PCF Stage 1 Environmental Assessment Report: Volume 1

A2 Bean & Ebbsfleet Junction Improvements

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1 Introduction

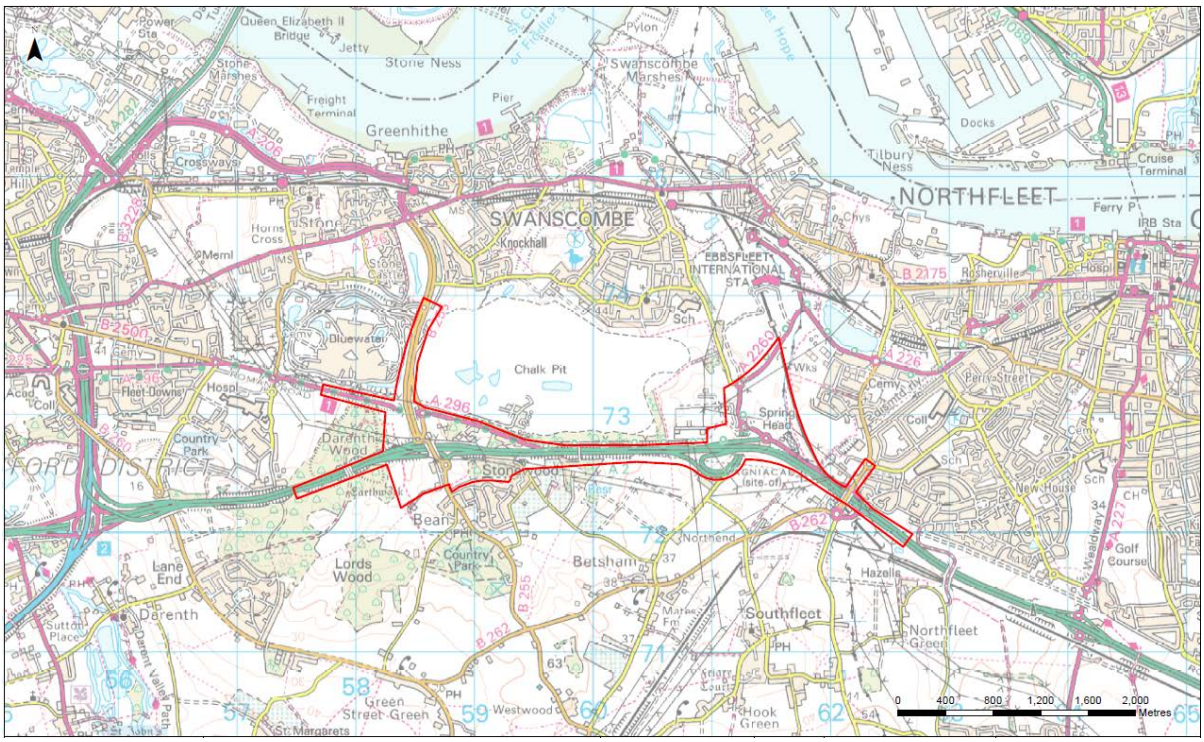
1.1 Overview of the Project

1.1.1 Highways England is considering solutions to existing and predicted congestion problems at the A2 Bean and Ebbsfleet Junctions (known hereafter as the Scheme). Halcrow Hyder Joint Venture (HHJV) has been appointed by Highways England to provide Design Services to develop the Scheme through the Options Phase. Insert 1-1 Scheme Location and Figure 1.1 in Volume 2 shows the location of the Scheme.

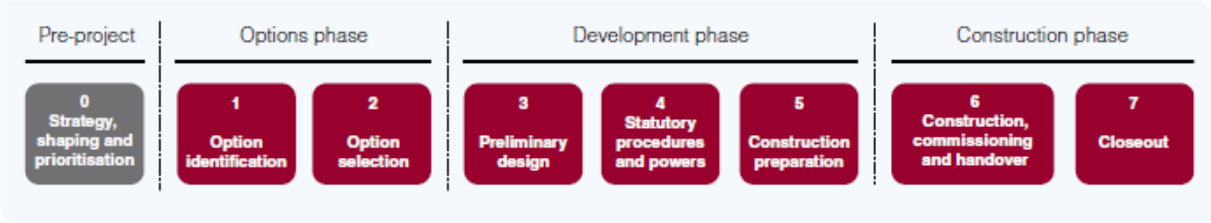
1.1.2 The purpose of this Environmental Assessment Report (EAR) is to present to the public, the statutory environmental bodies and other stakeholders, the environmental assessment findings for the Scheme options.

1.1.3 The Scheme is being delivered under Highways England's Project Control Framework (PCF) (Ref 1-1). The project is currently at PCF Stage 1- options phase (refer to Insert 1-2). Under the Options phase of the PCF for major road projects the preferred road solution to the transport problem is identified. By the end of this stage there is certainty, for example, that the project will involve widening along a specific route. The key outcomes of Stage 1 are:

- Identify options to be taken to public consultation
- Assess options in terms of environmental impact, traffic forecasts and economic benefits
- Refine the cost estimate of options (including an allowance for risk) (Marsh, 2016, see Ref 1-1)



Insert 1-1 Scheme Location



Insert 1.2 Major Project Lifecycle (Marsh, 2016). The project is currently at Stage 1.

1.2 Purpose of the Environmental Assessment Report

1.2.1 The purpose of this EAR is to present to the public, the statutory environmental bodies and other stakeholders, the environmental assessment findings for the Scheme options.

1.2.2 The report will be used to perform the following functions to assist in the iterative design process:

- To obtain and record baseline conditions
- To identify key environmental constraints and ensure these are taken account during the design process.
- To determine the magnitude and significance of effects
- To outline opportunities to avoid / minimise any adverse effects and identify opportunities for mitigation.
- To identify any residual effects and mitigation/monitoring measures to inform subsequent detailed scheme design.
- To provide a comparison of the environmental effects predicted for each option.
- To outline the next stages of assessment where applicable.

1.3 Scope and Content

1.3.1 The EAR comprises the following topics:

- Ecology and Nature Conservation
- Landscape and Visual
- Air Quality
- Noise and Vibration
- Cultural Heritage
- Road Drainage and the Water Environment
- People and Communities

1.3.2 The impact of the Scheme on policies and plans has been considered within each topic as appropriate. Cumulative impacts have also been considered within each topic assessment.

1.3.3 The chapters within this EAR present the findings of the various topics assessed as part of the ongoing planning and design of the options. A summary table is provided in Chapter 12, to allow comparison of overall environmental effects predicted for each option.

1.3.4 The scope followed for this Stage 1 EAR is provided in the Environmental Constraints and Scoping Report (01 February 2016), hereafter termed the Scoping Report (Ref 1-2).

1.3.5 Both Geology & Soils and Materials Chapters were scoped out for Stage 1, as there is not sufficient information available on construction methods to inform assessment of the options. These topics will be assessed for the preferred route option, at Stage 3. Road Drainage and the Water Environment, Chapter 10, does however summarise the underlying geology associated with the Scheme options and assesses contaminated land aspects and how the scheme might impact upon or be impacted by these aspects.

2 The Project

2.1 Project Objectives

2.1.1 Project objectives have been identified for the Scheme, in relation to Transport, Environment, Economy, Safety and Accessibility. The environment project objectives for the Scheme are provided below:

Environment

- Minimise environmental impact as measured in accordance with the Design Manual for Roads and Bridges (DMRB)
- Where possible, improve air quality with regard to vehicle emissions in declared Air Quality Management Areas (AQMAs)

2.1.2 A full list of the Scheme Objectives is included in the project Client Schedule Requirements dated March 2015. These are also included in section 2.2 of the Technical Appraisal Report.

2.1.3 Alongside the Scheme project objectives Highways England sets out its own approach to meeting the key performance indicators identified within the Roads Investment Strategy (Ref 2-1) of "no net loss of biodiversity by 2020" in it Biodiversity Plan. The Highways England Delivery Plan 2015-2020 also sets targets to mitigate noise in at least 1,150 Noise Important Areas between 2015/2016 and 2019/2020 through the bodies Delivery Plan (Ref 2-2).

2.2 The Existing Situation

2.2.1 Highways England is considering solutions to existing and predicted congestion problems at the A2 Bean and Ebbsfleet Junctions.

2.2.2 The A2 Bean Junction and A2 Ebbsfleet Junctions are adjacent grade-separated junctions located on the A2 trunk road in Dartford, Kent. The Bean Junction connects the Bluewater shopping centre via the B255 to the A2. The Ebbsfleet Junction connects the A2 to the B259 Southfleet Road and provides access to Ebbsfleet International railway station. The proposed improvements to the junctions are considered necessary to support the level of development growth planned for Kent Thameside including the Ebbsfleet Garden City proposals. The Road Investment Strategy 2015 and Highways England Delivery Plan 2015 both contain a detailed justification for the delivery of the Scheme. Insert 1-1 shows the location of the Scheme.

2.3 Description of the Proposed Project

Overview

2.3.1 Three Scheme options (with proposed junction improvements at both the Bean and Ebbsfleet Junctions) have been developed for the appraisal for PCF Stage 1. For the purposes of this Stage 1 EAR the three Scheme options are referred to by the following reference numbers:

- B03E01b - Bean Option 3 and Ebbsfleet Option 1b
- B04bE01b - Bean Option 4b and Ebbsfleet Option 1b
- B05E01b - Bean Option 5 and Ebbsfleet Option 1b

2.3.2 The proposed junction improvements at both Bean and Ebbsfleet are described in detail below and shown in Figure 2.1 to 2.4 in Volume 2.

2.4 Bean Option 3 (B3)

2.4.1 This option replaces the existing double roundabout layout with a single large traffic signal controlled gyratory with two structures crossing the A2, the existing Bean Road Overbridge and a new bridge crossing located to the west. The existing Hope Cottages Roundabout, Ightham Cottages Roundabout, eastbound off-slip and westbound slip roads are stopped up.

2.4.2 The new gyratory is located immediately to the west of the existing junction and has full traffic signal control with three lanes on the circulatory carriageway, except on the southern section which has four lanes.

2.4.3 To connect the new gyratory with the westbound carriageway of the A2, new westbound slip roads are provided in the south west and south east quadrants of the junction in a conventional diamond layout. The westbound on-slip crosses the valley to the west of the existing junction on a high embankment and joins the A2 westbound carriageway with a ghost island merge layout at the existing Down Farm Overbridge. To widen the A2 at the new merge Down Farm Overbridge is demolished and replaced with a new bridge with an increased span. The eastbound carriageway of the A2 is connected to the gyratory by a new slip road provided north of the existing on widened embankment. A dedicated left turn lane is provided between the eastbound off-slip and the B255 northbound carriageway. The existing arrangement with the eastbound on-slip provided at the junction via Bean Lane and the A296 Watling Street is retained.

2.4.4 A new single carriageway road, located to the west of Hope Cottages, would link the new gyratory to Bean Lane at a new junction south of Hope Cottages. The section of Bean Lane from this new junction and the existing Hope Cottages Roundabout would be stopped up.

2.4.5 The B255 is realigned at the gyratory and the northbound carriageway widened to provide three lanes at the exit from Ightham Cottages roundabout for up to 150m requiring the widening of the existing highway embankment. The widened carriageway tapers back down to tie into the existing two lanes before the existing bridge over the A296

2.4.6 Bean Lane (north) is widened to two lanes north bound with one lane south bound with provision for right turning movements into the access road to Ightham Cottages and bus laybys to replace the existing bus stops.

2.4.7 The A296 / Bean Lane roundabout is replaced with a signal controlled junction and the A296 widened to two lanes eastbound with one lane retained westbound along is full length. A new traffic signal controlled junction to the Eastern Quarry development would be provided by the Eastern Quarry developers. This junction also provides access to a two-way collector road that runs parallel to the A296 and provides access to properties located within the Bean Triangle. The collector road also provides for NMU access to Sandy Lane and the existing NMU crossing of the A2 at Sandy Lane underbridge.

2.4.8 The existing A296 eastbound on-slip is widened to provide two lanes at the merge with the A2 eastbound carriageway. The eastbound on-slip is also realigned from the access to Sandy Lane to enable the revised merge layout to be provided before Swanscombe Footbridge. The limited

headroom at Swanscombe footbridge means that no further widening of the carriageway can be accommodated at the footbridge without replacement.

2.5 Bean Option 4b (B4)

2.5.1 This option provides a redesigned dumbbell arrangement at the existing junction comprising two new roundabouts located either side of the A2 and connected by a new dual carriageway link road located to the west of Hope Cottages. A new bridge crossing of the A2 is provided on the new link road and the existing Bean Road Overbridge is demolished. An additional slip road is provided from the north roundabout connecting the junction directly with the A2 eastbound carriageway. The existing connections with the B255, Bean Lane and the A296 (via Bean lane) are retained. The eastbound carriageway of the A2 is widened to provide an additional lane from the end of the new slip road to the existing eastbound on-slip at the A296. There are opportunities to use retaining features to limit the extent of widening required to limit its impact. The existing eastbound on slip at the A296 is retained but converted from a lane gain to a single auxiliary lane layout to merge with the existing four lanes east of the junction. Swanscombe footbridge is retained by continuing the narrow lanes through the structure.

2.5.2 The new roundabout on the south of the A2 is located to the south of the existing Hope Cottages. The roundabout retains a link to Bean Lane and provides access to Hope Cottages. The existing Hope Cottages roundabout and the section of Bean Lane from the existing Bean Road Overbridge to the new roundabout would be stopped up. New realigned slip roads link the new south roundabout with the A2 westbound carriageway in a similar layout to the existing slip roads.

2.5.3 The new roundabout on the north of the A2 is located to the north of the existing Ightham Cottages roundabout which is stopped up. The roundabout provides access to the A2 eastbound carriageway, the B255 and Bean Lane (north). The eastbound on-slip is realigned and a new on-slip is provided from the roundabout in the north east quadrant of the junction in a diamond layout passing through land owned by Dartford Borough Council and used as a horse sanctuary.

2.5.4 The B255 is realigned at the roundabout and the northbound carriageway widened to provide three lanes at the exit from Ightham Cottages roundabout for up to 150m requiring the widening of the existing highway embankment. The widened carriageway tapers back down to tie into the two lanes before the existing bridge over the A296. On the B255 southbound carriageway the slip road between the B255 and the A296 is closed. As a result, traffic from the B255 travelling to the A2 eastbound carriageway and to the A296 uses Ightham Cottages roundabout rather than the A296/Bean Lane roundabout, which is converted to a three arm roundabout and the existing A296 layout is retained.

2.5.5 Bean Lane (north) is widened to two lanes northbound with one lane south bound with provision for right turning movements into the access road to Ightham Cottages and bus laybys to replace the existing bus stops.

2.5.6 On the B255 southbound carriageway the slip road between the B255 and the A296 is retained for A296 bound traffic only. The left turn filter lane from the B255 slip road to the A296 eastbound carriageway is closed. As a result, traffic from the B255 travelling to the A2 eastbound carriageway is required to uses Ightham Cottages roundabout rather than the A296/Bean Lane roundabout, which is converted to a three armed signal controlled junction. No improvements to the A296 are proposed.

2.6 Bean Option 5 (B5)

2.6.1 The option retains the existing junction layout but with the existing roundabouts enlarged and converted to full traffic signal control. A new bridge crossing of the A2 is provided immediately to the east of Bean Road Overbridge for southbound traffic. Bean Road Overbridge is retained for northbound traffic only. An additional slip road is provided from the Ightham Cottages roundabout connecting the junction directly with the A2 eastbound carriageway to serve traffic from the B255. The eastbound carriageway of the A2 is widened to provide an additional lane from the end of the new slip road to the existing eastbound on-slip at the A296. There are opportunities to use retaining features to limit the extent of widening required to limit its impact. The existing eastbound on slip at the A296 is retained but converted from a lane gain to a single auxiliary lane layout to merge with the existing four lanes east of the junction. Swanscombe footbridge is retained by continuing the narrow lanes through the structure.

