstream) due to crossing of watercourses or land drains.	Mardyke, Golden Bridge Sewer and Orsett Fen Sewer.	Conveyance of flood flows.	High - river channels shown (EA Flood Map) to convey flood flows at least up to 100-yr return period.	Local.	Moderate.	Not feasible.	High.	Minor Adverse with mitigation - viaducts spanning floodplain, provision of hydraulically linked floodplain compensation and a drainage channel maintaining floodplain connectivity.	Low significance.

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
Potential impacts: Increase in flood risk by affecting existing flood defence or by preventing future flood defence development (e.g. actions under Thames Estuary TE2100 planning).	Mardyke flood defences.	Protection of property / assets from flooding.	Low - no formal defences along channel banks shown on EA flood map in vicinity of route. (Structure at Thames outfall prevents ingress of tidal floodwaters).	Local.	Moderate.	n/a - no defences shown (EA Flood map) in vicinity of proposed route.	n/a.	n/a - no defences shown (EA Flood map) in vicinity of proposed route.	Insignificant - no defences shown (EA Flood map) in vicinity of proposed route.
Study area: Area surrounding Main Rivers, Ordinary Watercourses, land drains and ditches, including marshes									
Potential Impacts: Risk of afflux flooding (upstream) due to crossing of watercourses or land drains.	Drainage networks within the land to north and south of River Thames, including drainage of East Tilbury and Shorne Marshes.	Drainage of surface water, local flood risk.	Medium - Provides drainage of significant area of land.	Local.	Common.	Limited feasibility.	Low.	Minor Adverse to Negligible after mitigation, including appropriate design of watercourse crossings and diversions.	Insignificant.
Potential Impacts: Risk of increased runoff to watercourse or land drain causing increase in flood risk from watercourse.	As above.	Drainage of surface water, local flood risk.	Medium - Provides drainage of significant area of land.	Local.	Common.	Limited feasibility.	Low.	Minor Adverse to Negligible after mitigation, including provision of attenuation for road drainage discharges using Sustainable Drainage (SuDS) features.	Insignificant.
Potential Impacts: Risk of flooding resulting from change in watercourse/drain flow regime due to morphological changes for development.	As above.	Drainage of surface water, local flood risk.	Medium - Provides drainage of significant area of land.	Local.	Common.	Limited feasibility.	Low.	Minor Adverse to Negligible after mitigation (e.g. best practice culvert and watercourse diversion design).	Low significance.
Study area: Summary									
Potential Impacts: Risk of flooding from overland surface water flows (surface water "pluvial" flooding).	Various floodplains and surface water drainage areas.	Flood risk: People and property.	Medium - Located across multiple flood zones.	Local.	Common.	Limited feasibility.	Low.	Minor Adverse after mitigation.	Insignificant.
Potential Impacts: Risk of flooding from groundwater.	Various floodplains and surface water drainage areas.	Flood risk: People and property.	Medium - Located across multiple flood zones.	Local.	Common.	Limited feasibility.	Low.	Minor Adverse after mitigation.	Insignificant.
Potential Impacts: Risk of flooding from drains, sewers, and water mains.	Various floodplains and surface water drainage areas.	Flood risk: People and property.	Medium - Located across multiple flood zones.	Local.	Common.	Limited feasibility.	Low.	Minor Adverse after mitigation.	Insignificant.
Potential Impacts: Construction of the project would have a	At this stage it is considered likely that a combination of	Water supply / biodiversity / transport &	Groundwater resources High - supports numerous licenced and unlicensed	Regional.	Rare to Common.	Not feasible: Unlikely to be substitutable.	High to Medium.	Moderate to Minor Adverse after mitigation (Maximise water use	Significant to Low

Description of study area/ summary of potential impacts	Key environmental resource	Features	Quality	Scale	Rarity	Substitutability	Importance	Magnitude	Significance
large consumptive water use need.	groundwater (drawn from a Northumbria Water borehole at Linford) and mains water would supply the construction phase of the Project.	dilution waste products.	abstractions. Surface water resources Medium/High - receive numerous consented discharges and support abstractions.					efficiencies and water re-use on site).	significance (temporary).

Reference Sources

Unit A3. Environmental Impact Appraisal. Impacts on the Water Environment Sub-objective, Department for Transport, May 2022
Review of Lower Thames Crossing Options: Final Review Report Appendices. DfT/ AECOM April 2013
Thames River Basin Management Plan, Environment Agency 2015

Thames Estuary TE2100 Plan. Environment Agency 2012 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/322061/LIT7540_43858f.pdf

Roding, Beam, Ingrebourne and Mardyke Abstraction Licensing Strategy (CAMS), Environment Agency 2019
Long Term Flood Risk Information Service, Environment Agency 2022
Magic Interactive Mapping Defra, 2022
Thurrock Surface Water Management Plan (SWMP). URS. 2013
Tameside Surface Water Management Plan (SWMP). JBA. 2013
Havering Flood Risk Management Strategy (FRMS). London Borough of Havering. 2015
South Essex Catchment Flood Management Plan (CFMP). Environment Agency. 2009
North Kent Rivers Catchment Flood Management Plan (CFMP). Environment Agency. 2009
Highways Agency Drainage Data Management System (HA DDMS)
Water Quality Data Archive (Environment Agency, accessed online May 2022)
Environmental Statement, Chapter 14: Road Drainage and the Water Environment (Application Document 6.1)
Environmental Statement, Appendix 14.5: Hydrogeological Risk Assessment (Application Document 6.3)
Environmental Statement Appendix 14.6: Flood Risk Assessment (Application Document 6.3)
Environmental Statement Appendix 14.3: Operational Surface Water Drainage Pollution Risk Assessment (Appliction Document 6.3)

Summary assessment score

(Post mitigation) Slight Adverse impacts

Qualitative comments

This appraisal provides an update to previous published appraisals, considering new available information, changes in the design and conclusions from the Environmental Impact Assessment and its supporting technical studies.

Note 1: Risks from construction are only considered where they may have a permanent impact on the water environment once construction is completed.

Note 2: Impacts on habitats/ ecosystems/ flora/ fauna are covered separately under biodiversity and not included here to avoid "double counting".

Surface Water: The bored tunnel would have little impact on the quality or morphology of the River Thames, assuming no scour protection is required and appropriate treatment of effluents prior to discharge. The long-term impacts of sedimentation change (brought about during construction) are mostly related to tidal and intertidal habitats, assessed under biodiversity. Impacts on the Mardyke (WFD water body) are reduced by the nature of the crossing adopted with the design providing for a fully spanning viaduct crossing. Where other watercourses are to be crossed by culverts mitigation is generally available to reduce impacts to slight adverse.

Groundwater: Issues with rising groundwater levels have been identified regionally although it is understood these are less problematic in this immediate area. The tunnel crossing would require temporary dewatering during construction and may need longer term dewatering at the North Portal and M25 cutting. Larger groundwater resources and public supplies, primarily from the Chalk at depth are unlikely to be impacted, although there may be some impact on local licensed commercial/ industrial/ agricultural supplies from shallow groundwater in the gravels, these are not thought to be significant.

Flood Risk and Drainage: The bored tunnel would have no impact on channel conveyance in the River Thames. The design includes resilience to flooding in a defence breach or overtopping scenario, as well as to fluvial flooding in the Mardyke catchment under tide locked conditions. The bored tunnel design would need to integrate with (or not compromise) TE2100 River Thames flood defence plans and ensure the protection of the integrity of existing flood defences. The surface water drainage strategy/design (in accordance with National Highways guidance and standards) has been presented to the the relevant Lead Local Flood Risk Authorities, who are in agreement with the overarching principles of the strategy.

Overall the effects of the Project are considered to be Slight Adverse

4.7 Noise

Table 4.28 Noise worksheet

Proposal Name:	A122 Lower Thames Crossing
Present Value Base Year	2010
Current Year	2022
Proposal Opening year:	2030
Project (Road, Rail or Aviation):	Road

Net present value of change in noise (£):	£3,380,134
	*positive value reflects a **net benefit** (i.e. a reduction in noise)

Net present value of impact on sleep disturbance (£):	£1,232,751
Net present value of impact on amenity (£):	£1,321,369
Net present value of impact on AMI (£):	£415,240
Net present value of impact on stroke (£):	£163,287
Net present value of impact on dementia (£):	£246,947
	*positive value reflects a **net benefit** (i.e. a reduction in noise)

Quantitative results

Households experiencing increased daytime noise in forecast year:	6,015
Households experiencing reduced daytime noise in forecast year:	5,679
Households experiencing increased night-time noise in forecast year:	5,695
Households experiencing reduced night-time noise in forecast year:	5,002

Qualitative Comments:

N/A - as per Paragraph 2.4.2 of TAG Unit A3 Environmental Impact Appraisal

Data Sources:

04_LR_CM45_2030_InputModelDataForEnvirAssessment_v1.6_Noise_Values
04_LR_CM45_2045_InputModelDataForEnvirAssessment_v1.6_Noise_Values
04_LR_CS67_2030_InputModelDataForEnvirAssessment_v1.6_Noise_Values
04_LR_CS67_2045_InputModelDataForEnvirAssessment_v1.6_Noise_Values
OS AddressBase Premium

4.8 Air quality

Table 4.29 Air Quality worksheet

Scheme Name:	A122 Lower Thames Crossing
Present Value Base Year	2010
Current Year	2022
Proposal Opening year:	2030
Project (Road/Rail or Road and Rail):	Road Transport

Overall Assessment Score:

Damage Costs Approach (Emissions)	
Present value of change in NO_x emissions (£):	£0
Present value of change in $PM_{2.5}$ emissions (£):	£0
OR	
Present value of change in PM_{10} emissions (£):	£0
Impact Pathways Approach (Concentrations)	
Present value of change in NO_2 concentrations (£):	-£4,318,252
Of which:	
Concentration costs:	-£566,560
Other impacts:	-£3,751,692
Present value of change in $PM_{2.5}$ concentrations (£):	-£3,444,977
Of which:	
Concentration costs:	-£3,216,342
Other impacts:	-£228,635
Total Change	
Total value of change in air quality (£):	-£7,763,229

*positive value reflects a **net benefit** (i.e. air quality improvement)

Quantitative Assessment:

Impact Pathways Approach (Concentrations)	
Change in NO_2 assessment scores over 60 year appraisal period: (between 'With Scheme' and 'Without Scheme' scenarios)	89,785.60
Change in $PM_{2.5}$ assessment scores over 60 year appraisal period: (between 'With Scheme' and 'Without Scheme' scenarios)	64,450.40
Damage Costs Approach (Emissions)	
Change in NO_X emissions over 60 year appraisal period (tonnes): (between 'With Scheme' and 'Without Scheme' scenarios)	0
Change in $PM_{2.5}$ emissions over 60 year appraisal period (tonnes): (between 'With Scheme' and 'Without Scheme' scenarios)	0
OR	
Change in PM_{10} emissions over 60 year appraisal period (tonnes): (between 'With Scheme' and 'Without Scheme' scenarios)	0

Qualitative Comments:

Overall there is an increase in NO_2 and $PM_{2.5}$ concentrations and emissions with the Project which is likely to be because of an increase in vehicle kilometers travelled.

Emissions for 2030 have been used for the design year as these are the latest emission factors available. As such this is likely to lead to an overprediction of emissions, as beyond 2030 vehicle emissions will be cleaner with the introduction of ultra low emissions vehicles, such as electric vehicles.

Sensitivity Analysis:

Upper estimate net present value of change in air quality (£):	-£23,913,506
Lower estimate net present value of change in air quality (£):	-£2,778,259

Data Sources:

AADT flows and speed bands have been used to generate the emissions based on traffic simulations CM45 and CS67.

Emissions have been calculated using the IAN185-13 Speed Band Emission Factors v4.3 Tool.

Defra 2018 based background in NO_2 and $PM_{2.5}$ maps were used to generate concentrations.

5 Social impacts

5.1 Introduction

5.1.1 This chapter contains TAG worksheets for the following impacts:

a. Journey quality

b. Security

5.1.2 These worksheets summarise the results of the social impact appraisals in line with TAG Unit A4.1 (Department for Transport, 2022b).

5.1.3 For each impact, a qualitative appraisal is presented and an overall Summary Assessment Score and qualitative comments are provided.

5.1.4 The chapter also includes the metholdogy used to appraise Severance. This approach is based on guidance in TAG Unit A4.1. An appraisal worksheet for Severance is also included.

5.1.5 TAG does not provide a worksheet for personal affordability impacts.

5.2 Journey quality

Table 5.1 Journey quality worksheet

Factor	Sub-factor	Better	Neutral	Worse
Traveller Care	Cleanliness	N/A	N/A	N/A
	Facilities	N/A	X	N/A
	Information	X	N/A	N/A
	Environment	N/A	N/A	N/A
Travellers Views	-		X	
Traveller Stress	Frustration	X		
Fear of potential accidents		X		
Route uncertainty		X		

Reference Source

Views from the Road Assessment (Appendix 7.13 of Chapter 7 Landscape and Visual (Application Document 6.3))
Need for the Project (Application Document 7.1)

Summary Assessment Score

Large positive impact

Qualitative Comments

The change in impact across the sub-factors is, on balance, likely to be beneficial and large (the number of travellers per day is estimated to be more than 10,000).

In relation to travellers views, it is relevant to consider the two sections of road separately (south of the River Thames and north of the River Thames).

Typically within the rural landscape to the south of the River Thames, between the junction with the A2 and the South Portal, views out for road users would be limited as the carriageway would be in a cutting and therefore road users would not easily be able to see beyond this. Along this section it is anticipated that the structures at the proposed junction with the A2, the cutting slopes and potential chalk rock outcrops, and the South Portal would be the main features of the view.

To the north of the River Thames where the carriageway emerges on embankment as it crosses the River Thames floodplain, there is potential for views out across the urban fringe landscape of Thurrock, although screening mitigation such as false cuttings, environmental barriers and tree and shrub planting could limit these views. Elsewhere the new carriageway would pass through sections of cutting and embankment with associated mitigation measures. In this section it is anticipated that the North Portal and the structures at proposed junctions with the A13 and M25 with their associated tree and shrub planting would form the main features of the view for vehicle travellers north of the River Thames.

The effect on vehicle travellers in relation to views from the road during the operation phase is therefore likely to be positive.

In relation to traveller stress, it is expected that during the operation of the Project, there would be a positive effect through reductions in congestion at the Dartford Crossing and approach roads, resulting in improved accessibility to employment and other destinations. The overall effect here in relation to frustration in particular is likely to be positive as road users will be able to make good progress along their route. Given that the Project is built to modern design standards, there will be a benefit in terms of reduced fear of potential accidents. In terms of route uncertainty, clear

signage will be provided along the route and at key junctions, thereby helping to manage driver stress.

In terms of traveller care, the route connects with the A13, which will allow for users to access the Thurrock Service Station, south of the Mardyke Interchange.

5.3 Security

5.3.1 The security worksheet is divided into the following sections which reflect the different security impacts of the Project on the different types of transport users (for example vehicle users) from its different elements (for example tunnel):

a. Tunnel – vehicle driver and occupants

b. Route – vehicle driver and occupants

c. Route crossing facilities – walkers, cyclists, horse riders

d. Route crossing facilities – vehicle drivers and occupants

5.3.2 Most of the sections are also divided into two security categories:

a. Impacts during normal operation

b. Impacts during an incident

5.3.3 Each category is appraised in terms of:

a. Various security indicators or measures

b. Their relative importance

c. The impact on these measures without the Project

d. The impact on these measures with the Project

e. A summary assessment score is provided for each security indicator or category

f. Estimates are provided for the number of people affected

5.3.4 For each section, an overall set of qualitative comments is provided.

Table 5.2 Security worksheets: Tunnel - vehicle driver and vehicle occupants assessment

Category	Tunnel - Route Vehicle Driver and Vehicle Occupants					
Sub-category 1(a) Drivers and vehicle occupant's personal security impacted on by the actions of other road users: • Dangerous driving • Careless driving • Injudicious actions • Drink and drug driving	**Security Indicator** **Sub-category 1(a)**	**Relative importance** **(High / Medium / Low)**	**Without scheme** **(Poor/Moderate / High)**	**With scheme** **(Poor/Moderate / High)**	7-point scale summary assessment total for sub-category	Persons affected & reference sources
	Site perimeters	Low	N/A	High	Neutral	Persons Affected: Up to approximately 132,000 per day (year 2030); 157,000 per day (year 2045) Reference Source: • LTAM DCO Link Schematic v30-CORE (LR_CS72 DCO2 2030 CORE DS; LR_CS72 DCO2 2045 CORE DS) • Vehicle occupancy for LTC. DfT TAG Data Book version v1.18 May 2022 • Office of National Statistics Office for National Statistics publication 'Crime in England and Wales; year ending September 2021'. • Department for Transport Reported Road Casualties in Great Britain annual report, National Highways annual Reported Road Casualties on the Strategic Road Network; both references containing causal factors.
	Entrances and exits	Moderate	N/A	Moderate		
	Formal surveillance	High	N/A	High		
	Informal surveillance	Low	N/A	Moderate		
	Landscaping	Low	N/A	N/A		
	Lighting and visibility	High	N/A	High		
	Emergency call	High	N/A	High		
Qualitative Comments	• The A122 Lower Thames Crossing is a new asset on the Strategic Road Network. Without the scheme there is no project road and road tunnel. Therefore, the security indicators for the 'without scheme' scenario are not applicable. • The tunnel is constrained by its nature with the tunnel walls representing the perimeter for vehicles. The route through the tunnel will be self-explaining. • Formal surveillance from a 24/7 operations centre with 100% CCTV coverage and incident/stopped vehicle detection technology will be provided throughout the tunnel and at the North and South Portals. • The overall Project route (tunnel and open road) will have variable mandatory speed limit including speed enforcement technology. • Regular Traffic Officer Service patrols, observations by maintenance workers, the travelling public and emergency services will provide a moderate level of informal surveillance. • VMS will display driver and traffic information. • The overall effect on the security for drivers and vehicle occupants is considered neutral.					
Sub-category 1(b) During an incident within the tunnel (vehicle breakdown/live lane stop, tunnel closure and evacuation operating state) drivers and vehicle occupants will leave their vehicles and as a consequence will function as pedestrians.	**Security Indicator** **Sub-category 1(b)**	**Relative importance** **(High / Medium / Low)**	**Without scheme** **(Poor / Moderate / High)**	**With scheme** **(Poor / Moderate / High)**	7-point scale Summary assessment total for sub-category	Persons affected & reference sources
	Site perimeters	Low	N/A	High	Neutral	Persons Affected: Up to 2 persons per day (825 persons per year) Reference Source: • LTAM DCO Link Schematic v30-CORE (LR_CS72 DCO2 2030 CORE DS; LR_CS72 DCO2 2045 CORE DS)
	Entrances and exits	Moderate	N/A	Moderate		
	Formal surveillance	High	N/A	High		
	Informal surveillance	Low	N/A	Moderate		
	Landscaping	Low	N/A	N/A as infrastructure has tunnel walls		