2.6.2 Ightham Cottages roundabout is widened to the east to provide for the new southbound link to Hope Cottages roundabout, for the new eastbound on-slip and to accommodate full traffic signal control. This results in the demolition of all the cottages. The roundabout is converted to traffic signal control.

2.6.3 Hope Cottages roundabout is widened to the west to accommodate full traffic signal controlled. The west bound off-slip is widened to three lanes on the approach with all three lanes provided for right turn movement to Bean Lane (link road). The existing dedicated left turn lane from Bean Lane to the westbound on-slip is removed.

2.6.4 On the B255 southbound carriageway the slip road between the B255 and the A296 is closed. As a result, traffic from the B255 travelling to the A2 eastbound carriageway and to the A296 uses Ightham Cottages roundabout rather than the A296/Bean Lane roundabout, which is converted to a three arm roundabout and the existing A296 layout is retained.

2.7 Ebbsfleet Option 1b (E1)

2.7.1 This option retains the existing junction layout but with the existing roundabouts enlarged to provide for full traffic signal control. Access is provided at the junction to the Station Quarter South and Ebbsfleet Green developments. The link road between the roundabouts is widened from the existing single carriageway to a dual two lane carriageway with additional widening to three lanes on the approach to the roundabouts. The existing eastbound and westbound off-slips are retained, with the westbound off-slip converted to two lanes along is full length with provision for a ghost island merge layout onto the A2 westbound carriageway. The eastbound on-slip is widened to two lanes with provision for a ghost island merge layout onto the A2 eastbound carriageway.

2.7.2 The east roundabout is extended to the north and an additional arm added to accommodate access to the Station Quarter South development. The eastbound on-slip is widened to two lanes and separated from the one-way link road to the Pepper Hill Junction. The slip road is realigned from land forming part of the old service area to enable the existing merge to be moved west. This allows the widened carriageway to be provided before the constraint to widening caused by the existing Pepperhill Underbridge and soil nail retaining wall. The eastbound off-slip is widened at the approach to the roundabout with a dedicated signal controlled two lane left turn lane.

2.7.3 The west roundabout is extended to the south. The west arm at the roundabout will provide access to the Ebbsfleet Green development currently in construction. The circulatory carriageway is widened to provide for three lanes on the south circulatory carriageway with three lanes provided

on the exit from the roundabout northbound on the A2260 for 150m before tapering back to tie into the existing 2 lanes.

3 Alternatives Considered

3.1 Design Options Considered– Options Identification

3.1.1 This section presents the alternative design options considered in Stage 1. The three Scheme options which are to be taken forward and considered in this EAR are set out above in Section 2.3 Description of the Proposed Project

3.1.2 A Long List of design options for both junctions were developed during Stage 1 to accommodate initial forecast 2041 traffic flows and taking into account topography and environmental and physical constraints at the junctions. The long list includes:

- Bean Junction Option 1c
- Bean Junction Option 2a
- Bean Junction Option 3a
- Bean Junction Option 4a
- Bean Junction Option 4b
- Bean Junction Option 4c
- Bean Junction Option 5
- Ebbsfleet Junction Option 1b

3.1.3 Design Options rejected during the development of the long list are briefly described in Table 3-1 and listed below:

- Bean Junction Option 1a (Original design option presented at Stage 0)
- Bean Junction Option 1b (Original design option presented at Stage 0)
- Bean Junction Option 2b
- Bean Junction Option 2c
- Bean Junction Option 3b
- Ebbsfleet Junction Option 1a (Original design option presented at Stage 0)
- Ebbsfleet Junction Option 2

Table 3-1 Options Rejected During Development of the Long List

Option Name	Key features
Bean Junction – Option 1a	• Initial Option developed by the Stage 0 • Retain “dumbbell” junction layout • Enlarge and signalise existing roundabouts by Hope and Ightham cottages • Retain existing carriageway at Bean Road Overbridge • Provide two lane exit on B255 N/B from roundabout with dedicated left turn lane converted to a merge layout • Convert eastbound off slip to two lane ghost island layout • Convert A296/Bean Lane roundabout to signalised junction • Widen A296 to 2 lanes E/B and 1 lane W/B. No provision for access to property in Bean Lane. • Convert eastbound on slip to two lane ghost island merge

Option Name	Key features
	• Demolish and replace Swanscoombe footbridge This option was rejected as initial operational assessment showed that the northern and southern roundabout would not have sufficient capacity and was therefore not included in the Long List Options. Bean Junction Option 1c was developed from Option 1b to provide additional capacity.
Bean Junction – Option 1b	• As Option 1a but with widening Bean Road Overbridge to provide two lanes northbound and two lanes southbound This option was rejected as initial operational assessment showed that the northern and southern roundabout would not have sufficient capacity and was therefore not included in the Long List Options.
Bean Junction – Option 2b	• Retain “dumbbell” junction layout but construct in new location to the west. • Construct new permanent bridge crossing of A2 to west of existing structure providing 3 lanes N/B and 2 lanes S/B. • Retaining existing Bean Road Overbridge for access to A296 from Hope Cottages roundabout • Potential need to divert existing 133KV electricity pylons to accommodate new junction • Provide three lane exit on B255 N/B • Convert A296/Bean Lane roundabout to signalised junction • Widen A296 to 2 lanes eastbound and 1 lane westbound plus junction access to Eastern Quarry development. • Provide an access road to properties located along the A296 • Realign A296 eastbound on-slip merge onto A2 before Swanscombe footbridge (retained) This option is a minor variation to Bean Option 2a and assessment has been based on Option 2a rather than Option 2b and so was not included on the Long List Options.
Bean Junction – Option 2c	• Reconstruct the junction as a dumbbell layout with west facing slip roads in a diamond layout • Construct new permanent bridge crossing of A2 to west of existing structure providing 3 lanes N/B and 2 lanes S/B. • Realign the west facing slip roads in a diamond layout. • Provide new north/south connection to west of Hope Cottages to connect to Bean Lane • Demolish existing Bean Road Overbridge • Potential need to divert existing 133KV electricity pylons to accommodate new junction • Provide three lane exit on B255 N/B • Convert A296/Bean Lane roundabout to signalised junction • Widen A296 to 2 lanes eastbound and 1 lane westbound plus junction access to Eastern Quarry development.

Option Name	Key features
	• Provide an access road to properties located along the A296 • Realign A296 eastbound on-slip merge onto A2 before Swanscombe footbridge (retained) This option was rejected as initial operational assessment showed that the southern roundabout would not have sufficient capacity and was therefore not included in the Long List Options.
Ebbsfleet Junction Option 1a	• Option 1a - Enlarge and signalise the two A2/B259 roundabouts, upgrade the connecting roundabout link to dual carriageway with two lanes provided in each direction, realign the Pepperhill link and improve the eastbound merges.
Ebbsfleet Junction Option 2	• Existing double roundabout layout replaced with a single large traffic signal controlled gyratory. • Provide access points to Ebbsfleet Green new development and Station Quarter South new development from the gyratory • A2 W/B on slip widened to two lanes • A2 E/B on slip/Pepperhill link road reconfigured. This option was rejected as initial operational assessment showed that the southern roundabout would not have sufficient capacity and was therefore not included in the Long List Options.

3.1.4 A review of the long list options was undertaken to identify the design options to be taken forward for assessment. The review culminated with a workshop on the 14th April 2016 with representatives of Highways England. The following long list options were rejected:

- Bean Junction Option 1c
- Bean Junction Option 2a
- Bean Junction Option 4a
- Bean Junction Option 4c

3.1.5 All the rejected long list options are briefly described in Table 3-2 and shown in Drawings HA543917-HHJV-HGN-XXXX-DR-D-0009 to HA543917-HHJV-HGN-XXXX-DR-D-0014. The reasons for rejecting the options are also identified.

Table 3-2 Rejected Long List Options

Option Name	Key features
Bean Junction – Option 1c HA543917-HHJV-HGN-XXXX-DR-D-0009	• Retain “dumbbell” junction layout • Enlarge and signalise existing roundabouts by Hope and Ightham Cottages • Widen exiting Bean Lane Bridge to 3 lanes N/B and 2 lanes S/B • Provide temporary bailey bridge crossing of A2 for N/B traffic to enable widening of Bean Lane bridge • Provide three lane exit on B255 N/B

Option Name	Key features
	• Convert A296/Bean Lane roundabout to signalised junction • Widen A296 to 2 lanes eastbound and 1 lane westbound plus junction access to Eastern Quarry development. • Provide an access road to properties located along the A296 • Realign A296 eastbound on-slip merge onto A2 before Swanscombe footbridge (retained) This option was rejected as to enable the existing Bean Road Overbridge to be widened a temporary bridge crossing would be required to accommodate traffic diverted from the existing bridge. This would be located west of Hope Cottages requiring a temporary access road. To enable the baily bridge to be constructed the existing Ightham Cottages roundabout would need to be modified to provide sufficient space for construction. The temporary road layout would not have sufficient capacity to accommodate traffic flows resulting in unacceptable levels of congestion during construction.
Bean Junction – Option 2a HA543917-HHJV-HGN-XXXX-DR-D-0010	• Retain “dumbbell” junction layout but construct in new location to the west. • Construct new permanent bridge crossing of A2 to west of existing structure providing 3 lanes N/B and 2 lanes S/B. • Provide new north/south connection to west of Hope Cottages with new terminal roundabouts and slip roads to A2 • Retaining existing bridge for local/NMU use • Potential need to divert existing 133KV electricity pylons to accommodate new junction • Provide three lane exit on B255 N/B • Convert A296/Bean Lane roundabout to signalised junction • Widen A296 to 2 lanes eastbound and 1 lane westbound plus junction access to Eastern Quarry development. • Provide an access road to properties located along the A296 • Realign A296 eastbound on-slip merge onto A2 before Swanscombe footbridge (retained) This option was rejected in favour of Option 4b
Bean Junction – Option 4a HA543917-HHJV-HGN-XXXX-DR-D-0012	• Retain “dumbbell” junction layout but construct in new location to west with double eastbound diverge off-slip. • Construct new permanent bridge crossing of A2 to west of existing structure providing 3 lanes N/B and 2 lanes S/B. • Provide new north/south connection to west of Hope Cottages with new terminal roundabouts and slip roads to A2 • Retaining existing bridge for local/NMU use • Construct double diverge off A2 eastbound to separate traffic flows to B255 N/B from other movements • Widen B255 N/B to 3 lanes from Bean junction to Bluewater

Option Name	Key features
	• Divert existing 133KV electricity pylons to accommodate new junction • Convert A296/Bean Lane roundabout to signalised junction • Widen A296 to 2 lanes eastbound and 1 lane westbound plus junction access to Eastern Quarry development. • Realign A296 eastbound on-slip merge onto A2 before Swanscombe footbridge (retained) This option was rejected as widening of the B255 north of the existing bridge over the A296 was considered beyond the scope of the project.
Bean Junction Option 4c – HA543917-HHJV-HGN-XXXX-DR-D-0014	• Retain “dumbbell” junction layout but construct in new location to the west. • As Bean Option 2a except widens the B255 to 3 lanes N/B from Bean junction to the Bluewater exit. This option was rejected as widening of the B255 north of the existing bridge over the A296 was considered beyond the scope of the project.

3.1.6 The remaining short list design options for each junction are to be assessed in combination and for simplicity are referred to in this report using the following reference numbers:

- Bean Junction Option 3 with Ebbsfleet Junction Option 1b (B03E01b),
- Bean Junction Option 4b with Ebbsfleet Junction Option 1b (B04bE01b), and
- Bean Junction Option 5 and Ebbsfleet Junction Option 1b (B05E01b).

3.1.7 The current strategy for the A2 junction improvements at A2 Bean and A2 Ebbsfleet Junctions is for both junctions to be open to the public within the same year. Further detail on the description of junction options can be found in the Technical Appraisal Report.

4 Environmental Assessment Methodology

4.1 Methodology for the Environmental Assessment Report

4.1.1 The scope followed for this Stage 1 EAR is provided in the Scoping Report (01 February 2016). The Scoping Report was provided to and discussed with statutory consultees (Environmental Workshop - 3rd March 2016, refer to Appendix 4-1). The following statutory consultees were consulted:

- Dartford Borough Council (DBC)
- Gravesham Borough Council (GBC)
- Kent County Council (KCC)
- Environment Agency
- Kent Historic Environment Record
- English Heritage (now Historic England)
- Natural England
- Dartford Borough Council, Gravesham Borough Council, Kent County Council, Historic England, Environment Agency, Natural England
- Kent County Council (KCC)

4.1.2 Environmental assessments have been prepared in accordance with the Scoping Report and Volume 11 of the DMRB incorporating the relevant Interim Advice Notes (IANs), including the recently issued IAN 125/15 – Environmental Assessment Update (Ref 4-1).

4.1.3 Each chapter of the EAR is based around the following format:

- Introduction & Study Area
- Methodology
- Baseline Conditions
- Value (Sensitivity) of Resource
- Regulatory/Policy Framework
- Design, Mitigation and Enhancement Measures (including monitoring requirements)
- Magnitude of Impacts & Significant Effects
- Cumulative Effects
- Limitations of Assessment
- Summary

4.1.4 In addition to the EAR, WebTAG worksheets have also be produced for the topic in accordance with the proposed methodology set out in the Scoping Report, together with input to the Appraisal Summary Tables.

4.2 Design Freezes used for Assessment Work

4.2.1 All specialist chapters have assessed the three options under consideration B03E01b, B04bE01b and B05E01b and all specialists, with the exception of air and noise, have produced their assessments against the current 'Interim Design Freeze C' layouts described in Section 2.3.

4.2.2 Traffic forecast data is not yet available for the Interim Design Freeze C layouts and as a result the air and noise assessments, in this EAR, are based on traffic forecast data produced for a slightly earlier design freeze layout (known to the project team as 'Design Freeze B).

4.2.3 The key differences between DFB and interim DFC are summarised below:

E1b

- Minor changes to vertical alignment

B3

- Minor changes to vertical alignment
- Additional widening of Bean Lane from Bean Junction to junction with A296
- Change in junction layout at junction of Bean Lane with the new road connection revised junction layout with Bean Lane

B4b

- Minor changes to vertical alignment
- Additional widening of Bean Lane from Bean Junction to junction with A296
- Widening of new eastbound on slip adjacent to Ightham Cottages
- Provision for widening the A2 to provide full standard 4 lane cross section
- Converting A296 / Bean Lane roundabout to four arm signal controlled junction (layout as B3)

B5

- Minor changes to vertical alignment
- Additional widening of Bean Lane from Bean Junction to junction with A296
- Widening of new eastbound on slip adjacent to Ightham Cottages
- Provision for widening the A2 to provide full standard 4 lane cross section

4.3 Proposed Scope for PCF Stage 2

4.3.1 In light of IAN 125/15 and the need for proportionate and appropriate assessment, it is proposed that the scope and level of assessment produced in this report (PCF Stage 1 EAR) is maintained, at the same level, for PCF Stage 2. It is proposed that topic areas will only be reviewed and revisited as appropriate, at PCF Stage 2 in order to confirm:

- Any updates to baseline / existing conditions.
- Any updates / amendments to the proposed options being taken forward (including any amendments to traffic data and forecasts).

4.4 Establishment of the Baseline Environment

4.4.1 The baseline environment has been established through a combination of walkover surveys and collection of pre-existing data and available reports. This is detailed in the relevant topic chapters within this EAR.

4.4.2 Where necessary more detailed data collection activities or surveys will be undertaken during PCF stage 3 to inform the Environmental Assessment for the preferred Scheme.

4.5 Identification of Environmental Effects

4.5.1 The environmental assessments consider both direct, indirect, temporary, permanent, long, medium and short term effects arising due to the Scheme. The identification and reporting of environmental effects have been undertaken using professional judgement and established criteria in DMRB Volume 11 (Ref 4-2), as amended. IAN 125/15, 130/10, 135/10, 175/13, 174/13, 170/12v3 and 185/15 have also been used within this EAR as detailed in the topic chapters where relevant. More detailed analysis of the direct, indirect, temporary and permanent impacts will be considered at Stage 3.

4.6 Significance Criteria

4.6.1 In order to influence the design and identification of a preferred option, and to ensure that efforts to mitigate effects of environmental impacts from the Scheme are focussed on the most significant effects, the significance of the effect is generally established as a function of the receptor or resource environmental value (or sensitivity) and the magnitude of project impact (change). A typical matrix is presented below in Table 4-1.

Table 4-1 Determining the significance of effect (Modified from DMRB Volume 11 Section 2 Part 5 HA 205/08)

Sensitivity / Value	**Magnitude of Effect**				
	No Change	**Negligible**	**Minor**	**Moderate**	**Major**
Very High	Neutral	Slight	Moderate or Large	Large or Very Large	Large or Very Large
High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
Medium	Neutral	Neutral or Slight	Slight	Slight or Moderate	Moderate or Large
Low	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
Negligible	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

4.6.2 Some disciplines will not use a matrix-based approach to determining the significance of an effect, as quantitative calculations are used to assess effects. This is specifically the case for assessments of noise and air quality impacts. In these cases, it is important to note that the

relevant method is outlined in the appropriate chapter, and that a degree of professional judgement is also utilised in determining the significance of effect.

4.7 Summary Table – Overall Environmental Scoring of Options

4.7.1 A summary table is presented in Chapter 12, with an overall option score for each environmental topic area, to provide a clear overall comparison of the three options under consideration.

4.7.2 Table 4-2 presents the criteria used to determine an overall option score. The full methodology used for the environmental scoring of options is presented in Appendix 4-2.

Table 4-2 Overall environmental scoring of Options (Modified from DMRB Volume 11 Section 2 Part 5 HA 205/08)

Scoring	Considerations
1 **Red** (WebTAG equivalent very large adverse) e.g. Important at international scale	Option highly likely to be unacceptable to consenting body / competent authority / regulator even with mitigation. It cannot be reconciled with government / EU policy for protecting nationally / internationally recognised resources This relates to showstoppers. It may, for example, pitch government departments against government departments and require cross ministry decisions, be a major factor which could result in refusal, have EU implications / require EC level agreement, require mitigation that would be a significant / prohibitive component in the scheme cost.
2 **Red / Amber** (WebTAG equivalent large adverse) e.g. Important at national scale	Potentially unacceptable requiring extensive mitigation and approval from relevant bodies uncertain: It is in serious conflict with government policy for protecting nationally recognised resources. There are some significant issues but may not be showstoppers or result in the scheme being refused. May require significant concessions from statutory bodies.
3 **Amber** (WebTAG equivalent moderate adverse) e.g. Important at regional scale	Potentially acceptable but may require mitigation: Conflicts with local authority policies for protecting local and national environmental resources
4 **Amber / Green** (WebTAG equivalent – slight adverse) e.g. Important at county / local scale	Likely to be acceptable but may require limited mitigation: May conflict with local authority policies for protecting local environmental resources
5 **Neutral** (WebTAG equivalent – Neutral)	Option has no significant impact
6 **Green** (WebTAG equivalent – slight / more beneficial)	Acceptable, not a factor in decision making and may even offer opportunities to provide a net gain for the topic area.

4.8 Consultation

4.8.1 During PCF Stages 0 and 1 the environment team has started to engage with a number of statutory and non-statutory consultees. This has primarily been for the purposes of data collection and obtaining contact details for future consultation.

4.8.2 Appendix 4-1 provides a summary of consultation undertaken to date, and a brief description of the nature of this engagement.

4.9 Cumulative Assessment

4.9.1 Cumulative impacts occur when a receptor is subject to impacts from multiple actions within a scheme, or from multiple schemes.

4.9.2 Inter-relationships may exist between several different environmental topics. For example, an increase in traffic movements will not only lead to potential impacts on a road network and require consideration as part of a transport assessment, but will also create an increase in vehicle emissions which may have subsequent impacts on local air quality which in turn can have an impact on sensitive ecological sites. Cumulative impacts have been considered within each environmental topic and inter-relationships that may exist between different environmental topics have been duly considered and are discussed in the environmental topic chapters as appropriate.

4.9.3 In addition to the potential environmental impacts resulting from the proposed Scheme options, the EAR also provides an assessment of the Cumulative effects resulting in combination with those from other, surrounding developments which are currently in development in the surrounding area.

4.9.4 A review of the Dartford Borough Council and Gravesham Borough Council planning portals has been undertaken to identify approved developments in the area which have the potential to have a cumulative impact on the proposed Scheme. Table 4-3 and Figure 4-1 provide the details and locations of the cumulative schemes included for the purposes of this Stage 1 EAR assessment.

4.9.5 Once a preferred Scheme option has been selected, then Cumulative effects will be addressed in further detail, as part of the PCF Stage 3 EAR.

Table 4-3 Details of other developments considered for cumulative impacts

No	Planning Application Reference	Application Description	Type	Status
1	Dartford DA/12/01451/EQVAR	**Eastern Quarry Watling Street Swanscombe Kent** A mixed use development of up to 6250 dwellings & in addition up to 231,000 square metres of built floorspace (in total) for: business premises (B1 (a), (b) and (c)) education community & social facilities (D1 & D2) (schools, libraries, health centres, places of worship, sports leisure centres, community centres, care facilities for the young, old and/or infirm); hotels (C1); theatre (D2); supporting retail (A1, A2, A3, A4 & A5) & leisure (D2) facilities; miscellaneous sui generis uses, ancillary & support facilities. Such development to include; groundworks to provide revised ground contours and development	Mixed Use Development	Approved

No	Planning Application Reference	Application Description	Type	Status
		platforms; vehicle parking; laying out open space (including parks, play spaces, playing fields, allotments, lakes and water features, community woodland & formal and informal open space); landscaping; works to create ecological & nature reserves & refuge areas; provision and/or upgrade of services and related service media and apparatus; drainage works (including ground & surface water attenuation & control measures and replacement and/or refurbishment of existing discharges pipe through Craylands Gorge); pedestrian cyclist & vehicular ways, highways and public transport facilities (including new and improved links between the site & existing public highways (including Alkerden Lane, B255, A2 Watling Street & Southfleet Road), bridges & causeways, dual use & segregated facilities for public transport systems & cross site pedestrian, cyclist & vehicular routes); facilities for mooring, launching & landing water craft; & miscellaneous ancillary & associated engineering & other operations. All such development shall accord with the Application Plans & Development Parameters Schedule & the disposition of development table each as listed in condition 3. (incorporating variation of condition 3 to change finished ground level parameter plan; lineages parameter plan; land use disposition plan; development parameters schedule and disposition of development table)		
2	Dartford 15/00887/CPO	**Eastern Quarry Watling Street Swanscombe Kent** Application for construction of a waste water treatment works and ancillary infrastructure to serve the development at Eastern Quarry KCC/EDC	Services	Approved
3	Dartford 12/01464/OUT	**The West Village (and Adjacent Land) Bluewater Shopping Centre Greenhithe** Outline application for redevelopment of the West Village through part demolition, alteration and refurbishment of existing buildings/structures and erection of new buildings/structures to provide retail and related uses (within use Classes A1-A5), new basement servicing corridor, reconfiguration of existing car and coach parking areas, reconfiguration of existing lake, open space and public realm, alteration of existing pedestrian links within the site, amended vehicular link into existing transit centre; infrastructure and associated facilities	Commercial	Approval of Outline Permission August 2013

No	Planning Application Reference	Application Description	Type	Status
4	Dartford 12/01404/FUL	**Land At St Clements Way** Erection of 187 dwellings extending to between 2 and 3 storeys in height, including 132 houses and 55 flats, together with the provision of associated public realm and landscaping, parking and infrastructure works	Residential	Application Permitted October 2013
5	Dartford 05/00308/OUT	**Northfleet West Sub Station Southfleet Road Swanscombe Kent** Redevelopment of site comprising a mixed use of up to 950 dwellings & non-residential floorspace for: shopping, food & drink, hotel use; community, health, education & cultural uses; assembly & leisure facilities & associated works to provide the development	Mixed Use Development	Approval of Outline Permission
6	Gravesham 20150155	**Land at Ebbsfleet Bounded by A2, Southfleet Rd, Springhead Rd, North Kent Rail Line Excluding Blue Lake, Springhead Enterprise Park and CTRL Alignment, Swanscombe/Northfleet** EDC - The development of land at Ebbsfleet for mixed use up to 789,550m2 gross floorspace comprising employment, residential, hotel and leisure uses, supporting retail and community facilities and provision of car parking, open space, roads and infrastructure and being for the variation/deletion of the following planning conditions of outline planning permission 20120186 (which itself was a variation of the original outline planning permission reference 19960035): D9 (affordable housing quantum), D10 (lifetime homes quantum), D15 (employment timing), F6 (Springhead highway improvement), G1 (pre-school nursery timing), G2 (primary school timing), G3 (health care provisions), G4 (family centre timing), G7 (local park timing), G8 (allotments), G9 (playing fields quantum), G10 (sports centre requirement), G11 (affordable housing timing), G12 (Lifetime Homes timing), G15 (adult education provisions) and G16 (recycling facility provisions)	Mixed use Development	Application Permitted February 2016

5 Ecology and Nature Conservation

5.1 Introduction & Study Area

5.1.1 This chapter of the EAR presents the assessment of significant effects of the Scheme options on Ecology and Nature Conservation. Summary findings are presented in Section 5.10.

5.1.2 This chapter should be read in conjunction with Figures 5.1-5.3 and Appendix 5-1.

Study area

5.1.3 The study area for this assessment has been defined by determining the zone of influence (Zol) of the Scheme in relation to the effect it would have on each individual resource, based on professional judgement. The zone of influence is different for each of the receptors assessed and, therefore, the study area has been defined for each one and presented in Table 5-1, below.

Table 5-1 Study area for each ecological receptor (based on professional judgement)

Ecological resource	Study area
Statutory designated sites	2 km from the Scheme; 30 km from the Scheme for Special Areas of Conservation (SACs) designated for bats; Any sites considered to be hydrologically linked to the Scheme via surface or ground water.
Non-statutory designated sites	1 km from the Scheme; Any sites considered to be hydrologically linked to the Scheme via surface or ground water.
Ancient woodland	Woodland within and adjacent to the Scheme
Habitats and plants	Habitat within and adjacent to the Scheme
Invasive non-native plants	Habitat within and adjacent to the Scheme
Aquatic and terrestrial invertebrates	Habitat within and adjacent to the Scheme
Amphibians	Ponds within and up to 500 m of the Scheme. Terrestrial habitat within and up to 500 m from the Scheme.
Reptiles	Habitat within and adjacent to the Scheme
Birds	Habitat within and adjacent to the Scheme
Bats	All roost features within and adjacent to the Scheme. Foraging and commuting habitat within and adjacent to the Scheme.
Hazel Dormouse (*Muscardinus avellanarius*)	Habitat within and adjacent to the Scheme
Otter	Habitat within and adjacent to the Scheme

Ecological resource	Study area
Water vole (*Arvicola amphibius*)	Habitat within and adjacent to the Scheme
Other mammals	Habitat within and adjacent to the Scheme

5.2 Methodology

General Approach

5.2.1 The assessment methodology follows the guidance provided in DMRB Volume 11, Section 3, Part 4, 'Ecology and Nature Conservation' (Ref 5-1) and Interim Advice Note ("IAN") 130/10 'Ecology and Nature Conservation: Criteria for Impact Assessment' (Ref 5-2). In addition to DMRB, the assessment also makes use of the Chartered Institute of Ecology and Environmental Management's (CIEEMs) Guidelines for Ecological Assessment in the UK and Ireland (Ref 5-3) which give further detail on carrying out impact assessment and includes aspects not covered by DMRB.

5.2.2 When applying the methodologies set out below, professional judgement has been used in the: valuation of receptors; characterisation of effects; assessment of the likely success of mitigation measures to address these effects; and assessment of the likely residual effects after mitigation.

Consultation

5.2.3 In accordance with DMRB Volume 11, Section 4, Part 1 HD 44/09, Natural England were consulted during the screening phase of the Assessment of Implications on European Sites (AIES) (see Appendix 4-1). A full abbreviations list can be found at the end of this report. No further consultation has been carried out with regards to Ecology and Nature Conservation. Consultation with statutory agencies relating to other key ecological receptors, including Nationally designated sites, is anticipated to take place during Stage 2 and 3 of the environmental assessment process.

Establishing Baseline Conditions (Sensitivity)

5.2.4 The baseline conditions for Ecology and Nature Conservation were established through a desk-based study; an extended Phase 1 habitat survey and species specific surveys for great crested newt (*Triturus cristatus*) and hazel dormouse. The methodology for each survey is detailed in the Preliminary Ecological Appraisal (Ref 5-4) for the Scheme (Appendix 5-1) and described briefly below.

Desk study

5.2.5 An initial desk-based study was carried out in 2014. The aim of the desk study was to collate third party ecological data for the study area and associated buffers to inform the assessment. Data was obtained from the following organisations (full details are provided in Appendix 5-1):

- Kent and Medway Biological Records Centre (KMBRC);
- Kent Ornithological Society (KOS);
- Kent Bat Group (KBG);
- Kent Reptile and Amphibian Group (KRAG);
- West Kent Badger Group;

- Bluewater Retail Park;
- Land Securities (owners of Eastern Quarry, north of the study area); and
- Paramount Park

5.2.6 Online resources were also reviewed and comprised the Multi-Agency Geographic Information for the Countryside (MAGIC) website (Ref 5-5), the Ancient Woodland Inventory and Kent Biodiversity Action Plan (BAP) (Ref 5-6). ENVIS data has not yet been obtained from Asset Support Contractor but will be obtained for Stage 3 of the assessment.

Extended Phase 1 habitat survey

5.2.7 An extended Phase 1 habitat survey was undertaken on 29 and 30 April 2014. Following an update to the survey area boundary and to visit previously inaccessible areas, a second survey was carried out between 18 and 20 May 2015. This survey involved identifying and mapping the dominant habitat types following the survey methodology outlined in the Phase 1 habitat survey handbook (Ref 5-7). The survey also involved a critical assessment of the value of habitats present for plant and animal species and/or species which are legally protected and/or species of conservation concern.

Great crested newt Habitat Suitability Index (HSI) and environmental DNA (eDNA) survey

5.2.8 All accessible ponds within 500m of the study area were assessed for their potential to support great crested newts, using the (HSI) tool (Ref 5-8). This index grades the ponds in terms of how suitable they are for breeding great crested newt, enabling identification of ponds which require further survey, in this case eDNA testing. All ponds not considered to be of poor suitability for great crested newt (i.e. and index of > 0.5) were subject to further survey.

5.2.9 A great crested newt eDNA survey was undertaken in June 2015. Water samples were collected by experienced, licensed surveyors at seven ponds where the HSI was greater than 0.5 and which had an accessible bank from which to safely collect samples. Laboratory analysis of these water samples was then carried out to identify if great crested newt DNA was present within the water samples indicating their presence within each pond within the 2015 breeding season. Samples were collected as described in the protocol by Biggs *et al*. (2014) (Ref 5-9).

Hazel Dormouse survey

5.2.10 Targeted surveys to determine the presence or absence of dormice were undertaken following the best practice guidance given in the Dormouse Conservation Handbook (Ref 5-10). A total of 161 hazel dormouse tubes were installed in areas of suitable habitat where access was available. This included several sections of Highways England owned landscape planting; and along the northern edges of two blocks of woodland, one within the A2/A296/Bean Lane triangle, and the other south of the A2, approximately half way between the Bean Interchange and the Ebbsfleet Junctions.