Category	Tunnel - Route Vehicle Driver and Vehicle Occupants					
Associated personal security impacts: • Theft • Abuse • Assault • Greater exposure to risk from other road users: • Dangerous driving • Careless driving • Injudicious actions • Drink and drug driving	Lighting and visibility	High	N/A	High		• Vehicle occupancy for LTC. DfT TAG Data Book version v1.18 May 2022. • LTC Safety Report and associated hazard log. • Casualties in Great Britain annual report, National Highways annual Reported Road Casualties on the Strategic Road Network; both references containing causal factors.
	Emergency call	High	N/A	High		
Qualitative Comments	• The tunnel introduces a new asset on the Strategic Road Network as part of the A122 Lower Thames Crossing. Without the scheme there is no project road and road tunnel. Therefore, the security indicators for the 'without scheme' scenario are not applicable. • The tunnel will operate as an all-purpose trunk road (APTR) with traffic prohibitions. This means walkers, cyclists and horse riders will not be permitted within the tunnel. In an incident/evacuation scenario, persons alighting their vehicles will function as walkers. In these scenarios tunnel interventions will support walkers mobility and security. • The tunnel is constrained by its nature with the tunnel walls representing the perimeter for vehicles. The route through the tunnel will be self-explaining. • Formal surveillance from a 24/7 operations centre with 100% CCTV coverage and incident/stopped vehicle detection technology will be provided throughout the tunnel and at the North and South Portals. • Regular Traffic Officer Service patrols, observations by maintenance workers, the travelling public and emergency services will provide a moderate level of informal surveillance. • Emergency telephones will be provided throughout the tunnel that will be installed at locations in accordance with safe design standards. • A public address system will be provided within the tunnel to assist stranded drivers and vehicle occupants. • Lighting to be provided throughout the tunnel and interface with the highway links (at the North/South Portals) to a safe standard. • The design and operation of the tunnel will support drivers during live lane stops and breakdown scenarios with the objective of enabling arrival at the scene by core-responders thereby reducing level of vulnerability to criminal activity. • Use of technology interventions and operational on-road resource to reduce exposure to risk. • The overall effect on security for drivers and vehicle occupants is considered neutral.					

Table 5.3 Security worksheets: A122 Lower Thames Crossing route - vehicle driver and vehicle occupants assessment

Category	**A122 Lower Thames Crossing route – vehicle driver and vehicle occupants**					
Sub-category 2(a) Drivers and vehicle occupant's personal security impacted on by the actions of other road users: • Dangerous driving • Careless driving • Injudicious actions • Drink and drug driving	**Security Indicator** **Sub-category 2(a)**	**Relative importance** **(High / Medium / Low)**	**Without scheme** **(Poor / Moderate / High)**	**With scheme** **(Poor / Moderate / High)**	7-point scale summary assessment total for sub-category	Persons affected & reference sources
	Site perimeters	Medium	N/A	Moderate	Neutral	Persons Affected: Up to approximately 132,000 per day (year 2030); 157,000 per day (year 2045) Reference Source: • LTAM DCO Link Schematic v30-CORE (LR_CS72 DCO2 2030 CORE DS; LR_CS72 DCO2 2045 CORE DS) • Vehicle occupancy for LTC. DfT TAG Data Book version v1.18 May 2022 • Office of National Statistics Office for National Statistics publication 'Crime in England and Wales; year ending September 2021'.
	Entrances and exits	Medium	N/A	Moderate		
	Formal surveillance	High	N/A	High		
	Informal surveillance	Low	N/A	Moderate		
	Landscaping	Medium	N/A	High		
	Lighting and visibility	High	N/A	Moderate		
	Emergency call	High	N/A	High		

Category	A122 Lower Thames Crossing route – vehicle driver and vehicle occupants					
						• Department for Transport Reported Road Casualties in Great Britain annual report, National Highways annual Reported Road Casualties on the Strategic Road Network; both references containing causal factors.
Qualitative Comments	• The Project route introduces a new asset on the Strategic Road Network. Without the scheme there is no project road. Therefore, the security indicators for the 'without scheme' scenario are not applicable. • Formal surveillance from a 24/7 operations centre with 100% CCTV coverage and incident/stopped vehicle detection technology will be provided throughout the route. • The Project route will have variable mandatory speed limit including speed enforcement technology. • Regular Traffic Officer Service patrols, observations by maintenance workers, the travelling public and emergency services will provide a moderate level of informal surveillance. • VMS will display driver and traffic information • The overall effect on security for drivers and vehicle occupants is considered neutral.					
Sub-category 2(b) During an incident on the route (vehicle breakdown/ live lane stop), drivers and vehicle occupants will leave their vehicles and as a consequence, will function as pedestrians. Associated personal security impacts: • Theft	**Security Indicator** **Sub-category 2(b)**	**Relative importance** **(High / Medium / Low)**	**Without scheme** **(Poor / Moderate / High)**	**With scheme** **(Poor / Moderate / High)**	7-point scale Summary assessment total for sub-category	Persons affected & reference sources
	Site perimeters	Low	N/A	Moderate	Neutral	Persons Affected: Up to 12 persons per day (4,380) persons per year) Reference Source:
	Entrances and exits	Moderate	N/A	Moderate		
	Formal surveillance	High	N/A	High		
	Informal surveillance	Low	N/A	Moderate		
	Landscaping	Low	N/A	High		

Category	A122 Lower Thames Crossing route – vehicle driver and vehicle occupants					
• Abuse • Assault Greater exposure to risk from other road users: • Dangerous driving • Careless driving • Injudicious actions • Drink and drug driving	Lighting and visibility	High	N/A	Moderate		• LTAM DCO Link Schematic v30-CORE (LR_CS72 DCO2 2030 CORE DS; LR_CS72 DCO2 2045 CORE DS) • Vehicle occupancy for LTC. DfT TAG Data Book version v1.18 May 2022. • LTC Safety Report and associated hazard log.
	Emergency call	High	N/A	High		
Qualitative Comments	• The Project introduces a new asset on the Strategic Road Network. Without the scheme there is no project road. Therefore, the security indicators for the 'without scheme' scenario are not applicable. • The route will be appropriately signed for road users. • Formal surveillance from a 24/7 operations centre with 100% CCTV coverage and incident / stopped vehicle detection technology will be provided throughout the route. Additional stopped vehicle detection is being considered. • Regular Traffic Officer Service patrols, observations by maintenance workers, the travelling public and emergency services will provide a moderate level of informal surveillance. • ‘Places of Relative Safety’ are to be provided along the route with good visibility, provision of CCTV surveillance and emergency telephones. • Lighting will be provided to safe standards as required. • The design and operation of the route will support drivers during live lane stops and breakdown scenarios, with the objective of enabling arrival at the scene by core-responders and thereby reducing level of vulnerability to criminal activity. • Use of technology interventions and operational on-road resource to reduce exposure to risk. • The overall effect on security for drivers and vehicle occupants is considered neutral.					

Table 5.4 Security worksheets: Route crossing facilities - walkers, cyclists and horse riders assessment

Category	**Route – Walkers, cyclists and horse riders at crossing points**					
Sub-category 3(a) Walking, cycling and horse riding routes will be retained and diverted (where required) to maintain connectivity (overbridges, underbridges, green bridges) across the A122 Lower Thames Crossing route and at the interface between the A122 Lower Thames Crossing and the local road network. Associated personal security impacts: • Theft • Abuse • Assault Personal security impacted by the actions of other road users: • Dangerous driving • Careless driving • Injudicious actions • Drink and drug driving	**Security Indicator** **Sub-category 3(a)**	**Relative importance** **(High / Medium / Low)**	**Without scheme** **(Poor / Moderate / High)**	**With scheme** **(Poor / Moderate / High)**	7-point scale summary assessment total for sub-category	Persons affected & reference sources
	Site perimeters	Low	Moderate	High	Slight Beneficial	Persons Affected: 150 persons per day Reference Source: • Strava Heatmap and 2011 Census data • Office of National Statistics Office for National Statistics publication 'Crime in England and Wales; year ending September 2021'
	Entrances and exits	Moderate	High	High	Neutral	
	Formal surveillance	High	Poor	Moderate	Slight Beneficial	
	Informal surveillance	Low	Moderate	Moderate	Slight beneficial	
	Landscaping	Low	High	High	Neutral	
	Lighting and visibility	High	Poor	High	Large Beneficial	
	Emergency call	High	Poor	Poor	Neutral	
					Overall: Neutral	
Qualitative Comments	• The Project route introduces a new asset on the Strategic Road Network. Without the scheme there is no project road. • Walking, cycling and horse riding routes will be retained and diverted (where required) to maintain connectivity (overbridges, underbridges, green bridges) across the A122 Lower Thames Crossing route and at the interface between the Project and the local road network. Some crossings will be improved through lighting, landscaping and planting and there will be increased usage proviing more informal surveillance, while some crossings may require underpasses potentially having an adverse impact on security of walkers. • At this stage in project development the overall effect on security for walkers, cyclists and horse riders s is considered neutral. • Implementation of the Project's NMU Strategy					

Table 5.5 Security worksheets: Route crossing facilities - Vehicle drivers and vehicle occupants assessment

Category	**Route – Vehicle Drivers and Vehicle Occupants at Crossing Points**					
Sub-category 4(a) Drivers and vehicle occupant's personal security impacted on by the actions of other road users at overbridges, underpasses, green bridges, interfaces, where these structures provided for vehicular traffic. This sub-category includes those locations where the A122 Lower Thames Crossing has an interface with the local road network. Personal security impacts: • Dangerous driving • Careless driving • Injudicious actions • Drink and drug driving • Theft • Abuse • Assault • Suicide attempts	**Security Indicator** **Sub-category 4(a)**	**Relative importance** **(High / Medium / Low)**	**Without scheme** **(Poor / Moderate / High)**	**With scheme** **(Poor / Moderate / High)**	7-point scale summary assessment total for sub-category	Persons affected & reference sources
	Site perimeters	Low	Moderate	High	Neutral	Persons Affected: Numbers affected likely to be very low. Reference Sources: • Office of National Statistics Office for National Statistics publication 'Crime in England and Wales; year ending September 2021' • Office of National Statistics Office for National Statistics publication 'Suicides in the UK: 2018 registrations' (September 2019)
	Entrances and exits	Moderate	Moderate	High	Slight Beneficial	
	Formal surveillance	High	Poor	Moderate	Slight Beneficial	
	Informal surveillance	Low	Moderate	Moderate	Neutral	
	Landscaping	Low	Moderate	High	Neutral	
	Lighting and visibility	High	Moderate	High	Slight Beneficial	
	Emergency call	High	Poor	Poor	Neutral	
					Overall: Neutral	
Qualitative Comments	• The overall effect on security for drivers and vehicle occupants at crossing points is considered neutral. • The route crosses a number of classified A, B and C roads. The existing routes are at grade which will be replaced by grade separated facilities such as bridges and underpasses. • Design standards, lighting and landscaping will provide facilities at or above safety standards of existing routes. • Formal and informal surveillance associated with the LTC route will provide a moderate level of coverage. • Crossing points and approaches will be upgraded and to a good standard.					
Sub-category 4(b) During an incident (live lane stop/vehicle breakdown) drivers will either reach a place of relative safety or will come to a rest on a live traffic lane. Drivers and occupants will leave or remain in their vehicles. As a consequence, driver and vehicle occupants that alight their vehicles will	Security Indicator Sub-category 4(b)	Relative importance (High / Medium / Low)	Without scheme (Poor / Moderate / High)	With scheme (Poor / Moderate / High)	7-point scale Summary assessment total for sub-category	Persons affected & reference sources
	Site perimeters	Low	Moderate	Moderate	Neutral	Persons Affected: Up to 12 per day (4,380 per year) Reference Source: • LTAM DCO Link Schematic v30-CORE (LR_CS72 DCO2 2030 CORE DS; LR_CS72 DCO2 2045 CORE DS)
	Entrances and exits	Moderate	Moderate	Moderate	Neutral	
	Formal surveillance	High	Poor	Moderate	Slight Beneficial	
	Informal surveillance	Low	Moderate	Moderate	Neutral	
	Landscaping	Low	Moderate	High	Neutral	
	Lighting and visibility	High	Moderate	High	Slight Beneficial	
	Emergency call	High	Poor	Poor	Neutral	

Category	Route – Vehicle Drivers and Vehicle Occupants at Crossing Points					
function as pedestrians. Associated personal security impacts: • Theft • Abuse • Assault Greater exposure to risk from other road users: • Dangerous driving • Careless driving • Injudicious actions • Drink and drug driving					Overall: Neutral	• Vehicle occupancy for LTC. DfT TAG Data Book version v1.18 May 2022. • LTC Safety Report and associated hazard log.
Qualitative Comments	• The overall effect on security for drivers and vehicle occupants at crossing points is considered neutral. • The route crosses a number of classified A, B and C roads. The existing routes are at grade which will be replaced by grade separated facilities such as bridges and underpasses. • Design standards, lighting and landscaping will provide facilities at or above safety standards of existing routes. • Formal and informal surveillance associated with the LTC route will provide a moderate level of coverage. Crossing points and approaches will be upgraded and to a good standard. • Use of technology interventions and operational on-road resource to reduce exposure to risk on the LTC mainline					

Table 5.6 Security worksheets: Summary of assessments

ID	Category	Sub-Category	Sub-Category overall summary assessment total	7-Point Scale Assessment Summary Total
1	Tunnel – vehicle drivers and occupants	1(a)	Neutral	Neutral
		1(b)	Neutral	
2	LTC Route – Vehicle Drivers and Vehicle Occupants	2(a)	Neutral	Neutral
		2(b)	Neutral	
3	Route Crossing Facilities – walkers, cyclists and horse riders	3(a)	Neutral	Neutral
4	Route Crossing Facilities – vehicle driver and occupants	4(a)	Neutral	Neutral
		4(b)	Neutral	Neutral

5.4 Severance

Introduction

5.4.1 An appraisal has been undertaken of the extent to which the 60-year operational phase of the Project results in increases and decreases in community severance on walkers. The methodology is based on guidance about severance appraisal in TAG Unit A4.1 but has been developed to reflect the scale of the Project in relation to severance impacts (Department for Transport (2022b). Therefore, the sections below describe the appraisal methodolgy and results and include a severance worksheet.

5.4.2 A separate, but related, appraisal of severance on vulnerable social groups is included in the Distributional Impact Appraisal Report.

Methodology

5.4.3 The Project would result in two types of severance impacts – changes in physical severance of routes and changes in traffic related severance.

5.4.4 All routes severed by the Project would be re-instated using bridges or underpasses except Hornsby Lane in Thurrock. The increase in accessibility for walkers from the provision of new crossing infrastructure is included in the Physical Activity appraisal which is described in the Economic Appraisal Report.

5.4.5 Therefore, this appraisal focuses on changes in traffic related severance and includes the following three stages:

a. Traffic flow assessment

b. Link assessment

c. Net assessment

Traffic flow assessment

5.4.6 The first stage of the appraisal involved identifying those links within the LTAM transport model where there are material changes in traffic flows due to the Project and where walkers would expect to cross a road and for which there is no existing crossing provision.

5.4.7 Traffic flows from the LTAM transport model for the AM, inter-peak and PM periods in 2030 were reviewed to identify those links that meet both of the following traffic flow criteria:

a. In any one of these peak periods, there is a greater than 10 percent change (increase or decrease) in two-way traffic flows on the link between the Without Scheme and With Scheme scenarios.

b. For the same peak periods, the change in two-way traffic flow on the link between the Without Scheme and With Scheme scenarios is more than a 180 Passenger Car Units (PCU) reduction or increase. Such a change in flow equates to a PCU reduction or increase of three vehicles per minute. The purpose of this second criteria is to filter out links where the change in flow is small, but the percentage change is significant and exceeds 10%.

5.4.8 Two further filters were then applied to the links that met both of the above traffic flow criteria, as follows:

a. Using Ordnance Survey Integrated Transport Network data on road link classifications, those links which are part of dual carriageways, roundabouts and slip roads were removed because walkers would not be expected to cross these links.

b. GIS data was used to remove links that already have an existing pedestrian crossing. Crossing data was extracted from Open Street Map (OSM) in November 2021 (Open Street Map). This contains all crossings annotated on OSM, whether they are controlled, uncontrolled or traffic signals. It contains information on ther type of crossing, if an island is provided, whether the kerb is lowered/flush and if the crossing has tactile paving. The appraisal did not differentiate between the various types of crossings.

Link assessment

5.4.9 A desk-based qualitative review of the remaining links was then undertaken to further reduce the number of links based on an assessment of existing infrastructure, their location and any other factors that would influence peoples' crossing requirements. This reduction was based on the following factors:

a. Road widths, A-roads - any links where a single carriageway was two lanes were removed.

b. The presence of pavements along the link. This led to those rural links without pavements being removed.

c. The existence of existing crossing facilities not already identified based on the GIS data used in Stage 1. Where these were identified, the links were removed. This assessment took account of improvements in crossing facilities provided as part of the Project.

d. Other link characteristics indicating that people have a need to cross the road such as:

   i. the presence of housing on either side of the link

   ii. whether the link is located within an urban environment

   iii. whether there are other features such as green space, bus stop, school or community provision

Net assessment

5.4.10 To derive an appraisal score, the net daily number of walking trips by people that experience decreases and increases in severance was calculated. The extent of the decreases and increases in severance are based on the criteria in TAG Unit A4:

a. the overall assessment is Neutral if increases in severance are broadly balanced by relief of severance

b. the score will be Slight (Positive or Adverse) where the net change in the number of people affected by severance is less than 200 per day

c. the score will be Large (Positive or Adverse) where the net change in the number of people affected by severance is greater than 1,000 per day

d. the overall assessment is likely to be Moderate (Positive or Adverse) in all other cases

5.4.11 It should be recognised that the populations affected by increases and decreases in severance will be lower than the 2020 mid-year population estimates because not all of the populations will want to cross the roads that have been identified as experiencing a change in traffic severance.

Appraisal results

Traffic flow assessment

5.4.12 The traffic flow assessment involved 19,779 links in the LTAM model and these were reduced to 95 links for the next link assessment stage, as shown in Plate 5.1.

Link assessment

5.4.13 The link assessment reduced the number of impacted links to 29. Adjoining links were also combined to produce a final list of 18 links. These Stage 2 links are also shown in Plate 5.1.

5.4.14 Of these 18 impacted links:

a. There are 6 links where people could experience increases in traffic (i.e. walkers have greater severance) and the total number of people living within 800 metres of these links, based on 2020 mid-year population estimates, is 37,287.