5.2.11 The tubes were installed at approximately 20m intervals in July 2014, and checked between August and December 2014 by experienced, licensed surveyors. The survey effort was not quite sufficient to assume the absence of dormice (see Bright *et al.*, 2006 for further details regarding this survey score). All evidence of use by dormice or other small mammals, in the form of animals, nests and feeding remains, was noted.

Assessing Impacts and Effects (Magnitude of Impacts and Significance of Effects)

5.2.12 The assessment of the magnitude of impacts and significance of effects follows the framework outlined in DMRB Volume 11, Section 2, Part 5 Assessment and Management of Environmental Effects (Ref 5-11). The application of the significance criteria used in the assessment follows guidance in IAN 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment (Highways Agency, 2010).

5.2.13 The resources which have the potential to be associated with significant effects have been identified and valued based on their geographical context in line with Table 5-2 and with local context applied.

Table 5-2 Resource Valuation (taken from IAN 130/10)

International or European value
Natura 2000 sites including: Special Protected Areas (SPAs); potential SPAs (pSPAs); Special Areas of Conservation (SACs); candidate or possible SACs (cSACs or pSACs); and Wetlands of International Importance (Ramsar sites). Biogenetic Reserves, World Heritage Sites and Biosphere Reserves. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Resident, or regularly occurring, populations of species which may be considered at an International or European level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale.
UK or National Value
Designated sites including: Sites of Special Scientific Interest (SSSIs); Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs); and National Nature Reserves (NNRs). Areas which meet the published selection criteria (e.g. JNCC (1998)) (Ref 5-12) for those sites listed above but which are not themselves designated as such. Areas of key/priority habitats identified in the UK BAP, including those published in accordance with Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (Ref 5-13) and those considered to be of principal importance for the conservation of biodiversity. Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory. Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale.
Regional Value

Areas of key/priority habitats identified in the Regional Biodiversity Action Plan (BAP) (where available); areas of key/priority habitat identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats; and areas of key/priority habitat listed within the Highways Agency's (now Highways England) BAP. Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/priority species listed within the Highways England BAP where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.
County or Unitary Authority Area Value
Designated sites including: Sites of Importance for Nature Conservation (SINCs); County Wildlife Sites (CWSs); and Local Nature Reserves (LNRs) designated in the county or unitary authority area context. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key/priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent). Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species across the County or Unitary Authority Area; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.
Local Value
Designated sites including: LNRs designated in the local context. Trees that are protected by Tree Preservation Orders (TPOs). Areas of habitat; or populations/communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.

5.2.14 Criteria to define the magnitude of an impact are detailed in Table 5-3.

Table 5-3 Magnitude criteria used in the assessment (Modified from DMRB Volume 11 Section 2 Part 5 HA 205/08)

Magnitude of impact	Typical criteria descriptors
Major	Loss of resource and/or quality of resource; severe damage to key characteristics, features or elements (Adverse)
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial)
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse)
	Benefit to, or addition of, key characteristics, features or elements; improvement to attribute quality (Beneficial)

Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to one (maybe more) key characteristics, features or elements (Adverse)
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial)
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse)
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial)
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction

5.2.15 The significance of effects on resources at different levels of value can be established using the matrix shown in Table 5-4 and compared to the overall significance categories used in other DMRB topics, as set out in Table 5-5.

Table 5-4 Arriving at the significance of effect categories (adapted from DMRB Volume 11 Section 2 Part 5 HA 205/08)

		Magnitude of impact (degree of change)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
Environmental value (sensitivity)	**International/ European**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	UK/National	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Regional	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
	County/Unitary Authority Area	Neutral	Neutral or Slight	Neutral or Slight	Slight	Sight or Moderate
	Local	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

Table 5-5 Significance of Effects (taken from IAN 130/10)

Significance category	Typical descriptors of effect
Very Large	An impact on one or more receptor(s) of International, European, UK or National Value. NOTE: only adverse effects are normally assigned this level of significance. They should be considered to represent key factors in the decision-making process.
Large	An impact on one or more receptor(s) of Regional Value. NOTE: these effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	An impact on one or more receptor(s) of County or Unitary Authority Area Value. NOTE: these effects may be important, but are not likely to be key decision-making factors.
Slight	An impact on one or more receptor(s) of Local Value. NOTE: these effects are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No significant impacts on key nature conservation receptors. NOTE: absence of effects, or those that are beneath levels of perception.

5.3 Baseline Conditions

5.3.1 A summary of the ecological baseline conditions is given below. Further detail is presented in the A2 Bean Ebbsfleet Preliminary Ecological Appraisal (Appendix 5-1). Figures 5.1, 5.2 and 5.3 show their locations.

Designated Sites

5.3.2 The location of designated sites are shown on Figure 5.1. There are no statutory designated sites of International or European importance to nature conservation within the study area. Furthermore, there are no SACs for which bats are a qualifying feature within 30km of the study area. A screening exercise was undertaken to assess the impact of the Scheme on European designated sites (HD 44/09 Annex D findings of no significant effects report matrix (screening)). This concluded 'no significant impact' on European designated sites (HHJV, 2015b, Ref 5-14).

5.3.3 There are three Nationally designated sites within the study area: Darenth Wood SSSI lies partially within the footprint of the Bean Option 3 design, west of the Bean Interchange; Swanscombe Skull Site SSSI and National Nature Reserve (NNR) is approximately 900m north of the Scheme; and Baker's Hole SSSI is approximately 500m north of the Scheme. Both Swanscombe Skull Site SSSI NNR and Baker's Hole SSSI are designated for the geological interest and not considered here (see Chapter 10 for impacts on these sites in relation road and water drainage).

5.3.4 Darenth Wood SSSI comprises ancient semi-natural broadleaved, mixed and Yew (*Taxus baccata*) woodland, with areas of open heathland and a small area of chalk grassland (to the west of the woodland). The chalk grassland is known to support Field Eryngo (*Eryngium campestre*) and Man Orchid (*Orchis anthropophorum*). The woodland area comprises several rare woodland types

including Sessile Oak (*Quercus petraea*) – Hornbeam (*Carpinus betulus*) woodland, which represents the largest known example of this habitat in Britain. Extensive invertebrate surveys over many years have revealed a valuable assemblage of invertebrates, which include a number of species of conservation concern.

5.3.5 One non-statutory designated site of nature conservation importance lies partially within the Ebbsfleet Option 1b footprint. The southern spur of Ebbsfleet Marshes Local Wildlife Site (LWS) is situated east of the Ebbsfleet Junction. The wider site comprises a calcareous stream with surrounding marsh, scrub and grass habitat. However, the section immediately adjacent to the scheme comprises amenity grassland and landscape planting. Badger (*Meles meles*), great crested newt, slow-worm (*Anguis fragilis*) and grass snakes (*Natrix natrix*) have been recorded within the LWS.

5.3.6 Three non-statutory designated sites were identified within 1km the study area. These are:

- Disused Hospital Grounds, Mabledon LWS, located approximately 600m southwest of the Scheme: a developing chalk (calcareous) grassland community with Man Orchid, Bee Orchid (*Ophrys apifera*), Pyramidal Orchid (*Anacamptis pyramidalis*) and a population of adder (*Vipera berus*).
- Alkerden Pit, Swanscombe LWS located approximately 950m northeast of the Scheme: a former chalk pit with the county-scarce Broadleaved Helleborine (*Epipactis helleborine*), orchids, common lizard (*Zootoca vivipara*), slow-worm and great crested newt.
- A Kent Wildlife Trust Roadside Nature Reserve (RNR) located approximately 860m north of the Scheme.

Habitats

5.3.7 The results of the Phase 1 habitat survey are shown on Figure 5.2.

Woodland and scrub

5.3.8 Five areas of ancient woodland were identified during the desk study which are situated within the study area (see Figure 5.1) comprising:

- The eastern fringes of Darenth Wood SSSI;
- The entire area of woodland known as The Thrift (south of the A2);
- Two small areas of woodland remnants of The Thrift located adjacent to the east bound carriageway of the A2, within the A2/A296/Bean Lane triangle; and
- The northern half of Parkhill Wood located half way between the Bean Interchange and the Ebbsfleet Junction (also south of the A2).

5.3.9 These woodlands were subsequently visited during the field survey. All of these woodlands qualify as 'lowland mixed deciduous woodland' a Habitat of Principal Importance (HoPI) in England, as listed on Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (Ref 5-13), and a Priority Habitat (Native Woodland) under the Kent BAP (Ref 5-6). Mature and semi-mature trees were found in these woodlands although a veteran tree survey within them was not carried out.

5.3.10 During the extended Phase 1 habitat survey a number of other blocks of broadleaved woodland were recorded that qualify as a 'lowland mixed deciduous woodland' HoPI (Ref 5-13); these were located around the Bean Interchange; on both sides of the A2 carriageway and northeast of the Ebbsfleet Junction in Ebbsfleet Marsh LWS. One additional broadleaved woodland that was

recorded in the study area at Ebbsfleet Marsh LWS also qualified as 'wet woodland' HoPI (Ref 5-13) and a Priority Habitat (Native Woodland) under the Kent BAP.

5.3.11 Several mature and immature blocks of plantation woodland were recorded from the study area. These largely comprised landscape planting on the soft estate bordering the A2, A296 and B255 highways.

5.3.12 Dense and scattered scrub was recorded throughout the study area with large areas within the Bean triangle and in grassland east of the Ebbsfleet Junction.

5.3.13 No veteran trees were identified within the study area during the extended Phase 1 habitat survey. Mature trees were present in areas of ancient woodland, although none of the trees within the study area were identified as veteran. An arboriculture survey has not been carried out.

Grassland

5.3.14 Three narrow strips of species-rich semi-improved grassland that qualify as 'Lowland Meadows' HoPI and a Priority Grassland under the Kent BAP were present within the study area at the following locations:

- between the north and southbound carriageways of the B255;
- north of the A296, north of the Bean triangle; and
- west of the Pepperhill Road, southeast of the Ebbsfleet Junction.

5.3.15 Other grasslands recorded from the study area comprise species-poor semi-improved grassland east of the Ebbsfleet Junction and several areas of amenity grassland along the highway.

Hedgerows

5.3.16 A total of five hedgerows were identified within the study area (see Figure 5.2). Just one of these hedgerows is classified as 'important' under the Hedgerows Regulations (Ref 5-15) and a Priority Habitat under the Kent BAP for 'Ancient and/or Species Rich Hedgerows'. This is located on Sandy Lane, along the northeast side of Bean.

Waterbodies

5.3.17 Twenty-seven waterbodies (Appendix 5-1) were found within 500m of the study area. Ponds are a HoPI and 'Standing Open Water' is a Priority Habitat in the Kent BAP.

Watercourses

5.3.18 A single watercourse, Ebbsfleet River was situated within the study area. It lies east of the Ebbsfleet Junction within the Ebbsfleet Marshes LWS and adjacent to the southeast extent of the Scheme. Rivers are a HoPI.

Other habitat

5.3.19 A small area of reedbed (*Phragmites australis*) was identified during the desk study within that part of the Ebbsfleet Marshes LWS which is within the study area. Reedbed is a HoPI and listed on the Kent BAP.

5.3.20 Large areas of arable farmland lie within the study area. Although these fields are of limited nature conservation value, narrow field margins have been retained in some cases, however there were no signs that these margins were being actively managed for wildlife and do not meet the criteria for 'arable field margin' HoPI or 'cereal field margin' in the Kent BAP.

Protected or notable plant species

5.3.21 There are recent (post 2006) records of Field Eryngo (*Eryngium campestre*) from within 1km of the study area Darenth Country Park, east of the Bean Interchange. This species is listed on Schedule 8 of the Wildlife and Countryside Act (WCA) 1981 (as amended) (Ref 5-16), and is a Species of Principal Importance (SoPI) in England as listed on Section 41 of the NERC Act 2006. This species was not found during the field surveys and since it is associated with unimproved calcareous grassland, it is not expected to be found within the study area.

5.3.22 Other plant species listed on Section 41 of the NERC Act previously recorded within 1km of the study area in recent times (post 2004) were: Man Orchid; Divided Sedge (*Carex divisa*); Sea Barley (*Hordeum marinum*); and Basil Thyme (*Clinopodium acinos*). Man Orchid was the only one of these species recorded during the extended Phase 1 habitat survey where it was observed west of the Bean interchange on the soft estate of the A296. This species is associated with grasslands and scrub, particularly on alkaline soils. It was not possible to access all of the study area, due to steep banks, dense undergrowth and some areas where access was denied, so this species could also be present within suitable habitat that has not been surveyed.

Invasive non-native species

5.3.23 There were a number of records of invasive non-native plant species within 1km of the study area. During the extended Phase 1 habitat survey Japanese Knotweed (*Fallopia japonica*) was recorded within the Bean Triangle. A giant rhubarb (*Gunnera* sp.) was found along the Ebbsfleet River. Scattered False-acacia (*Robinia pseudoacacia*) was also present within the study area. These species are listed on Schedule 9 of the WCA 1981 making it an offence to cause them to grow in the wild.

Protected and notable species

Aquatic invertebrates

5.3.24 No records of aquatic invertebrates of conservation concern were identified during the desk study. Surveys for aquatic macro-invertebrates undertaken by Middlemarch Environmental (Ref 5-17 and 5-18) on the Ebbsfleet River and two waterbodies (one of which is within the study area) revealed that these habitats did not support a significant assemblage of macro-invertebrates. A significant assemblage of aquatic invertebrates would not be expected within the study area.

Terrestrial invertebrates

5.3.25 There are a large number of recent terrestrial invertebrate records within 1km of the study area. This included 12 species of invertebrate which are SoPI (NERC Act, 2006), including stag beetle

(*Lucanus cervus*), grizzled skipper (*Pyrgus malvae*) and brown-banded carder bee (*Bombus humilis*).

5.3.26 Habitats of particular potential value to terrestrial invertebrates within the study area include the wet woodland within Ebbsfleet Marshes LWS, the species-rich grassland and the area of mature coppice woodland within Darenth Wood SSSI.

5.3.27 The areas of recently-planted woodland, scrub and regularly-mown grassland are likely to support limited assemblages of common terrestrial invertebrate species, and none of the habitats are considered sufficiently large or diverse to support assemblages of notable invertebrates.

Amphibians

5.3.28 No records of great crested newts from within the study area were identified during the desk study; however there were many historic records (pre 2004) from locations within 1km. Two of these locations were within the Eastern Quarry land to the north of the A2, and a third was alongside Southfleet Road, north of the Ebbsfleet Junction. In addition, the citation for Ebbsfleet Marsh LWS states that great crested newts are present at the site.

5.3.29 A recent record of great crested newts comes from a monitoring report of a translocation undertaken at the Eastern Quarry in 2005 where one individual was recorded. Surveys for great crested newts and other amphibians were also undertaken at Bluewater Retail Park in 2013 although great crested newt was not recorded.

5.3.30 As part of the desk study, a review of aerial photography and the 1:25,000 Ordnance Survey (OS) map of the area was undertaken to identify waterbodies within the study area and up to 500m from the study area boundary, where there would be no major barrier to the movement of newts (e.g. major roads, residential areas) between these waterbodies and the study area. This review excluded the seven lakes at Bluewater Retail Park and the numerous ponds within Eastern Quarry because recent great crested newt survey information is already available for these waterbodies. A total of 14 waterbodies were identified, including four within the study area (Figure 10-8). Following the Extended Phase 1 survey, which identified a further three waterbodies, a total of 17 waterbodies were assessed using the HSI (Ref 5-8).

5.3.31 Of these 17 waterbodies, two were found to be good (HSI >0.7); four were average (HSI = 0.6-0.7); two were below average (HSI = 0.5-0.6); two were poor (HSI = 0.4-0.5); five were permanently dry (HSI = 0); one pond had been removed; and one pond within a development was not accessible although the site ecologist confirmed that the pond was no longer present. The seven ponds with an HSI score of below average or above (i.e. an HSI greater than 0.5) were subsequently selected for further eDNA surveys.