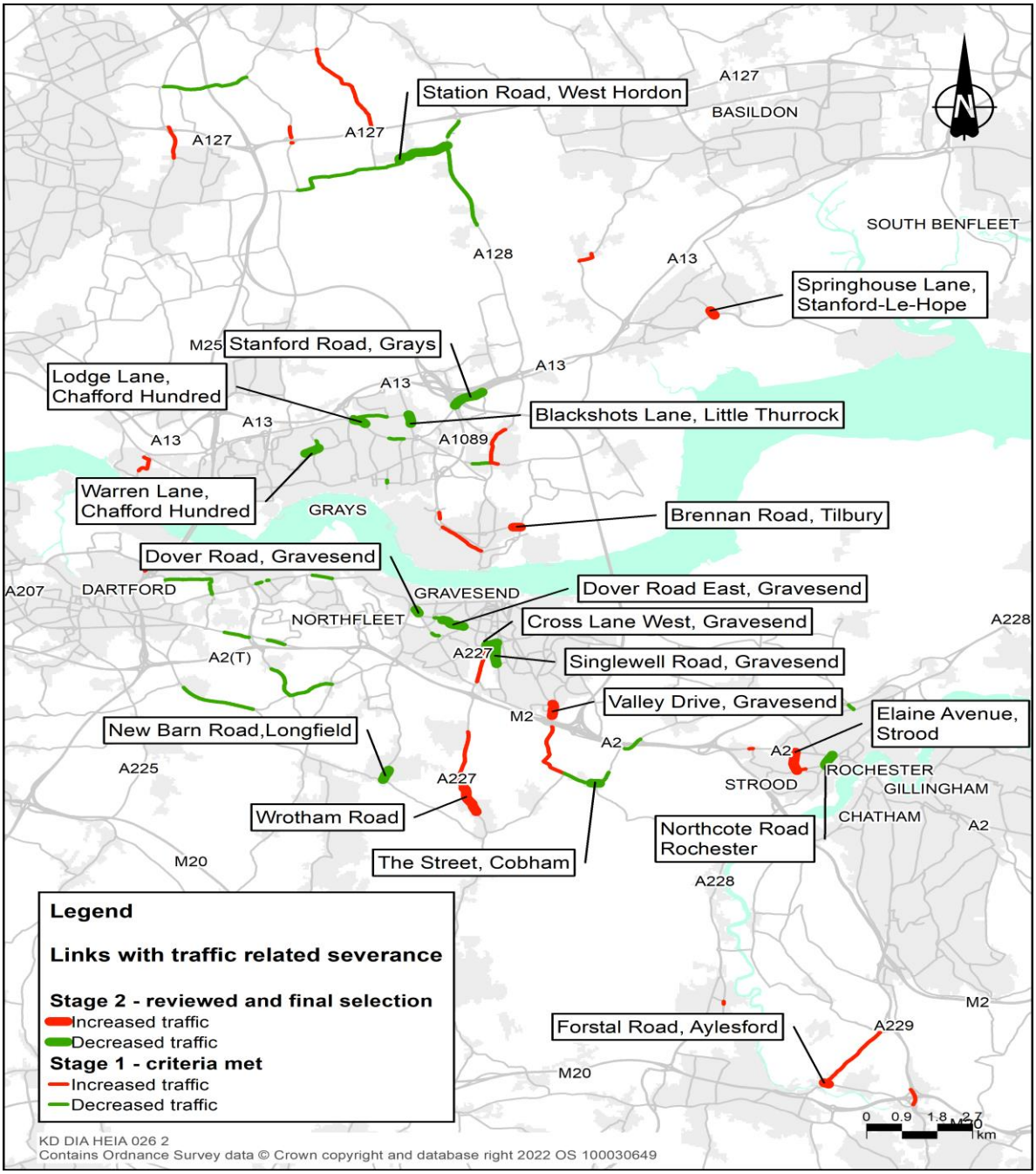
b. There are 12 links where people could experience decreases in traffic (less severance) and the total number of people living within 800 metres of these links, based on 2020 mid-year population estimates, is 107,722.

5.4.15 People’s propensity to walk and experience changes in severance varies depending on whether they live in an urban or rural location. Table 5.7, which is based on National Travel Survey data for 2021, shows how the average annual number of walking trips per person varies between different urban and rural locations.

Table 5.7: Average annual number of walking trips per person by type of location

Rural / urban locations	Average annual number of walking trips per person
Urban Conurbation	253
Urban City and Town	239
Rural Town and Fringe	187
Rural Village Hamlet and isolated dwellings	152
All areas	**235**

Plate 5.1 Links with changes in severance



5.4.16 Table 5.8 shows rural/urban classification for locations that experience a change in severance.

Table 5.8 Rural/urban classification for locations with a change in severance

Link	Location	Urban / Rural
1	Valley Drive, Gravesend	Urban major conurbation
2	New Barn Road,Longfield	Urban city and town
3	Forstal Road, Aylesbury	Urban city and town
4	The Street, Cobham	Rural village
5	Stanford Road, Grays	Urban city and town
6	Warren Lane, Chafford Hundred	Urban major conurbation
7	Station Road, West Hordon	Rural town and fringe
8	Singlewell Road, Gravesend	Urban major conurbation
9	Cross Lane West, Gravesend	Urban major conurbation
10	Dover Road East, include to train track	Urban major conurbation
11	Dover Road	Urban major conurbation
12	Wrotham Road	Rural town and fringe
13	Elaine Avenue, Strood	Urban city and town
14	Northcote Road, Rochester	Urban city and town
15	Springhouse Lane, Stanford-le-Hope	Urban city and town
16	Brennan Road, Tilbury	Urban major conurbation
17	Lodge Lane, Chafford Hundred	Urban major conurbation
18	Blackshots Lane, Little Thurrock	Urban major conurbation

5.4.17 For each of the 18 locations, the average annual number of walking trips per person, for that location's rural/urban classification type, was applied to the population living within 800 metres to calculate the number of trips that could experience an increase and decrease in severance as shown in Table 5.9.

5.4.18 Table 5.9 shows that:

a. 8,968,979 walking trips per annum, or 24,573 per day, could experience more severance

b. 26,861,444 walking trips per annum, or 73,503 per day, could experience less severance

Net assessment

5.4.19 The net assessment is that there are 49,020 walking trips per day that experience a reduction in traffic-related severance. Using the criteria in TAG Unit A4.1, reduced severance for this number of walking trips per day equates to a Large Positive appraisal score.

Table 5.9 Populations and rural/urban classifications for locations experiencing a change in severance

Increased severance	**Location**	**Valley Drive, Gravesend**	**Forstal Road, Aylesford**	**Wrotham Road, Gravesend**	**Elaine Avenue, Strood**	**Springhouse Lane, Stanford-le-Hope**	**Brennan Road, Tilbury**	**Total**	
	Rural / Urban classifciation	Urban Conurbation	Urban City and Town	Rural Town and Fringe	Urban City and Town	Urban City and Town	Urban Conurbation		
	Population within 800 metres	6,697	1,511	2,373	13,655	6,835	6,216	37,287	
	Trips potentially impacted	1,694,341	361,129	443,751	3,263,545	1,633,565	1,572,648	8,968,979	
Decreased severance	Location	New Barn Road, Longfield	The Street, Cobham	Stanford Road, Grays	Warren Lane, Chafford Hundred	Station Road, West Hordon	Singlewell Road, Gravesend	Sub-total	
	Rural / Urban classifciation	Urban City and Town	Rural Village	Urban City and Town	Urban Conurbation	Rural Town and Fringe	Urban Conurbation		
	Population within 800 metres	2,936	480	1,916	12,132	1,526	15,425	34,415	
	Trips potentially impacted	701,704	72,960	457,924	3,069,396	285,362	3,902,525	8,489,871	
	Location	Cross Lane West, Gravesend	Dover Road East (up to railway line)	Dover Road	Northcote Road, Rochester	Lodge Lane, Chafford Hundred	Blackshots Lane, Little Thurrock		
	Rural / Urban classifciation	Urban Conurbation	Urban Conurbation	Urban Conurbation	Urban City and Town	Urban Conurbation	Urban Conurbation	**Sub-total**	**Total**
	Population within 800 metres	13,797	19,574	7,252	12,507	11,619	8,558	73,308	107,722
	Trips potentially impacted	3,490,641	4,952,222	1,834,756	2,989,173	2,939,607	2,165,174	18,371,573	26,861,444

Reference sources

The populations within 800 metres are sourced from ONS Mid-Year Population Estimates 2020

Summary assessment score

Large Positive

Qualitative comments

The populations affected by increases and decreases in severance will be lower than the 2020 mid-year population estimates because not all of the populations will want to cross the roads that have been identified as experiencing a change in traffic severance.