5.3.32 The eDNA surveys of these seven waterbodies was carried out in spring 2015. Two of the ponds, 22a and 24a, tested positive for great crested newt eDNA, indicating their presence (see on Figure 5.2 and 5.3). Pond 22a is adjacent to the study area and Pond 24a is approximately 200m southeast of it. The remaining five waterbodies that were surveyed all had negative results indicating the absence of great crested newt.

5.3.33 Both of the ponds with confirmed presence of great crested newts are balancing ponds within the study area. They are both located within the A2 highway boundary, southeast of the Ebbsfleet Junction.

5.3.34 Four common amphibian species (smooth newt (*Lissotriton vulgaris*), palmate newt (*Lissotriton helveticus*), common frog (*Rana temporaria*) and common toad (*Bufo bufo*) have been recorded from various locations within 1km of the study area. Of these species, only common toad, although widespread, is a SoPI (NERC Act, 2006).

Reptiles

5.3.35 Numerous records of slow-worm, common lizard and grass snake were identified during the desk study from several locations outside of the study area, but within 1km of it. There have been consistent records of these species during annual monitoring surveys undertaken between 2006 and 2014 within Eastern Quarry (Middlemarch Environmental, 2014b). There were also four records of adder (*Vipera berus*) from locations within Beacon Wood Country Park to the south of the Scheme and Darenth Wood. The Kent Wildlife Trust citation for Ebbsfleet Marshes LWS states that slow-worm and grass snake have been observed within the site, and this was confirmed from records provided by KMBRC and KRAG. However, none of these records were from the southern section of the LWS that falls within the Scheme footprint. All three species are protected under Schedule 5 of the WCA 1981 which prohibits the killing, injuring or taking by any method and are also a SoPI.

5.3.36 Slow-worm and common lizard were both recorded within the study area during the extended Phase 1 survey. Both of these species were recorded on the semi-improved grassland strip adjacent to and on the southern side of the A2, just west of the Bean Interchange. They were also observed at the north-west corner of the A2/A296/Bean Lane triangle where areas of bare ground and dense scrub provided basking sites. Slow-worms and common lizard were also observed within areas of young landscape planting with semi-improved grassland or introduced scrub north of the Ebbsfleet Junction during the extended Phase 1 survey.

5.3.37 Habitats with the potential to support reptiles include areas of rough grassland, particularly where scrub and bare ground is also present, forming a mosaic of habitats. Woodland edge habitat could also have the potential to be used as hibernation sites.

Birds

5.3.38 There are recent desk study records (post 2004) for bird species within 1km of the Scheme which include records of 21 species (Appendix 5.1) listed on Schedule 1 of the WCA 1981. These species are protected from intentional or reckless disturb to an ‘active’ nest. It is considered possible that the habitats within the study area could potentially provide suitable nesting opportunities for two of these species: hobby (*Falco subbuteo*); and firecrest (*Regulus ignicapillus*). The areas of broad-leaved woodland within the study area may provide nesting sites for firecrest. The hobby is a summer visitor to the UK, using isolated trees to nest, often in close proximity to gravel pits and other wetland habitats, so unlikely to be found within the study area.

5.3.39 There are also records for several species which are listed as a SoPI (Ref 5-13), including bullfinch (*Pyrrhula pyrrhula*); dunnock (*Prunella modularis*); linnet (*Carduelis* cannabina); skylark (*Alauda arvensis*); song thrush (*Turdus philomelos*); and starling (*Sturnus vulgaris*).

5.3.40 Woodland, scrub and hedgerow habitat within the study area are likely to provide suitable habitat for nesting birds.

Bats

5.3.41 There are recent records (post 2004) from KBG of nine species of bat foraging or commuting within 5km of the study area, comprising serotine (*Eptesicus serotinus*), Daubenton's (*Myotis daubentonii*), Natterer's (*Myotis nattereri*), Leisler's (*Nyctalus leisleri*), noctule (*Nyctalus noctula*), Nathusius' pipistrelle (*Pipistrellus nathusii*), common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*) and brown long-eared bat (*Plecotus auritus*). Given that all of these species are highly mobile they are considered to be foraging and commuting within the Scheme boundary.

5.3.42 No records of bat roosts were provided by KBG from within the Scheme boundary. However, at least 12 records of bat roosts from within 1km of the study area boundary were identified. Two significant roosts were recorded within Darenth Wood SSSI. One of these supported 21 *Myotis* bats and the other was a bat hibernation roost where Daubenton's bat, Natterer's bat, whiskered/Brandt's bat (*M. mystacinus/brandtii*), brown long-eared bat, common pipistrelle and soprano pipistrelle have all been recorded since 1985. Two roosts were identified from the Swanscombe residential area to the north of the study area, one of which was a pipistrelle (common or soprano) maternity roost supporting at least 76 bats, and the other was a roost of an unknown bat species supporting 10 bats. A common pipistrelle roost supporting 16 bats was identified at Northend, just south-west of the Ebbsfleet Junction, and another supporting 10 bats was identified at Hazells, just south of the far eastern end of the study area.

5.3.43 Records of smaller bat roosts (typically of a single bat) were identified within Darenth Country Park, on the eastern edge of Bean, a location in Wombwell Park in Gravesend, and from two locations in Northfleet.

5.3.44 There are a number of buildings within the study area that could have features suitable for use by roosting bats. These are buildings within the Bean triangle, including Ightham Cottages; and Hope Cottages on Bean Lane, south of the A2. These were not assessed during the extended Phase 1 habitat survey due to restricted access permission. An Ash (*Fraxinus excelsior*) tree with a woodpecker hole was identified as a potential roosting bat site, located north of the Bean triangle, adjacent to the A296. The majority of the woodland around the Scheme contained semi-mature trees that lacked the features with potential to support roosting bats. Due to dense undergrowth and steep banks in places, bat roosts within these woodlands cannot be ruled out, as not all of the area was accessible.

5.3.45 Habitats/features were present within the study area which could provide foraging opportunities and commuting features for bats, such as woodland/woodland edges, landscape planting, scrub, hedgerows and the Ebbsfleet River and waterbodies.

Hazel Dormouse

5.3.46 Hazel Dormouse has been recorded in several locations within the study area with Darenth Wood SSSI; Beacon Wood Country Park; Bluewater; the Thrift ancient woodland, adjacent to the A2 at the Bean Interchange.

5.3.47 Mature broad-leaved woodland, dense scrub and mature landscape planting provide a suitable habitat for hazel dormouse, whereas the younger landscape planting provides marginal habitat for them. The hazel dormouse tube survey undertaken in 2014 revealed the presence of dormice in three locations. Two of these locations were within the landscape planting to the north of the A2. The third record was from the northern edge of the woodland block within the Bean triangle. The

full results of the hazel dormouse survey are provided in the preliminary ecological appraisal (Ref 5-4).

5.3.48 Due to access restrictions, the tube survey did not cover all the areas of potentially suitable habitat within the study area. However, the survey results combined with the desk study data indicate that hazel dormice are widespread in the areas surrounding the A2 Bean to Ebbsfleet Scheme and there is good habitat connectivity. It was therefore agreed with Highways England that the survey would not need to be continued into 2015, since the presence of hazel dormice could be assumed in all areas of suitable habitat within the study area.

Water vole

5.3.49 Water vole have been recorded in the River Darenth, west of Bean and in the Ebbsfleet River, within the Ebbsfleet Marshes LWS. Evidence from the annual monitoring of the water vole population in the Ebbsfleet River by Ebbsfleet Joint Monitoring Strategy suggests a population along the watercourse of approximately 17 individuals. The Ebbsfleet River is the only watercourse within the Scheme, and the only site where water vole would be expected, within the study area.

Otter

5.3.50 There were no recent records of otter (*Lutra lutra*) from within 1km of the study area. The Ebbsfleet River, east of the Ebbsfleet Junction provides suitable habitat for this species.

Badger

5.3.51 Records of badger were identified close to the Scheme with setts identified during the Phase 1 habitat survey. Specific locations have been given in Appendix 5-1 ‘Preliminary Ecological Appraisal’ (Ref 5-4) and shown on Figure 5.3a, Ecological Constraints Map - Confidential Badger Information. This information is not reproduced in this document for confidentiality.

Other mammals

5.3.52 There are numerous records of hedgehog (*Erinaceus europaeus*) from within 1km of the study area, mainly from locations in the surrounding towns and villages. It is possible that this species, which is a SoPI under NERC 2006 (Ref 5-13), is present within the study area. Woodland, scrub and rough grassland present throughout the study area provides suitable habitat for this species.

5.3.53 Similarly, there were no records for brown hare (*Lepus europaeus*) within 1km of the study area, although suitable habitat was present in the arable fields and woodland in and around the study area. Brown hare is a SoPI under NERC 2006.

5.4 Value (Sensitivity) of Resource

5.4.1 The value of each ecological resource described in the baseline section is given in Table 5-6. This is a preliminary assessment which will be further informed by subsequent surveys and detailed design (see Section 5.9).

Table 5-6 A summary of ecological feature and their value

Ecological resource	**Value (sensitivity)**	**Scoped in or out of further assessment**	**Rationale for scoping / potential effects (identified in Scoping Report)**
European designated sites	International	Scoped out	No impact pathways identified in the AIES (Ref 5-14).
Nationally designated sites	National	Darenth Wood SSSI scoped in. Swanscombe Skull SSSI NNR; Bakers Hole SSSI: scoped out	Potential for direct loss through land-take; Impacts on vegetation adjacent to the Scheme from polluted spray. Geological sites, not considered in this section.
Non-statutory designated sites	County	Ebbsfleet Marsh LWS: scoped in. Disused Hospital Grounds, Mabledon LWS; Alkerden Pit LWS; Kent Wildlife Trust Roadside Nature Reserve: scoped out.	Potential for direct loss through land-take; Impacts on vegetation adjacent to the Scheme from polluted spray. No impact pathway identified.
Ancient woodland (excluding Darenth Wood SSSI)	County	Scoped in	Potential for direct loss through land-take; Impacts on vegetation adjacent to the Scheme from polluted spray.
Habitats: Lowland mixed deciduous (excluding Darenth Wood SSSI) woodland; lowland meadow; pond	Local	Scoped in	Potential for direct loss through land-take; Impacts on vegetation adjacent to the Scheme from polluted spray
Habitats: wet woodland; reedbed; river, hedgerow	Local	Scoped out	No impact pathway identified.
Habitats: plantation woodland; scrub; species-poor semi-improved grassland; arable.	Site	Scoped out	These habitats are of negligible importance for ecology and nature conservation.

Ecological resource	Value (sensitivity)	Scoped in or out of further assessment	Rationale for scoping / potential effects (identified in Scoping Report)
Protected or notable plants: Man orchid	Local	Scoped in	Potential for direct loss through land-take; Impacts on vegetation adjacent to the Scheme from polluted spray.
Protected or notable plants: Field Eryngo; Divide Sedge; Sea Barley; Basil Thyme	Local to national	Scoped out	No impact pathway identified.
Invasive non-native plants.	N/A	Scoped in	Control measures required to prevent spread of invasive non-native species.
Aquatic invertebrates	Site	Scoped out	Desk study and field surveys indicate likely absence of notable species or assemblage.
Terrestrial invertebrates	Local	Scoped out	Potential for direct loss of habitat but to a limited extent of common and widespread habitats.
Amphibians	Local to County	Scoped in	Potential for direct loss of habitat; potential mortality of protected species (great crested newt).
Reptiles	Local to County	Scoped in	Potential for direct loss of habitat; potential mortality of protected species; permeant fragmentation of existing roadside habitat.
Birds	Site to County	Scoped in	Potential for direct loss of habitat; potential mortality of protected species; indirect temporary impacts as a result of disturbance; temporary effects through lighting.
Bats	Site to County	Scoped in	Potential for direct loss of habitat; potential mortality of protected species; indirect temporary impacts as a result of disturbance; temporary effects through lighting.
Hazel dormouse	County	Scoped in	Potential for direct loss of habitat; potential mortality of protected species; indirect temporary impacts as a result of disturbance.
Water vole	Local	Scoped out	No impact pathway identified.
Other mammals	Local	Scoped in	Potential for direct loss of habitat; potential mortality of protected species; indirect temporary impacts as a result of disturbance; temporary effects through lighting.

5.5 Regulatory/Policy Framework

5.5.1 There are a number of regulations and policies which protect Ecology and Nature Conservation resources at European, National and Local level. The legislation and policy considered relevant to

the ecological features identified in the baseline section (Section 5.3) and the anticipated impacts arising from the Scheme are stated below:

European legislation

- EC Habitats Directive (Council Directive 92/43/EEC (Ref 5-19) on the conservation of natural habitats and of wild fauna and flora; and
- EC Council Directive on the Conservation of Wild Birds 79/409/EEC (as amended, and codified by Directive 2009/147/EC) (the Birds Directive) (Ref 5-20)

National legislation

- Wildlife and Countryside Act 1981 (as amended) (Ref 5-16);
- Protection of Badgers Act 1992 (Ref 5-21);
- Wild Mammals (Protection) Act 1996 (Ref 5-22);
- Hedgerows Regulations 1997 (Ref 5-15);
- Countryside and Rights of Way (CRoW) Act 2000 (Ref 5-23);
- Natural Environment and Rural Communities (NERC) Act 2006 (Ref 5-13); and
- Conservation of Habitats and Species Regulations 2010 (as amended) (Ref 5-24).

National planning policy

5.5.2 National Planning Policy Framework (NPPF) (UK Government, 2012) (Ref 5-25) sets out the government's national planning policy with a presumption towards sustainable development. The NPPF includes a chapter on biodiversity, Chapter *11 – Conserving and Enhancing the Natural Environment*. In addition to being concerned with the protection of statutorily designated sites, the Chapter outlines ways in which the planning system is required to contribute to and enhance the local environment and sets out guidance for public bodies and local authorities in respect of the consideration of biodiversity and green infrastructure. The NPPF is a material planning consideration.

Local planning policy

5.5.3 Local authorities with planning policy relevant to Ecology and Nature Conservation are:

- Gravesham Borough Council (2014 (Ref 5-30));
    - *Policy CS12 Green infrastructure:* A multifunctional linked network of green spaces, footpaths, cycle routes and wildlife stepping stones and corridors will be created, protected, enhanced and maintained. Where a negative impact on protected or priority habitats/species cannot be avoided on development sites and where the importance of the development is considered to outweigh the biodiversity impact, compensatory provision will be required either elsewhere on the site or off-site, including measures for ongoing maintenance.
- Dartford Borough Council Core Strategy (2015 (Ref 5-29):

- *Policy CS13 Green belt*: Actively manage the green belt as a recreational and ecological resource, including Darenth Wood.
- *Policy CS 14 Green space*: Protecting and enhancing open spaces, including those identified and designated as locally important including SSSIs and LWSs.

Ecology and Nature Conservation Policy

5.5.4 The 'UK Post-2010 Biodiversity Framework' (Ref 5-26) succeeded the UK Biodiversity Action Plan (UKBAP) in July 2012. The post-2010 framework is underpinned by the biodiversity and environment strategies of the four countries of the UK and sets out their common purpose and shared priorities. The UKBAP list of priority species, however, remains as a reference source and has been used to help draw up statutory lists of priorities. Locally, the Kent BAP sets out the County's plan to protect its natural assets and characterises its local conservation priorities.

5.5.5 Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services (Ref -27), published in 2011, is the most recent biodiversity strategy for England, and has as its mission to halt overall biodiversity loss, support healthy well-functioning ecosystems, and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people.

5.5.6 Highways England sets out its own approach to meeting the key performance indicators identified within the Roads Investment Strategy of "no net loss of biodiversity by 2020" in its Biodiversity Plan (Ref 2-1).

5.5.1 Natural England have produced standing advice relating to ancient woodland and veteran trees. This gives guidance on what planning authorities should consider for developments near ancient woodland (Ref 5-28)

5.6 Design, Mitigation and Enhancement Measures (including monitoring requirements)

5.6.1 At Stage 1, the design, mitigation and enhancement measures described in this section are generic and relevant to each of the three options described in Section 2. Detailed mitigation measures would be described at Stage 3 following selection of the preferred option and further design information.

Generic Mitigation Measures

5.6.2 All design and construction work would be carried out in accordance with a number of generic mitigation measures and follow best practice guidelines that would prevent damage, or loss to ecological resources. It is anticipated that the following generic measures would be applied throughout the design, construction and operation phases of the Scheme:

Design

- Adverse impacts on ecological resources would be avoided where possible. Detailed design of the selected option would aim to minimise landtake and habitat loss. This could include minor design amendments to avoid damage or loss to a valuable ecological feature and locating access tracks/haul roads and site compound/material storage areas outside of ecologically sensitive habitats;
- Spray from the road would be minimised through provision of adequate drainage to prevent water pooling on the road. Woodland habitat would be buffered from spray with landscape planting;

- The road lighting design would aim to minimise light spillage away from the road;

Construction

- Impacts arising from construction would be managed through the Construction Environmental Management Plan (CEMP). Best practice pollution prevention and control measures will be adopted to ensure that ecological resources are not adversely affected by dust created during construction, storm water runoff or accidental spillages from construction sites;
- Vegetation removal would be minimised. Land cleared of vegetation for temporary construction works will be replanted following construction, these will be native species appropriate to the local area;
- All ecological resources would be reassessed prior to construction and where necessary update surveys carried out;
- An Ecological Clerk of Works (ECoW) would be appointed. The ECoW would be responsible for overseeing works that could, without appropriate control, cause damage or loss to an ecological resource during the construction phase; and
- Timing of site clearance works would be programmed to avoid the most sensitive seasons.

Further Surveys

5.6.3 Further targeted surveys of the following are considered necessary to inform the Scheme design Stage 3 assessment:

- Bats (roosting); and
- Badger.

5.7 Magnitude of Impacts & Significance of Effects

5.7.1 The magnitude of impacts and significance of effects on ecological resources are assessed below. The magnitude and characterisation of impacts is based on the baseline data described in Section 5.3 and assumes all necessary mitigation, outlined in Section 5.6, is carried out.

5.7.2 Impacts and their significance relating to Ebbsfleet (Option 1b) are common to each of the three Scheme Bean options (i.e. Bean Option 3, Bean Option 4b and Bean Option 5) and discussed first. Impacts specific to each option (i.e. those relating to the Bean Interchange) are discussed individually. A map showing all ecological constraints is provided in Figure 5.3.

Ebbsfleet Junction

5.7.3 Table 5-7 identifies the ecological receptors where construction or operational impacts could arise from Ebbsfleet Option 1b.

Table 5-7 Impacts from Ebbsfleet Junction Option 1b on ecological receptors and their significance

Resource	Magnitude and characterisation of impact	Significance
Darenth Wood SSSI	Construction No construction impacts anticipated. Operation	Neutral

Resource	Magnitude and characterisation of impact	Significance
	No operational impacts anticipated.	Neutral
Ancient woodland (excluding Darenth Wood SSSI)	<u>Construction</u> No construction impacts anticipated. <u>Operation</u> No operational impacts anticipated.	Neutral Neutral
Ebbsfleet Marsh LWS	<u>Construction</u> *Habitat loss:* The southern extent of Ebbsfleet Marsh LWS includes a small section of the road verge between Pepperhill Road and the access road to the adjacent nursery. Realignment of Pepperhill Road would result in the permanent loss of approximately 0.03ha of LWS habitat (less than 0.1% of the site). The area that would be lost is however isolated and supports habitats of low ecological value (amenity grassland and young landscape planting) and does not support any feature that the LWS is designated for. The majority of the verge would be retained, maintaining a buffer between the LWS and the Pepperhill Road. <u>Operation</u> *Spray deposition*: Increased amounts spray could degrade vegetation within the LWS where it is adjacent to Pepperhill Road. Since the section of the LWS adjacent to the road is isolated, of low ecological value and acts as a partial buffer to the rest of the LWS, the effect of spray is considered to be negligible and not significant.	Neutral Neutral
Lowland mixed deciduous woodland HoPI (excluding Darenth Wood SSSI)	<u>Construction</u> No construction impacts anticipated. <u>Operation</u> No operational impacts anticipated.	Neutral Neutral
Lowland Meadow HoPI	<u>Construction</u> *Habitat loss*: A 0.05ha section of road verge containing lowland meadow habitat adjacent to Pepperhill Road would be lost during the roads realignment. The area of the verge adjacent to the road would be permanently lost with the strip furthest from the road temporarily lost during construction only. The area temporarily lost would be appropriately reseeded with the aim of returning it to its current high value. <u>Operation</u>	Neutral to slight adverse

Resource	Magnitude and characterisation of impact	Significance
	Spray deposition: Increased amounts of spray could degrade the lowland meadow habitat. This could lead to a reduction in plant diversity as sensitive species are outcompeted by those more tolerant of higher salt levels. Provision of adequate drainage to prevent waterpolling on the road would mitigate for this, however some minor negative impact would be expected. Given the small extent of this locally valuable habitat, the magnitude of this impact is considered to be negligible.	Slight adverse
Pond HoPI	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Amphibians	Construction *Habitat loss:* The two ponds where the presence of great crested newt was identified are adjacent to the A2, southeast of the Ebbsfleet Junction. Pond 24a is situated >250m from the works so great crested newt using this pond are not likely to move this distance and Pond 22a is separated from the works by the live carriageway which is a barrier to movement. Based on current baseline information, no impact is anticipated on great crested newts and/or their habitat. *Mortality*: Killing or injury to individual amphibians during vegetation clearance is not significant since the works are not anticipated to result in the loss of suitable terrestrial habitat within 250m of a known breeding pond. Operation No operational impacts anticipated.	Neutral Neutral Neutral
Reptiles	Construction *Habitat loss*: Suitable habitat for reptiles adjacent to the existing roads would be temporarily lost during the enlargement of west and east roundabouts; widening of the roundabout link road; creation of new access to roads to Ebbsfleet Green and the proposed petrol station; and the realignment of Pepperhill Road. The majority of this habitat is marginal, with significant areas of suitable habitat retained and unaffected by this Option. Phased vegetation removal would encourage reptiles to move into adjacent habitat. Road verges and earthworks would be reseeded with appropriate grassland and reptiles from the adjacent habitats expected to readily recolonise them. The adder population associated with Ebbsfleet LWS would not be affected as suitable habitat within the site is sufficiently distant from the Scheme. *Mortality*: Individual reptiles could be killed or injured during vegetation clearance. Providing generic mitigation measures are implemented, the magnitude of this impact would be negligible.	Neutral Neutral

Resource	Magnitude and characterisation of impact	Significance
	Operation No operational impacts anticipated.	Neutral
Birds	Construction *Habitat loss*: Localised clearance of plantation woodland would result in the temporary loss of habitat for breeding birds. Breeding birds tend to nest away from main roads so the loss of this vegetation would likely effect small numbers only. Habitat likely to be used by Schedule 1 bird species (such as fire-crest or hobby) is not likely to be effected. Vegetation would be removed outside of the breeding season or under an ecological watching brief. Landscape planting around the road would be reinstated on completion of the works to ensure bird breeding habitat is provided for. *Destruction of nest*s: Destruction of nests could occur during vegetation clearance. Providing works are carried out at appropriate times (i.e. outside of the bird breeding season) or else under supervision of the ECoW, then this impact would be negligible. Operation No operational impacts anticipated.	Neutral to slight adverse Neutral Neutral
Bats	Construction *Damage/disturbance to a roost:* Derelict cottages south of the east roundabout would be demolished to accommodate its enlargement. The buildings have the potential to support roosting bats, however the structures have not yet been surveyed. Further surveys to assess the buildings for roosting bats are necessary. If the buildings are found to support bats, they would need to be demolished under a Natural England European Protected Species Licence (EPSL). Prior to demolition, a compensatory roost would need to be created and the buildings demolished at an appropriate time of year. Operation *Light disturbance*: Road lighting would not be expected to cause significant disturbance to bats if light spillage away from the road is controlled.	Neutral to slight adverse (dependent on outcome of surveys) Neutral
Hazel dormouse	Construction *Habitat loss*: Some landscape planting around Ebbsfleet Junction would be lost during construction, though the majority would be retained. This habitat was considered to be of low value to hazel dormouse since it is was largely immature and lacked arboreal connectivity. Despite its generally low suitability for this species, the removal of this habitat would require a Natural England EPSL given that there are records for this species in landscape planting between the Bean triangle and the Ebbsfleet Junction. Works would need to be undertaken at an appropriate time of the year to minimise	Slight adverse

Resource	Magnitude and characterisation of impact	Significance
	impacts to hazel dormouse potentially present. Replacement planting that exceeds the area lost would be a requirement of a licence. *Mortality:* Killing or injury of hazel dormouse could occur during vegetation clearance. Providing vegetation clearance of hazel dormouse habitat is carried out under EPSL, under supervision of a suitably licensed ecologist, at an appropriate time of year, the magnitude of this impact would be negligible. Operation No operational impacts anticipated.	Neutral Neutral
Badger	Construction *Damage/disturbance of a sett*: A partially-used badger sett could be affected by the works. If damage to this sett is likely to occur then it may be necessary to close the sett under a Natural England Licence. This would have a small and temporary effect on this species. Operation *Mortality*: There could be an increase in road fatalities with higher traffic volumes. Further badger surveys would be required to confirm the requirement for and location of mitigation measures. If required, fencing would prevent badgers accessing the active road, and underpasses may be possible to ensure that badgers continue to be able to access land within their range.	Neutral to slight adverse (dependent on outcome of surveys) Neutral to slight adverse (dependent on outcome of surveys)

Bean Option 3

5.7.4 Table 5-8 identifies the ecological receptors where construction or operational impacts could arise from Bean Option 3.

Table 5-8 Impacts from Bean Option 3 on ecological receptors and their significance

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
Darenth Wood SSSI	Construction *Habitat loss:* A 0.5ha strip of the 120ha woodland south of the A2 and a second, smaller strip of 0.04ha on the north side would be permanently lost to the widening of the eastbound off and westbound on slip roads, west of the Bean interchange (approximately 0.6% loss to the SSSI). This loss would be permanent and irreversible. Since the woodland is ancient, it is considered to be irreplaceable and the loss cannot be directly compensated for. The total landtake is limited in extent, affecting woodland immediately adjacent to the road only. Operation	Large adverse

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	Spray deposition: Increased amounts of spray could degrade vegetation within the SSSI. Woodland on the south side of the A2 would be protected from significant spray deposition by the cutting embankment. Woodland on the north side of the A2 is not protected by a cutting embankment as the slip road rises up an embankment to the new two bridge roundabout. However trees and shrubs would be planted on the soft estate between the slip road and the woodland to act as a buffer to the SSSI against spray deposition. The magnitude of this impact is therefore expected to be negligible.	Neutral
Ancient woodland (excluding Darenth Wood SSSI)	<u>Construction</u> No construction impacts anticipated. <u>Operation</u> No operational impacts anticipated.	Neutral Neutral
Lowland mixed deciduous woodland HoPI (excluding Darenth Wood SSSI)	<u>Construction</u> *Habitat loss:* Construction of the access to junction for the Bean triangle properties from the A296 would result in the loss of 0.3ha of this 2.5ha lowland mixed deciduous woodland. A further small loss of 0.02 ha would arise from the construction of the A2 westbound off slip road. The total loss represents a 1.2% loss of woodland habitat. The loss of woodland would be permanent although compensatory planting on the new road verge and earthworks would ensure that there is no net loss of area to this habitat. <u>Operation</u> *Spray deposition*: The woodland would be set back from the road and buffered from spray by landscape planting on the road verge and earthworks. No impact from road spray would be expected.	Slight adverse Neutral
Lowland Meadow HoPI	<u>Construction</u> *Habitat loss*: The widening of the north and southbound carriageways of the B255 would result in the loss of approximately 0.2 ha of the 0.7ha grassland situated between the carriageways. The total loss represents a 28% loss of grassland habitat. The remaining grassland would be retained through the construction phase. The new road verge and cutting would be reseeded with meadow species. Permanent loss of grassland could be mitigated for through reseeding other road verge and earthworks within the Scheme with lowland meadow species. <u>Operation</u> *Spray deposition*: Increased amounts of spray could degrade the lowland meadow habitat. This could lead to a reduction in plant diversity as sensitive species are outcompeted by those more tolerant of higher salt levels. Given the small extent of this	Slight adverse Neutral to slight adverse

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	locally valuable habitat, the magnitude of this impact is considered to be slight adverse.	
Amphibians	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Reptiles	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Birds	Construction *Habitat loss*: Localised clearance of woodland and scrub would result in the loss of habitat for breeding birds. Breeding birds tend to nest away from main roads so the loss of this vegetation would likely effect small numbers of birds. The loss of broadleaved woodland at Darenth Wood SSSI and within Bean triangle could impact on the Schedule 1 species firecrest which nests in broadleaved woodland. Nesting habitat for hobby would not be impacted. Landscape planting around the road would be reinstated on completion of the works to ensure breeding habitat is present in the future. *Destruction to nest*s: Destruction of active nests could occur during vegetation clearance within the bird breeding season. Providing works are carried out at appropriate times (i.e. outside of the bird breeding season) or else under supervision of the ECoW then this impact would be negligible. Operation No operational impacts anticipated.	Neutral to slight adverse Neutral Neutral
Bats	Construction *Damage/disturbance to a roost:* Construction of the two bridge roundabout above the A2 would require the demolition of 14, 15 and 16 Hope Cottages. These buildings, as well as other buildings at Hope Cottages, have the potential to support roosting bats, however they have not yet been surveyed. Further surveys to assess the buildings for roosting bats are necessary. If they are found to support bats, the building/s would need to be demolished under a Natural England EPSL. Prior to demolition, a compensatory roost would need to be created and the building/s demolished at an	Neutral to slight adverse (dependent on outcome of surveys)

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	appropriate time of year. Operation *Fragmentation*: The Bean Lane diversion around the west side of Hope Cottages could permanently fragment any roosts at Hope Cottages from foraging habitat at Darenth Wood SSSI, to the west. Landscape planting and sensitive lighting would be used to encourage bats to suitable crossing points to ensure connectivity is retained. In addition, there would be no change to commuting routes east of Hope Cottages and foraging habitat at Thrift Wood. The magnitude of this impact would therefore considered to be minor. *Light disturbance*: Road lighting would not be expected to cause significant disturbance to bats if light spillage away from the road is controlled.	Neutral to slight adverse
Hazel Dormouse	Construction *Habitat loss*: Suitable hazel dormouse habitat (i.e. landscape planting and woodland) would be removed to accommodate the widening of the A296, B255 and A2 slip roads and the construction of the two bridge roundabout. This includes high value woodland habitat within the Bean triangle where hazel dormouse were previously recorded during 2014 surveys. The majority of habitat that would be removed is landscape planting which is considered to be of moderate suitability for hazel dormouse due to its small area and young age. It is however considered valuable for adding to connectivity between isolated blocks of woodland. The removal of this habitat would require a Natural England EPSL and mitigation plan that would include strategic and sensitive removal of vegetation under supervision of a licensed hazel dormouse ecologist and where necessary a translocation. Landscape planting along the road verge and earthworks would be reinstated to ensure no net loss of habitat for this species. *Mortality:* Killing or injury of hazel dormouse could occur during vegetation clearance. Providing vegetation clearance of hazel dormouse habitat is carried out under EPSL, under supervision of a suitably licensed ecologist at an appropriate time of year, the magnitude of this impact would be negligible. Operation No operational impacts anticipated.	Moderate adverse Neutral Neutral
Badger	Construction *Damage/disturbance of a sett*: A main badger sett would be lost. The badger sett would need to be closed under a Natural England Licence at an appropriate time of year and a replacement sett would need to be constructed to mitigate this loss. Operation	Neutral to slight adverse (dependent on outcome of surveys)

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	Mortality: There could be an increase in road fatalities with higher traffic volumes. Further badger surveys would be required to confirm the requirement for and location of mitigation measures. If required, fencing would prevent badgers accessing the active road, and underpasses may be possible to ensure that badgers continue to be able to access land within their range.	Slight adverse (dependent on outcome of surveys)

Bean Option 4b

5.7.5 Table 5-9 identifies the ecological receptors where construction or operational impacts could arise from Bean Option 4b.