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Glossary

Term	Abbreviation	Explanation
100-year appraisal period		A sensitivity test used to appraise benefits and costs of the Project over a 100-year appraisal period.
2010 prices and values		The price base and present value year used to present and compare monetised costs and benefits of a transport project.
2030 opening year		A modelled year in the Project's LTAM traffic model in which traffic flows and costs are estimated when the Project is opened.
2045 design year		A modelled year in the Project's LTAM traffic model in which traffic flows and costs are estimated on which the Project design is based.
A-weighted decibel	dB(A)	An expression of the relative loudness of sounds as perceived by the human ear. A-weighting gives more value to frequencies in the middle of human hearing and less value to frequencies at the edges of human hearing.
A122 Lower Thames Crossing	Project	A proposed new crossing of the Thames Estuary linking the county of Kent with the county of Essex, at or east of the existing Dartford Crossing.
AM peak hour		The hour between 07:00–08:00 in in the Project traffic model LTAM.
AM peak period		The period between 06:00–09:00 in in the Project traffic model LTAM.
Acute Myocardial Infarction	AMI	Commonly known as a heart attack, this occurs when blood flow decreases or stops to the coronary artery of the heart, causing damage to the heart muscle.
Active Mode Appraisal Toolkit	AMAT	A DfT toolkit for appraising the physical activity impacts of transport projects.
Adjusted Benefit Cost Ratio	Adjusted BCR	The ratio of the sum of Level 1 and 2 PVBs to PVC
Affected Road Network	ARN	In air quality assessment, the network of roads to be considered within the air quality model (selection of the roads within the model depends on a number of criteria such as changes in Heavy Duty Vehicle flows).
Agglomeration		In traffic and economics assessment, benefits which come when firms and/or people locate near one another in geographical clusters
Air quality management area	AQMA	An area, declared by a local authority, where air quality monitoring does not meet Defra's national air quality objectives.
Air Quality Strategy Objective	AQSO	An objective set by the Air Quality Strategy for England, Scotland, Wales and Northern Ireland to improve air quality in the UK in the medium term. Objectives are focused on the main air pollutants to protect health.
Analysis of Monetised Costs and Benefits	AMCB	In transport and economic assessment, the conversion of changes due to a project into an estimated monetary value.
Ancient Semi-Natural Woodland	ANSW	A type of ancient woodland, acknowledged as non-statutory designated sites and protected under the National Planning Policy Framework.

Term	Abbreviation	Explanation
Annual Average Daily Traffic	AADT	An estimate of the average daily traffic along a defined segment of roadway. This value is calculated from short-term counts taken along the same section, which are then factored to produce the estimate of AADT. Because of this process, the most recent AADT for any given roadway will always be for the previous year.
Annual Average Weekday Traffic	AAWT	The average weekly flow of vehicles on a road or section of a road
Appraisal		The process of defining objectives, examining options and weighing up the relevant costs, benefits, risks and uncertainties.
Appraisal period		The period of time over which benefits, costs and revenues are appraised. For a road scheme this includes benefits and costs before scheme opening and all impacts for 60 years from scheme opening.
Appraisal Summary Table	AST	A table that appraises the performance of each option against economic, environmental, social and distributional sub-impacts and is used to directly inform the Value for Money assessment for the economic case.
Appraisal year		The year in which an appraisal is undertaken and is used to determine when changes to the discount rate are applied
Area of Outstanding Natural Beauty	AONB	Statutory designation intended to conserve and enhance the ecology, natural heritage and landscape value of an area of countryside.
Balance of payments	BoP	The difference between all money flowing into a country in a particular period of time (e.g. a quarter or a year) and the outflow of money to the rest of the world.
Base cost		A category of project costs that covers the material and labour inputs.
Benefit		An increase in the welfare of society from a project, programme or policy.
Benefit Cost Ratio	BCR	The ratio of a project's benefits to its costs.
Biodiversity Action Plan	BAP	National, local and sector-specific plans established under the UK Biodiversity Action Plan, with the intention of securing the conservation and sustainable use of biodiversity.
Black, Asian and Minority Ethnic	BAME	A collective term for the minority ethnic population.
Building Cost Information Service	BCIS	A provider of cost and price information for the UK construction industry and part of RICS.
CM45		Core traffic growth without scheme scenario used to appraise noise, air quality and greenhouse gases.
CM49		Core traffic growth without scheme scenario used to appraise all impacts except noise, air quality and greenhouse gases.
Capital expenditure	CAPEX	The cost of developing or providing non-consumable parts of the product or system.
Carbon Budget	CB	Carbon budgets are a simplified way to measure the additional emissions that can enter the atmosphere, whilst limiting global warming to defined levels, such as 1.5°C. Carbon budgets are based on the fact that the amount of warming that will occur can be approximated by total CO2 emissions

Term	Abbreviation	Explanation
Carbon dioxide equivalent	CO_2e	A standard unit for measuring carbon footprints that describes, for a given amount of greenhouse gas emissions, the amount of CO_2 that would have the same Global Warming Potential (GWP) when measured over a timescale of 100 years.
Central case appraisal		The expected benefits and costs of the Project being submitted for development consent
Closed Circuit Television	CCTV	National Highways CCTV cameras are used to monitor traffic flows on the English motorway and trunk road network primarily for the purposes of traffic management.
Combined Modelling and Appraisal Report	ComMA	The purpose of the Combined Modelling and Appraisal Report is to inform decision makers and stakeholders on how the evidence underpinning the business case has been developed, from the initial identification of the underlying problem through the collection of data and the production of any supporting traffic models and forecast impacts of the Project on traffic to the eventual economic appraisal.
Compensation of employees	COE	A statistical measure of the total gross (pre-tax) wages paid by employers to employees for work done in an accounting period, such as a quarter or a year.
Conservation area		An area of special environmental or historic interest or importance, of which the character or appearance is protected by law against undesirable changes (Section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990).
Consumer Price Index	CPI	A measure that examines the weighted average of prices of a basket of consumer goods and services, such as transportation, food and medical care. It is calculated by taking price changes for each item in the predetermined basket of goods and averaging them.
Consumer Prices Index including owner occupiers' housing costs	CPIH	A price index that measures the price of a weighted average market basket of consumer goods and services purchased by households including owner occupiers housing costs.
Core traffic growth		The central traffic growth forecast
COst and Benefit to Accidents – Light Touch	COBALT	DfT's software used to appraise the change in accidents due to a transport project.
CS67		Core traffic growth with scheme scenario used to appraise noise, air quality and greenhouse gases
CS72		Core traffic growth with scheme scenario used to appraise all impacts except noise, air quality and greenhouse gase
Day to day variability	DTDV	The daily variability in travel times excluding the impact of incidents
Decibel	dB	The unit of measurement used for sound pressure levels and noise levels.
Department for Business, Energy and Industrial Strategy	BEIS	A department of the UK government, with responsibility for business, industrial strategy, and science and innovation with energy and climate change policy.

Term	Abbreviation	Explanation
Department for Environment, Food and Rural Affairs	Defra	The government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities in the United Kingdom of Great Britain and Northern Ireland.
Department for Transport	DfT	The government department responsible for the English transport network and a limited number of transport matters in Scotland, Wales and Northern Ireland that have not been devolved.
DfT Value for Money Framework		Outlines the Department's approach to Value for Money assessments and provides guidance on how the outputs of these assessments should be communicated to decision-makers.
Design Manual for Roads and Bridges	DMRB	Design Manual for Roads and Bridges: A comprehensive manual which contains requirements, advice and other published documents relating to works on motorway and all-purpose trunk roads for which one of the Overseeing Organisations (National Highways, Transport Scotland, the Welsh Government or the Department for Regional Development (Northern Ireland)) is the highway authority. For the A122 Lower Thames Crossing, the Overseeing Organisation is National Highways.
Development Consent Order	DCO	Means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects (NSIPs) under the Planning Act 2008.
Disbenefits		Negative benefits.
Discounting		A technique used to compare costs and benefits occurring at different points of time
Displacement		An increase in employment in one firm, locality or region which is offset by reductions elsewhere
Distributional impact	DI	The variance of transport intervention impacts across different social groups. The appraisal of DIs is mandatory in the appraisal process and is a constituent of the Appraisal Summary Table (AST)
Distributional Impact Appraisal	DIA	An appraisal of Distributional Impacts.
Dynamic clustering		Benefits come when firms and/or people locate near one another in geographical clusters by changing their spatial location
Dynamic Integrated Assignment and DEmand Model	DIADEM	DfT software for finding equilibrium between demand and supply in a transport model
Economic Appraisal Report	EAR	A report that presents the appraisal methods and results for a transport project
Emissions Factor Toolkit	EFT	The Emissions Factors Toolkit (EFT) is published by Defra and the Devolved Administrations to assist local authorities in carrying out review and assessment of local air quality as part of their duties under the Environment Act 1995.

Term	Abbreviation	Explanation
Environment Agency	EA	A non-departmental public body of Defra, established under the Environment Act 1995. It is the leading public body for protecting and improving the environment in England and Wales. The organisation is responsible for wide-ranging matters, including the management of all forms of flood risk, water resources, water quality, waste regulation, pollution control, inland fisheries, recreation, conservation and navigation of inland waterways.
Environmental Impact Assessment	EIA	A process by which information about environmental effects of a proposed development is collected, assessed and used to inform decision making. For certain projects, EIA is a statutory requirement, reported in an Environmental Statement.
Environmental Quality Standards	EQS	The standards set out in the Environmental Quality Standards Directive (2008/105/EC) which concern the presence in surface water of certain pollutants and substances or groups of substances identified as priority or 'priority hazardous', on account of the substantial risk they pose to or via the aquatic environment.
Environmental Statement	ES	A document produced to support an application for development consent that is subject to Environmental Impact Assessment (EIA), which sets out the likely impacts on the environment arising from the proposed development.
Essex Red Data List	ERDL	Endangered species in Essex included in the Red Data Book which is a public document created to record endangered and rare species of plants, animals, fungi as well as some local subspecies which are present in a particular region.
Foreign Direct Investment	FDI	Investment into the UK economy by overseas companies and governments.
GDP deflator		A measure of the level of prices of all new, domestically produced, final goods and services in an economy in a year.
Geographic Information System	GIS	An integrated collection of computer software and data used to view and manage information about geographic places, analyse spatial relationships and model spatial processes.
Great Crested Newt	GCN	Great crested newts are a European protected species. The animals and their eggs, breeding sites and resting places are protected by law.
Greenhouse gas	GHG	Gases able to absorb infrared radiation emitted from Earth's surface and reradiate it back to Earth's surface, thus contributing to the greenhouse effect. Carbon dioxide, methane, and water vapour are the most important greenhouse gases.
Green Belt		A policy and land use zone designation used in land use planning to retain areas of undeveloped land surrounding urban areas.
Green Book		HM Treasury's guidance on how publicly funded projects, programmes and policies should be appraised and evaluated.
Gross Disposable Household Income	GDHI	The standard measure of household income
Gross Domestic Product	GDP	Total value of all goods and services produced within an economy in one year.
Gross Domestic Product per worker		A measure of productivity.