Table 5-9 Impacts from Bean Option 4b on ecological receptors and their significance

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
Darenth Wood SSSI	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Ebbsfleet Marsh LWS	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Ancient woodland (excluding Darenth Wood SSSI)	Construction *Habitat loss:* Construction of the new A2 westbound off slip road would require the loss of a small area of ancient woodland to the northwest corner of the Thrift to accommodate the new embankment. The area lost would be less than 0.01ha and less than 0.1% of the woodland. This loss would be permanent and irreversible. Since the woodland is ancient, it is considered to be irreplaceable and the loss cannot be directly compensated for. The total landtake is however limited in extent, affecting woodland immediately adjacent to the road only. Operation *Spray deposition*: Woodland vegetation immediately adjacent to the new A2 westbound off slip road could be impacted by increased spray form the road. The effect of spray on the woodland would be negligible providing that there is adequate drainage to prevent water pooling on the road and the existing noise fence is	Slight adverse Neutral

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	reinstated or landscape planting is established along the road verge to buffer it.	
Lowland mixed deciduous woodland HoPI	Construction *Habitat loss:* Construction of the new A2 westbound off slip road would bisect lowland mixed deciduous woodland south of the A2, resulting in the permanent and irreversible loss 0.4ha of this habitat. This represents a 3.8% total loss of woodland habitat. The section of woodland that would be lost is of local value to biodiversity only since it is relatively young with a sparse ground flora. The loss of this woodland could be mitigated through compensatory planting to ensure no net loss of lowland mixed deciduous woodland. Operation *Fragmentation*: The northwest corner of the woodland south of the A2 would be permanently and irreversibly fragmented from the rest of the woodland. The isolated woodland block would lose connectivity to other areas of semi-natural woodland since it would be situated within an island between the A2 and the westbound on and off slips. *Spray deposition*: Woodland vegetation immediately adjacent to the new A2 westbound off slip road could be impacted by increased spray form the road. The effect of spray on the woodland would be negligible providing that there is adequate drainage to prevent water pooling on the road and that landscape planting is established along the road verge to buffer the adjacent woodland.	Slight to moderate adverse Slight to moderate adverse Neutral
Lowland Meadow HoPI	Construction *Habitat loss*: Lowland meadow habitat situated between the north and southbound carriageways of the B255 would be lost to the widening of both carriageways and the enlargement of the Ightham Cottages roundabout. A total of 0.6ha of grassland would be permanently lost. This represents a 85% total loss of grassland habitat. The new road layout does not require significant earthworks and has a small road verge so reinstating habitat would not be possible. Permanent loss of grassland would be mitigated for through reseeding other road verge and earthworks with lowland meadow species to ensure no net loss to this habitat type. Operation *Spray deposition*: Increased amounts of spray could degrade the lowland meadow habitat. This could lead to a reduction in plant diversity as sensitive species are outcompeted by those more tolerant of higher salt levels. Providing that adequate road drainage is designed to prevent water from pooling on the road, the impact of spray on this locally valuable habitat is likely to be minor.	Slight adverse Neutral to slight adverse
Pond HoPI	Construction *Habitat loss*: Construction of the A2 eastbound on slip road would require the loss of a pond. Earthworks supporting the road would extend into the pond with any retained	

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	section likely to be damaged or degraded by the construction works. The pond is isolated given its position within the Bean triangle and not known to support protected or notable species, such as great crested newts. If the pond is lost completely, a new pond would be created in compensation. If part of the pond can be retained, then it would be restored following construction. Operation No operational impacts anticipated.	Slight adverse Neutral
Amphibians	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Reptiles	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Birds	Construction *Habitat loss*: Localised clearance of woodland and scrub would result in the temporary loss of habitat for breeding birds. Breeding birds tend to nest away from main roads so the loss of this vegetation would likely effect small numbers of common and widespread species only. The loss of broadleaved woodland south of the A2 could impact on the Schedule 1 species firecrest which nests in broadleaved woodland. Nesting habitat for hobby would not be effected. Landscape planting around the road would be reinstated on completion of the works to ensure breeding habitat is present in the future. *Destruction of nest*s: Destruction of active nests could occur during vegetation clearance in the bird breeding season. Providing works are carried out at appropriate times (i.e. outside of the bird breeding season) or else under supervision of the ECoW then this impact would be negligible. Operation No operational impacts anticipated.	Neutral to slight adverse Neutral Neutral
Bats	Construction	

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	Damage/disturbance to a roost: Construction of the A2 westbound off slip road would require the loss of 0.4ha of woodland south of the A2. Trees within this woodland could have the potential to support roosting bats, but have not yet been surveyed. Further surveys to assess the trees for roosting bats are necessary. If trees are found to support roosting bats, their removal would need to be carried out under a Natural England EPSL. Compensatory roost sites would need to be created and the trees removed at an appropriate time of year. <u>Operation</u> *Fragmentation*: Bats roosting in buildings at Hope Cottages, if present, could have commuting routes to foraging habitat fragmented by new roads. Hope Cottages would be encircled by the new two lane dual carriageway link road to the west and the A2 westbound on slip road to the east. Similarly, any roosts within the fragmented northeast corner of the woodland south of the A2 would be separated from foraging habitat by the A2 westbound on and off slip roads. Landscape planting and strategic lighting would be used to encourage bats to suitable crossing points to ensure connectivity is retained. The magnitude of this impact would therefore be minor. *Light disturbance*: Bats could be deterred from roosting in buildings at Hope Cottages or trees in the fragmented corner of the woodland south of the A2 if new roads encircling them are to be illuminated at night. Light spillage would be controlled to prevent spillage outside of the road itself minimising the magnitude of this impact. Dark corridors would be maintained at landscape crossing points to help maintain connectivity for bats.	Neutral to slight adverse (dependent on outcome of surveys) Neutral to slight adverse Neutral to slight adverse
Hazel Dormouse	<u>Construction</u> *Habitat loss*: Suitable hazel dormouse habitat (i.e. landscape planting and woodland) would be removed to accommodate the widening of the A296, B255 and A2 eastbound on and off slip roads and the construction of the new westbound on and off slip roads. The majority of habitat that would be removed is landscape planting which is considered to be of moderate suitability for hazel dormouse due to its small area and young age but valuable for adding to connectivity between isolated blocks of woodland. High value habitat in the woodland south of the A2 would be lost during construction of the new A2 westbound off slip road. The removal of all suitable habitat would require a Natural England EPSL and mitigation plan that would include sensitive and strategic removal of vegetation under supervision of a licensed hazel dormouse ecologist and where necessary a translocation of dormice to retained habitat. Landscape planting along the road verge and earthworks would be reinstated to ensure no net loss of habitat for this species and connectivity for this species is restored. *Mortality:* Killing or injury of hazel dormouse could occur during vegetation clearance of dormouse habitat. Providing it is carried out under EPSL, under supervision of a suitably licensed ecologist at an appropriate time of year, the magnitude of this impact would be negligible.	Moderate adverse Neutral

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	Operation *Fragmentation:* The hazel dormouse population within the northeast corner of the woodland south of the A2 would be permanently fragmented from the local population by the A2 westbound on and off slip roads. Connectivity would not be restored as elsewhere through tree/scrub planting.	Slight to moderate adverse
Badger	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral

Bean Option 5

5.7.6 Table 5-10 identifies the ecological receptors where construction or operational impacts could arise from Bean Option 5.

Table 5-10 Impacts from Bean Option 5 on ecological receptors and their significance

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
Darenth Wood SSSI	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Ebbsfleet Marsh LWS	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Ancient woodland (excluding Darenth Wood SSSI)	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
Lowland mixed deciduous woodland HoPI	Construction *Habitat loss:* Widening of the A2 eastbound on slip road would result in the loss of approximately 0.04ha of woodland with the Bean triangle. A second small area of approximately 0.01ha would also be lost to the realignment of the A2 westbound off slip road. This represents a 0.01% total loss of woodland habitat. Both of these woodlands were relatively young with a sparse ground flora. Loss of these woodlands would be permanent and irreversible but minimal given a total loss of approximately 0.05ha. The loss of this woodland could be mitigated through compensatory planting to ensure no net loss of lowland mixed deciduous woodland. Operation *Fragmentation*: No fragmentation of woodland would arise from Bean Option 5. *Spray deposition*: Bean Option 5 would not increase the area of woodland likely to come into contact with road spray. Landscape planting would be reinstated adjacent The effect of spray on the woodland would be negligible providing that there is adequate drainage to prevent water pooling on the road and that landscape planting is established along the road verge to buffer the adjacent woodland.	Neutral Neutral Neutral
Lowland Meadow HoPI	Construction *Habitat loss*: Lowland meadow habitat situated between the north and southbound carriageways of the B255 would be lost to the widening of both carriageways and to the enlargement of the Ightham Cottages roundabout. A total of 0.5ha of the 0.7ha grassland would be lost. This represents a 70% total loss of grassland habitat. Areas of temporary loss would be reseeded with meadow species to meet the value of the retained area. Permanent loss of grassland would be mitigated for through reseeding other road verge and earthworks with lowland meadow species. Operation *Spray deposition*: Increased amounts of spray could degrade the lowland meadow habitat. This could lead to a reduction in plant diversity as sensitive species are outcompeted by those more tolerant of higher salt levels. Providing that adequate road drainage is designed to prevent water from pooling on the road, the impact of spray on this locally valuable habitat is likely to be minor.	Slight adverse Neutral to slight adverse
Pond HoPI	Construction *Habitat loss*: Construction of the A2 eastbound on slip road would require the loss of a pond. Earthworks supporting the road would extend one third of the way in the pond. The remaining two thirds of the pond, if possible to retain, would likely to be damaged or degraded by the construction works. The pond is isolated given its position within the Bean triangle and not known to support protected or notable species, such as great crested newts. If the pond is lost completely, a new pond would be created in	Sight adverse

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	compensation. If part of the pond can be retained, then it would be restored following construction. Operation No operational impacts anticipated.	Neutral
Amphibians	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Reptiles	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Birds	Construction *Habitat loss*: Localised clearance of woodland and scrub would result in the loss of habitat for breeding birds. Breeding birds tend to nest away from main roads so the loss of this vegetation would likely effect small numbers only. The Schedule 1 species firecest could nest within the broadleaved woodland south of the A2. Landscape planting around the road would be reinstated on completion of the works to ensure breeding habitat is present in the future. *Destruction of nest*s: Destruction of active nests could occur during vegetation clearance in the bird breeding season. Providing works are carried out at appropriate times (i.e. outside of the breeding season) or else under supervision of the ECoW, then this impact would be negligible. Operation No operational impacts anticipated.	Neutral to slight adverse Neutral Neutral
Bats	Construction *Damage/disturbance to a roost:* Enlargement of the Ightham Cottages roundabout would require the demolition of the all of the Ightham Cottages. These buildings could have the potential to support roosting bats but have not yet been surveyed. If they are found to support a bat roost, their demolition would need to be carried out under a	Neutral to slight adverse (dependent on outcome of surveys)

Receptor	Magnitude and characterisation of impact (Worst Case)	Significance
	Natural England EPSL. Compensatory roosts would need to be constructed and the buildings demolished at an appropriate time of year. Operation *Fragmentation*: Much of the woody vegetation lining the south side of the A2 and westbound on and off slips would be removed. This could disrupt commuting routes for bats moving between Darenth Wood SSSI and Thrift Wood. Reinstating landscape planting would ensure no permanent loss of connectivity for bats. *Light disturbance*: Road lighting would not be expected to cause significant disturbance to bats if light spillage away from the road is controlled.	Neutral Neutral
Hazel Dormouse	Construction *Habitat loss*: Suitable hazel dormouse habitat (i.e. landscape planting, scrub and woodland) would be removed to accommodate the widening of B255; A2 westbound on and off slip roads; enlargement of the Ightham roundabout; and construction of the A2 eastbound on slip road. The majority of habitat that would be removed is landscape planting which is considered to be of moderate suitability for hazel dormouse due to its small area and young age but valuable for adding to connectivity between isolated blocks of woodland. The majority of the high value habitat that would be lost is within the Bean triangle. The removal of all suitable habitat would require a Natural England EPSL and mitigation plan that would include sensitive and strategic removal of vegetation supervised by a licensed hazel dormouse ecologist and where necessary a translocation of dormice to retained habitat. Landscape planting along the road verge and earthworks would be reinstated to ensure no net loss of habitat for this species and connectivity for this species is restored. *Mortality:* Killing or injury of hazel dormouse could occur during vegetation clearance of hazel dormouse habitat. Providing vegetation clearance is carried out under an EPSL, supervised by a suitably licensed ecologist at an appropriate time of year, the magnitude of this impact would be negligible. Operation No operational impacts anticipated.	Slight to moderate adverse Neutral Neutral
Badger	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral

5.8 Cumulative Effects

5.8.1 As presented in Section 4.9, six approved developments have been identified that are of a sufficient scale to be considered as cumulative developments. Of these, three of the proposed developments within/adjacent to the site have been considered with regards to potential cumulative effects on Ecology and Nature Conservation. These are summarised in Table 5-11.

Table 5-11 Cumulative impacts on Ecology and Nature Conservation

Planning application reference	Development summary	Distance from Scheme	Potential cumulative effects
DA/12/01451/EQVAR DA12/00758/EQVAR Approval of condition variations October 2012 Dartford app number: 03/01134/OUT	**Eastern Quarry Watling Street Swanscombe Kent** A mixed use development of up to 6250 dwellings & in addition up to 231,000 square metres of built floorspace. The development will include open space (including parks, play spaces, playing fields, allotments, lakes and water features, community woodland & formal and informal open space); landscaping; works to create ecological & nature reserves & refuge areas.	Land to the North of the A2, within the Ebbsfleet Eastern Quarry site adjacent to the scheme – see attached detailed map for mixed use breakdown	Eastern Quarry development could exacerbate the impact of loss of habitat. Loss of terrestrial habitat for reptiles and amphibians (if present) could be exacerbated. Extensive plans for onsite habitat creation are shown on the Eastern Quarry Masterplan. This includes a buffer of green infrastructure, including a constructed wetland that entirely separates the A2 and its Junctions from the development. This buffer would provide habitat for reptiles and amphibians Hazel dormouse habitat along the A2 would be largely unaffected by the development with roadside planting retained to shield the development from the A2 and other roads. Poor lighting design for the junction improvements and Eastern Quarry could have a combined negative impact on bats. The new wetland at Eastern Quarry could provide an important foraging resource for bats Scheme dependent on the lighting design. Pressure from increased recreational use of Darenth Wood SSSI could be compounded by habitat loss from the Bean Option 3 improvements.
15/00887/CPO Approved November 2015	**Eastern Quarry Wastewater Treatment Works** Wastewater treatment works and ancillary infrastructure to serve the development at Eastern Quarry	Approximately 100m north of the Scheme (within the Ebbsfleet Quarry development)	No cumulative effect anticipated beyond those described for the Eastern Quarry development.

Planning application reference	Development summary	Distance from Scheme	Potential cumulative effects
20150155 Application Permitted February 2016	**Land at Ebbsfleet Bounded by A2.** The development of land at Ebbsfleet for mixed use up to 789,550m2 gross floorspace comprising employment, residential, hotel and leisure uses, supporting retail and community facilities and provision of car parking, open space, roads and infrastructure	Adjacent to Ebbsfleet Junction	The development is adjacent to Ebbsfleet Marsh LWS however no cumulative effect is expected as the designating features of the LWS would not be affected by the Scheme. Loss of reptile and amphibian (if present) habitat could be exacerbated by the junction improvements and developments as habitat for these species is constricted. Dormouse habitat is generally poor around the Ebbsfleet Junction, however landscape planting on the soft estate and within the development could have a net positive impact on this species by strengthening the connectivity for this species. Pressure from increased recreational use of Darenth Wood SSSI could be compounded by habitat loss from the Bean Option 3 improvements.