Term	Abbreviation	Explanation
Gross Value Added	GVA	The measure of the value of goods and services produced in an area, industry or sector of an economy.
Groundwater and Groundwater Dependent Terrestrial Ecosystems	GWDTE	A wetland that critically depends on groundwater flows and chemistries to support sensitive ecosystems.
Habitat of Principal Importance	HoPI	Habitats listed in section 41 of the Natural Environment and Rural Communities (NERC) Act 2006, considered to be the UK's most important habitats for wildlife.
Hectare	ha	The hectare is an SI unit of area primarily used in the measurement of land as a metric replacement for the imperial acre. An acre is about 0.405ha and 1ha is about 2.47 acres.
Herfindahl–Hirschman Index	HH index	An economic measure of market concentration.
Heavy Goods Vehicle	HGV	A large, heavy motor vehicle used for transporting cargo.
High Speed 1	HS1	A 109km high-speed railway between London and the UK end of the Channel Tunnel. The line carries international passenger traffic between the UK and continental Europe; it also carries domestic passenger traffic to and from stations in Kent and east London, as well as Berne gauge freight traffic.
Highways England Water Risk Assessment Tool	HEWRAT	A water risk assessment tool produced by National Highways
HM49		High traffic growth without scheme scenario
HM Treasury	HMT	The government's economic and finance ministry which maintains control over public spending, setting the direction of the UK's economic policy.
HS72		High traffic growth with scheme scenario
Income Domain		One of components of the Index of Multiple Deprivation that measures the proportion of the population in an area experiencing deprivation in terms of low income
Index of Multiple Deprivation	IMD	Official measure of relative deprivation for 32,844 small census areas in England. A rank of 1 is the most deprived area.
Indices of deprivation	IOD	A measure of the relative levels of deprivation. In England this considers 32,844 small areas or neighbourhoods, called Lower Layer Super Output Areas. The IOD 2019 is based on 39 separate indicators, organised across seven distinct domains of deprivation; these relate to income, employment, education, health, crime, living environment and barriers to housing and services.
Indirect tax revenue		Revenues from indirect taxes, such as fuel duty, paid by road users
Industrial structure		The categorisation of industries with an economy
Inflation		A measure of the increase in prices within the economy

Term	Abbreviation	Explanation
Initial BCR		The BCR that includes Level 1 benefits
Inter-peak	IP	An average hour within LTAM to represent an hour within the period 09:00–15:00
International Union for Conservation of Nature	IUCN	The International Union for Conservation of Nature is the global authority on the status of the natural world and the measures needed to safeguard it.
International Territorial Level	ITL	A geocode standard for referencing the subdivisions of the United Kingdom for statistical purposes, used by the Office for National Statistics (ONS). Within the UK it replaced the EU's NUTS system after Brexit.
Journey time reliability	JTR	The variation in journey times that travellers are unable to predict due to incidents and other factors
Krugman Specialisation Index	KSI	An economic measure of regional industrial specificalisation
Land Use Transport Interaction model	LUTI	An economic model used to estimate the wider economic impacts based on variable land uses
Landscape Character Area	LCA	The discrete geographical areas of a particular landscape type. Also referred to as Local Landscape Character Area (LLCA)
Level 1 benefits		Monetised benefits estimated using established methodologies that are included in the Level 1 PVB when calculating the Initial and Adjusted BCRs
Level 2 benefits		Monetised benefits estimated using less established methodologies that are included in the Level 2 PVB when calculating the Adjusted BCR
Level 3 benefits		Either monetised or qualitatively appraised benefits that are not included in BCRs but which are taken into account in assessing a project's Value for Money
Light Goods Vehicle	LGV	Vehicles meeting the Department for Transport VEH04 criteria.
LM49		Low traffic growth without scheme scenario
Local authority areas	LAA	Several local authorities
Local Nature Reserve	LNR	Locally designated nature site protected through the planning system.
Local Planning Authority	LPA	A local planning authority is the local authority or council that is empowered by law to exercise statutory town planning functions for a particular area of the UK. May also be referred to as 'local authority'.
Local North		The Lower Thames local authorities of Havering, Thurrock and Brentwood
Local South		The Lower Thames local authorities of Dartford, Gravesham and Medway
Local Wildlife Site	LWS	Locally designated nature site protected through the planning system.
Location Quotient	LQ	An economic concept used as a relative measure of industry concentration

Term	Abbreviation	Explanation
Lower Layer Super Output Area	LSOA	A geographical area defined by the ONS used to produce neighbourhood statistics for small areas with a typical population of around 1,500 people
Lower Thames Area Model	LTAM	Transport model designed to forecast impacts of providing additional road based capacity across the River Thames at locations at or east of the existing Dartford Crossing.
LS72		Low traffic growth with scheme scenario
M25 motorway		Orbital motorway that encircles most of Greater London
Marginal external costs	MEC	The additional cost imposed on third parties by producing an extra unit of a good or service. In the case of transport projects it includes congestion, air pollution, noise, infrastructure impacts and accidents.
Market failure		A situation where the allocation of goods and services is inefficient resulting from a divergence between the private costs and benefits experienced by individuals, businesses and society.
Monte-Carlo simulation		A computational algorithm based on repeated random sampling to obtain cost estimates.
Most Likely		The expected level of CAPEX costs expressed as a probability (P) level.
Motorway Reliability Incidents And Delays	MyRIAD	Motorway Reliability Incidents And Delays appraisal software.
Moves to more or less productive jobs	M2MLPJ	A Level 3 wider economic impact that reflects the distortionary effect of taxes on the labour market and is measured by the change in tax revenues to Government due to a transport scheme
National Character Area	NCA	NCAs divide England into 159 distinct natural areas. Each NCA is defined by a unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity. Their boundaries follow natural lines in the landscape rather than administrative boundaries.
National Highways Carbon Valuation Toolkit v1.4.2		National Highways appraisal tool used to present and value in monetary terms all greenhouse gas emissions of a road project.
National Highways Commercial Services Division	CSD	National Highways division responsible for commercial services.
National Planning Policy Framework	NPPF	The National Planning Policy Framework was published in March 2012 by the UK's Department of Communities and Local Government, consolidating over two dozen previously issued documents called Planning Policy Statements (PPS) and Planning Practice Guidance Notes (PPG) for use in England. The NPPF was updated in February 2019 and again in July 2021 by the Ministry of Housing, Communities and Local Government.

Term	Abbreviation	Explanation
National Policy Statement for National Networks	NPSNN	The NPSNN sets out the need for, and Government's policies to deliver, development of Nationally Significant Infrastructure Projects on the national road and rail networks in England. It provides planning guidance for promoters of Nationally Significant Infrastructure Projects on the road and rail networks, and the basis for the examination by the Examining Authority and decisions by the Secretary of State.
National Trip-End Model	NTEM	A DfT model that forecasts the growth in trip origin-destinations (or productions-attractions) up to 2051 for use in transport modelling. The forecasts take into account national projections of population, employment, housing, car ownership and trip rates.
National Vocational Qualifications (NVQ) Level 4	NVQ4	National Vocational Qualifications are work-based awards in England, Wales and Northern Ireland that are achieved through assessment and training. NVQ level 4 is equivalent to a degree level education.
Net Present Value	NPV	A measure of the total impact of a scheme upon society, in monetary terms, expressed in 2010 prices.
New Economic Geography	NEG	A theoretical framework for locational decisions in the context of imperfectly competitive markets.
Nitrogen dioxide	NO_2	A reactive gas introduced into the environment by natural causes, including entry from the stratosphere, bacterial respiration, volcanos, and lightning. It is also introduced by the emissions of internal combustion engines burning fossil fuels.
NOMIS		An ONS web site that publishes official census and labour market statistics for the UK
NOMIS Business Register and Employment Survey	BRES	An employer survey of the number of jobs held by employees at the location of their workplace broken down by full/part-time and detailed industry classification using five digit SIC codes
Nomenclature of Territorial Units for Statistics	NUTS	A standard for referencing the subdivisions of countries for statistical purposes. The standard is developed and regulated by the European Union, and thus only covers the member states of the EU in detail.
Non-Motorised Users	NMU	Users of non-motorised vehicles (eg cyclists, horse riders) and pedestrians.
Non-recoverable VAT	NR VAT	Value added tax that has been paid but cannot be reclaimed by a business.
Non-traded carbon		Carbon emissions in sectors not included in Emission Trading Systems such as those from road vehicles
O&M model		National Highways model for estimating operating, maintenance and renewals costs of road projects
Office for National Statistics	ONS	The executive office of the UK Statistics Authority, a non-ministerial Government department responsible for the collection and publication of statistics related to the economy, population and society of the UK
Off-peak period	OP period	The hours between 18:00-06:00 within the Project traffic model (LTAM).
Operating, maintenance and renewals expenditure	OMR	Operating, maintenance and renewal expenditure.

Term	Abbreviation	Explanation
Origin-destination	OD	Origin-destination data (also known as flow data) includes the travel-to-work and migration patterns of individuals, cross-tabulated by variables of interest (for example occupation).
OSPAR		The mechanism by which 15 governments (including the UK) and the EU cooperate to protect the marine environment of the North-East Atlantic.
Other Goods Vehicle 1	OGV1	All rigid vehicles over 3.5 tonnes gross vehicle weight including all large vehicles on a single frame: trucks, tow trucks, campers, motor homes, large ambulances, etc.
Other Goods Vehicle 2	OGV2	All articulated vehicles including multi-unit goods-carrying vehicles with a tractor or straight truck power unit, including goods-carrying rigid trucks pulling trailers and rigid vehicles with four or more axles.
P10		Costs for which there is a 10% chance that they will not be exceeded.
P90		Costs for which there is a 90% chance that they will not be exceeded.
PM peak hour		The hour between 17:00–18:00 within LTAM
PM peak period		The hours between 15:00–18:00 within LTAM
Particulate matter	$PM_{2.5}$	Particulate matter with a diameter smaller than 2.5 micrometers
Passenger car unit	PCU	A metric to allow different vehicle types within traffic flows in a traffic model to be assessed in a consistent manner. PCU factors used within the Project's transport model are: 1 for a car or Light Goods Vehicle; 2 for a bus, 2.5 for a Heavy Goods Vehicle.
Pence per hour	PPH	Travel cost per hour
Pence per kilometre	PPK	Travel cost per kilometre
Pence per minute	PPM	Travel cost per minute
Personal Injury Accident	PIA	An accident that involves personal injury occurring on the public highway (including footways) in which at least one road vehicle or a vehicle in collision with a pedestrian in involved and which becomes known to the police within 30 days of its occurrence.
Present Value	PV	The result of discounting a stream of benefits or costs
Present Value of Benefits	PVB	The sum of discounted benefits
Present Value of Costs	PVC	The sum of discounted costs
Public Accounts table	PA table	A TAG appraisal table that reports the impacts of the Project on the public finances
Public Rights of Way	PRoW	A right possessed by the public, to pass along routes over land at all times. Although the land may be owned by a private individual, the public may still gain access across that land along a specific route. The mode of transport allowed differs according to the type of Public Right of Way which consist of footpaths, bridleways and open and restricted byways
Public Transport	PT	A system of vehicles such as buses and trains that operate at regular times on fixed routes and are used by the public

Term	Abbreviation	Explanation
Quantitative Risk Assessment	QRA	A formal and systematic risk analysis approach to quantifying the risks associated with the operation of an engineering process.
Quarter 1	Q1	The first three month period in a financial year.
Queen Elizabeth II bridge	QEII bridge	Queen Elizabeth ll Bridge, part of the Dartford-Thurrock crossing.
QUeues And Delays at Roadworks maintenance delays appraisal software	QUADRO	A National Highways sponsored computer program to estimate the effects of roadworks in terms of time, vehicle operating and accident costs on the users of the road
Quality Index	QI	A measure of the robustness of TRIS traffic data
RAMSAR site		A wetland of international importance, designated under the Ramsar convention
Real terms		A data series for costs and benefits excluding the effect of the general level of price increases
Reliability ratio		A ratio used to calculate Journey Time Reliability benefits
Retail Prices Index	RPI	A price index that measures the change in the cost of a representative sample of retail goods and services. No longer classified as a national statistic in the UK
Revenue		Income from road users that are included in the PVC
Risk (costs)		A category of costs associated with events that may arise or may not arise due to a road project
River Basin Management Plan	RBMP	A planning document published by the Department for Environment, Food and Rural Affairs and the Environment Agency which sets out how organisations, stakeholders and communities will work together to improve the water environment.
Road user charging	RUC	A road user fee for the use of the tunnel.
Roll on – roll off	Ro-ro	Freight that can be driven on and off ships using their own wheels or a platform vehicle such as a self-propelled modular transporter
Sensitivity test		A test carried out to investigate the dependency in the model outputs to the values input into the model. Often a single input value is changed in turn and the resulting model outputs examined.
Simulation and Assignment of Traffic to Urban Road Networks, software	SATURN	Software used to build transport models
Site of Importance for Nature Conservation	SINC	Locally designated nature site protected through the planning system.
Site of Special Scientific Interest	SSSI	A conservation designation denoting an area of particular ecological or geological importance

Term	Abbreviation	Explanation
Social cost benefit analysis	CBA	A technique used to assess and compare the costs and socio-economic benefits of different options
Social impact appraisal		Social impacts cover the human experience of the transport system and its impact on social factors, not considered as part of economic or environmental impacts
South East Local Enterprise Partnership	SELEP	The business-led, public-private body established to drive economic growth across East Sussex, Essex, Kent, Medway, Southend and Thurrock
South East Regional Traffic Model	SERTM	National Highways South East Regional Traffic Model
Spatial Computable General Equilibrium model	SCGE	A methodology that can be used in the appraisal of the wider economic impacts of a transport intervention.
Special Area of Conservation	SAC	A designation under EU Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, also known as the Habitats Directive.
Special Protection Area	SPA	A designation under EU Directive 2009/147/EC on the Conservation of Wild Birds.
Standard Industrial Classification	SIC	A system used to classify business establishments and other statistical units by the type of economic activity in which they are engaged.
Strategic Road Network	SRN	The core road network in England managed by National Highways
Static clustering		Benefits that come when firms and/or people locate near one another in geographical clusters but do not change their spatial location
STATS19		A database of all road traffic accidents that resulted in a personal injury and were reported to the police within 30 days of the accident. The data are collected by the police at the roadside or when the accident is reported to them by a member of the public in a police station.
Teletrac		DfT traffic dataset
Tender Price Index	TPI	An index of the prices for which contractor offer to carry out projects
Thames Estuary 2100	TE2100	An Environment Agency project (formed November 2012) to develop a comprehensive action plan to manage flood risk for the Tidal Thames from Teddington in West London, through to Sheerness and Shoeburyness in Kent and Essex.
Transport Analysis Guidance	TAG	Transport Analysis Guidance published by DfT which provides methods to model and appraise the impacts of transport projects
TAG data book		The data book of appraisal parameters used in transport appraisals for DfT
Transport Decarbonisation Plan	TDP	The government's commitments and actions needed to decarbonise the entire transport system in the UK

Term	Abbreviation	Explanation
Transport Economic Efficiency	TEE	An appraisal table used to report the Level 1 benefits that measure the impact of a transport scheme on the efficiency of the transport system
Transport User Benefits Appraisal	TUBA	DfT's transport user benefits appraisal software
TRIS		National Highways Traffic Count Database
Traded carbon		Carbon emissions in the traded sectors covered by Emission Trading Systems such as the power and industrial sectors
Travel time variability	TTV	The daily variation in travel times not due to incidents
Tunnel Boring Machine	TBM	A large machine used to excavate tunnels with a circular cross-section.
Uncertainty (costs)		A category of project costs that are unpredictable
User class	UC	Categorisation of different transport users based on their journey purposes
Value Added Tax	VAT	A consumption tax levied in the UK which was introduced in 1973. It is administered and collected by HM Revenue and Customs. VAT is levied on most goods and services provided by registered businesses in the UK and some goods and services imported from outside the European Union. The default VAT rate is the standard rate, 20% since 4 January 2011. Some goods and services are subject to VAT at a reduced rate of 5% (such as domestic fuel) or 0% (such as most food and children's clothing).
Value for Money	VfM	Value for Money, being the optimum combination of whole-life costs and quality to meet the user requirement.
Value of time	VOT	The opportunity cost of the time that a traveller spends on their journey and would be the amount that a traveller would be willing to pay in order to save time
Variable demand model	VDM	A transport model that represents how people respond to changes in travel times and costs
Vehicle operating costs	VOC	Costs that vary with vehicle usage, including fuel, tyres, maintenance, repairs, and mileage-dependent depreciation costs.
VISUM		Strategic car and rail modelling software
Volume over capacity	V/C	The ratio of a road's current or projected traffic volumes to its saturation flow or capacity
Water Framework Directive	WFD	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. The Directive establishes a framework for the protection of inland surface waters, estuaries, coastal waters and groundwater. The framework for delivering the WFD is through river basin management planning. The UK has been split into several river basin districts. Each river basin district has been characterised into smaller management units known as water bodies. The surface water bodies may be rivers, lakes, estuary or coastal.
Weekend	WE	A time period included in the transport model that covers travel on Saturdays and Sundays

Term	Abbreviation	Explanation
Wider Economic Impacts	WEI	Land use-related economic consequences of transport interventions, not directly related to impacts on users of the transport network, such as increased productivity. There are two Levels of Wider Economic Impacts, Level 2 and Level 3 benefits, that vary depending on whether land use is assumed to change.
WITA v2.2		DfT Wider Impacts Transport Appraisal Version 2.2 software used to appraise Level 2 wider economic impacts
With Scheme		Appraisal scenario that includes a proposed intervention such as a project, programme or policy. Also referred to as With Project
Without Scheme		Appraisal scenario that excludes a proposed intervention such as a project, programme or policy. Also referred to as Without Project
World War II	WWII	World War 2

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