5.9 Limitations of Assessment

5.9.1 This assessment is subject to a number of limitations:

- The assessment has been based on high level designs of the three options. Further details provided in Stage 3 could alter the magnitude of impacts or significance of effects on specific receptors.
- Limited baseline data has been obtained for some species, for example bats. Where necessary, further surveys will be carried out to inform the Stage 3 assessment to ensure the conclusions that are reported are accurate.
- Access to all areas of the study area during the walkover was not possible as some land was privately owned. These areas were assessed from aerial photography. They largely comprised built areas and are considered likely to be of low ecological value and not expected to make a material difference to the conclusions presented in this report.
- Topography of the land in some areas consisted of steep banks leading down to the A2. These areas could not be accessed for health and safety reasons. In other areas, dense scrub or undergrowth prevented access to the entire study area. Therefore it is possible that protected species constraints, such as badger setts, or mature trees which may support roosting bats, could have been missed. However, it is considered that sufficient information has been gathered to identify any major ecological constraints and usefully inform the options assessment.
- Due to the access constraints, it was not possible to undertake the dormouse tube survey in all areas of suitable habitat within the study area, and so some populations may have been missed. However, based on desk-study records and the results of the survey that was undertaken, and taking into account the habitat connectivity within the area, the presence of dormice in all areas of suitable habitat within the study area has been assumed

5.10 Summary

5.10.1 This section of the Chapter draws together the results of the assessment of the 3 Route Options, namely Route Options B03E01b, B04bE01b and B05E01b. A summary of the significant effects, mitigation proposed and residual effects for each option is given Table 5-12.

5.10.2 Option B03E01b has the most adverse predicted impact incurring a loss of Ancient Woodland which is categorised as an irreplaceable resource. It should be noted that loss of ancient woodland will also occur with Option B04bE01b but it will not be as extensive. All three options will incur the loss of hazel dormouse habitat and potential loss of bat roosts.

Table 5-12 Summary of significant effect, mitigation proposed and residual effects on Ecology and Nature Conservation. Scoring follows guidance in Table 4-2.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Option B03E01b					
Ecology and Nature Conservation	2 **Red**/ **Amber**	Permanent and irreversible loss of ancient woodland at Darenth Wood SSSI; Significant loss to high value hazel dormouse habitat. Localised loss or disturbance to other receptors, including possible loss of bat roosts and a main badger sett.	Darenth Wood SSSI is a nationally important designated site. Hazel dormouse and its habitat and bats and their roosts are protected under European legislation. Badgers are protected under the Protection of Badgers Act 1992.	Ancient woodland is an irreplaceable resource. Significant compensatory planting likely to be required. Hazel dormouse mitigation to include EPSL license, habitat manipulation and/or translocation of individuals and compensatory habitat planting and landscape planting reinstated. Bats, if found, would require mitigation and could include construction of artificial roosts. The loss of a badger sett would require an artificial sett to be constructed.	Increased recreational activity at Darenth Wood SSSI associated with new residential developments compounded by habitat loss from Scheme.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Option B04bE01b					
Ecology and Nature Conservation	3 **Amber**	Permanent and irreversible loss of a small section of the Thrift ancient woodland. Loss and permanent fragmentation of semi-natural woodland (not ancient); Temporary loss of high value hazel dormouse habitat and possible fragmentation of population. Localised loss or disturbance to other receptors, including possible loss of bat roosts.	The Thrift ancient woodland is protected through planning policy. Semi-natural woodland is a habitat of principal importance and as such a material consideration. Hazel dormouse and its habitat and bats and their roosts are protected under European legislation.	Ancient woodland is an irreplaceable resource. Planting to compensate for loss of woodland and hazel dormouse habitat. Hazel dormouse mitigation to include EPSL licence, habitat manipulation and/or translocation and construction of a hazel dormouse bridge to minimise fragmentation of population. Bats, if found, would require mitigation and could include construction of artificial roosts.	No option specific cumulative effects.
Option B05E01b					
Ecology and Nature Conservation	4 **Amber / Green**	Loss of small area of high value hazel dormouse habitat. Localised loss or disturbance to other receptors, including possible loss of bat roosts.	Hazel dormouse and its habitat and bats and their roosts are protected under European legislation.	Hazel dormouse mitigation to include EPSL licence, habitat manipulation and/or a translocation of individuals and compensatory habitat planting and landscape planting reinstated. Bats, if found, would require	No option specific cumulative effects.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
				mitigation and could include construction of artificial roosts.	

6 Landscape and Visual

6.1 Introduction & Study Area

6.1.1 This chapter of the EAR presents the assessment of likely significant effects of the Scheme options on the character of the surrounding landscape and townscape as well as the likely significant effects on the visual amenity. Summary findings are presented in Section 6.10.

6.1.2 This chapter should be read in conjunction with Figures 6.1-6.9.

6.1.3 The study area consists of a 1km corridor either side of each of the four Scheme options. The study area for the assessment of the landscape and visual impacts has been defined by a combination of desk studies and a site survey along with professional judgement and consideration of the extent of the Zone of Theoretical Visibility (ZTV) derived from modelling and verified in the field. The extent of the study area can be seen in Figure 6.7.

6.2 Methodology

6.2.1 Throughout the Chapter the methodology that has been developed for this assessment seeks to make reference to relevant guidance from the DMRB, IAN135/10.

Landscape / Townscape Sensitivity

6.2.2 The sensitivity of the landscape and townscape resource are determined using the examples shown in Table 6-1.

Table 6-1 Landscape and Townscape Sensitivity (based on DMRB IAN135/10 Annex 1 Table 2, Ref 6-1)

Landscape/ Townscape Sensitivity	Typical Descriptors and Examples
High	Resource which by nature of its character would be unable to accommodate change of the type proposed. Typically these would be: • Of high quality with distinctive elements and features making a positive contribution to character and sense of place; • Likely to be designated, but the aspects which underpin such value may also be present outside designated areas, especially at the local scale; • Areas of special recognised value through use, perception or historic and cultural associations; and • Likely to contain features and elements that are rare and could not be replaced.
Moderate	Resource which by nature of its character would be able to partly accommodate change of the type proposed. Typically these would be: • Comprised of commonplace elements and features creating generally unremarkable character but with some sense of place; • Locally designated, or their value may be expressed through non-statutory local publications; • Containing some features of value through use, perception or historic and cultural associations; and • Likely to contain some features and elements that could not be replaced.
Low	Resource which by nature of its character would be able to accommodate change of the type proposed. Typically these would be:

Landscape/ Townscape Sensitivity	Typical Descriptors and Examples
	• Comprised of some features and elements that are discordant, derelict or in decline, resulting in indistinct character with little or no sense of place; • Not designated; • Containing few, if any, features of value through use, perception or historic and cultural associations; and • Likely to contain few, if any, features and elements that could not be replaced.

Visual Sensitivity and Typical Descriptors

6.2.3 Visual impacts are likely to occur where there are residential properties within the study area which may have a view to the Scheme. This also applies to users of publicly accessible areas where views are impacted, such as open access land, as well as other Public Rights of Way (PRoW) within the study area. Criteria to define visual sensitivity are defined in Table 6-2.

Table 6-2 Visual Sensitivity and Typical Descriptors (based on DMRB IAN135/10 Annex 2 Table 1, Ref 6-1)

Visual Sensitivity	Typical Criteria
High	• Residential Properties • Users of Public Rights of Way or other recreational trails (e.g. Regional Trails, footpaths, bridleways etc.) • Users of recreational facilities where the purpose of that recreation is enjoyment of the countryside (e.g. Country Parks, National Trust or other access land etc.)
Moderate	• Outdoor workers • Users of scenic roads, railways or waterways or users of designated tourist routes • Schools and other institutional buildings, and their outdoor areas
Low	• Indoor workers • Users of main roads (e.g. trunk roads) or passengers in public transport on main arterial routes • Users of recreational facilities where the purpose of that recreation is not related to the view (e.g. sports facilities)

Assessing Impacts and Effects (Magnitude of Impacts and Significance of Effects)

6.2.1 For the purposes of the appraisal, the scale of impact on the landscape and townscape resources are determined using the seven-point scale shown in Table 6-3.

Table 6-3 Magnitude and Nature of Impact and Typical Descriptors (based on DMRB IAN135/10 Annex 1, Table 1, Ref 6-1)

Magnitude of Impact on Landscape/ Townscape	Typical Criteria Descriptors
Major Beneficial	Large scale improvement of character by the restoration of features and elements, and/or the removal of uncharacteristic and conspicuous features and elements, or by the addition of new distinctive features.
Moderate Beneficial	Partial or noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic and noticeable features and elements, or by the addition of new characteristic features.
Minor Beneficial	Slight improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.
No Change	No noticeable loss, damage or alteration to character or features or elements.
Negligible Adverse	Barely noticeable loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.
Minor Adverse	Slight loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.
Moderate Adverse	Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.
Major Adverse	Total loss or large scale damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic conspicuous features and elements.

6.2.1 For the purposes of the appraisal, the scale of impact on the visual receptors are determined using the scale and indicative criteria shown in Table 6-4. Please note the nature of the magnitude of impact would be either adverse or beneficial depending on the extent to which the Scheme is out of character with the existing view.

Table 6-4 Magnitude and Nature of Impact and Typical Descriptors (based on DMRB IAN135/10 Annex 2, Table 2, Ref 6-1)

Magnitude of Impact on Visual Receptors	Typical Criteria Descriptors
Major	The project, or a part of it, would become the dominant feature or focal point of the view.
Moderate	The project, or a part of it, would form a noticeable feature or element of the view which is readily apparent to the receptor.
Minor	The project, or a part of it, would be perceptible but not alter the overall balance of features and elements that comprise the existing view.
Negligible	Only a very small part of the project would be discernible, or it is at such a distance that it would form a barely noticeable feature or element of the view.
No Change	No part of the project, or work or activity associated with it, is discernible.

Determination of Significance

6.2.2 Determination of significance is a factor of the previously described sensitivity of the resource or receptor and the magnitude of the impact as described above. The range of significance of effects on the landscape and townscape resources and visual receptors is presented in Table 6-5.

6.2.3 Where there is a choice in significance score, professional judgement is used to determine the significance level.

Table 6-5 Significance of Effects Categories (based on DMRB IAN 135/10 Annex 1 Table 3 and Annex 2 Table 3, Ref 6-1)

		Magnitude of Impact				
		No Change	Negligible	Minor	Moderate	Major
Sensitivity	High	Neutral	Slight	Slight/Moderate	Moderate/ Large	Large/Very Large
	Moderate	Neutral	Neutral/Slight	Slight	Moderate	Moderate/Large
	Low	Neutral	Neutral/Slight	Neutral/Slight	Slight	Slight/Moderate

Typical Descriptors of Significance of Effect Categories for landscape / townscape and visual setting

6.2.4 Please note the significance of effects would be either adverse or beneficial as described in DMRB IAN 135/10 Annex 1 Table 4 and Annex 2 Table 4.

6.3 Baseline Conditions

6.3.1 This section describes the baseline conditions of the landscape and townscape resource and visual setting within the study area.

Landscape Character Areas

6.3.2 Refer to Figure 6.4 to 6.6 for locations and extents of Landscape Character Areas. National Character Areas are shown on Figure 6.4, Regional Landscape Character Areas are show on Figure 6.5, and Local Landscape Character Areas are shown on Figure 6.6.

6.3.3 A description of the different Character Areas can be found in 6.6.3 to 6.6.16.

6.3.4 A description of these local landscape character areas and their sensitivity to change is provided in Section 6.4.

National Character Areas

6.3.5 Natural England (NE) has published 'National Character Area (NCA) Profiles' (Ref 6-2), defining areas that share similar landscape characteristics. As identified by NE, the study area lies within parts of the NCA (113) – North Kent Plain, as shown in Figure 6.4.

6.3.6 The key characteristics of the National Character Area 113 and relevant to the study area are described as:

- *'An open, low and gently undulating landscape, characterised by high quality, fertile, loamy soils dominated by agricultural land uses.*

- *The area's geology is dominated by Palaeogene clays and sands, underlain by the Chalk.*
- *Geologically a chalk outlier….*
- *Large arable/horticultural fields with regular patterns and rectangular shapes predominating, and a sparse hedgerow pattern.*
- *Orchards and horticultural crops characterise central and eastern areas, and are often enclosed by poplar or alder shelterbelts and scattered small woodlands.*
- *Other semi-natural habitats include fragments of neutral, calcareous and acid grassland, and also heathland.*
- *The area has rich evidence of human activity from the Palaeolithic period. ….; and historic parks and buildings.*
- *Large settlements and urban infrastructure (including lines of pylons) are often visually dominant in the landscape, with significant development around Greater London and the Medway Towns, as well as around towns further east and along the coast. Major rail and road links connect the towns with London.'*

Regional Landscape Character Areas (LCAs)

6.3.7 At a regional level Kent County Council (KCC) has identified a number of landscape character types and areas in its Landscape Assessment of Kent (LAK) document published in 2004 (Ref 6-3). The relevant landscape character areas (LCA) described within this that cover the study area also form part of the Dartford Borough Council Biodiversity and Landscape Technical Paper, which makes up part of Dartford's Local Development Framework (Ref 6-4).

6.3.8 **North of the A2** the proposed development site falls within the **Dartford and Gravesend Fringes** LCA, which is described in the BLTP as follows:

'This covers a number of open areas such as Dartford Heath, Darenth Country Park and part of Darenth Woods that are rural in character, which perform an important amenity function within or close to the urban area. It also covers former chalk quarries at Eastern Quarry and Ebbsfleet, both of which have planning permission for development.'

6.3.9 The 'Characteristic Features' of this LCA as stated in the LAK are:

- *'Contained by A2 and urban edges.*
- *Some semi-natural heathland and woodland.*
- *Some farmland with remnant hedgerows and trees.*
- *Landfill sites. Fragmentation by roads.*
- *Wide scale amenity uses.'*

6.3.10 **South of the A2** the proposed development site falls within two different LCA, the **Southfleet Arable Lands and Darenth Downs**.

6.3.11 The **Southfleet Arable Lands** LCA is described in the BLTP as follows;

'this covers the eastern part of the borough, with open undulating arable landscape, interspersed with unkempt hedgerows, copses. The landscape is impacted by the High Speed 1 railway line and electricity powerlines;'

6.3.12 Its key 'Characteristic Features' are stated in the LAK as:

- *'Good quality soils developed on the Tertiary Beds overlying the chalk. A generally open arable landscape.*
- *Open landscape allowing transport routes, pylons and settlement to dominate many areas.*
- *Remnant unkempt hedgerows, shelterbelts and woodland copses giving a scruffy and unmanaged feel.*

- *Long views to the busy A2 (T) and Kent Thames-side beyond'*

6.3.13 The **Darenth Downs** LCA is described in the BLTP, 2010 as follows;

'this covers the gentle undulating dip slope of the North Downs with open arable landscape, ancient semi-natural woodland at Darenth Woods, Lords Wood and Ladies Wood. It has attractive views southwards. Views northwards are dominated by the urban edge and major transport routes.'

6.3.14 It's 'Characteristic Features' are stated in the LAK as:

- *'Smooth, open arable landscape on the chalk.*
- *Crossed by major transport routes.*
- *Scattered settlement.*
- *Long views to the Kent Thames Gateway'*

6.3.15 No specific LCA has been completed for Dartford Borough. Gravesham Borough has produced the Gravesham Landscape Character Assessment, 2009 (Ref 6-5). The eastern end of the site lies within the '**Gravesend Southern Fringe**' LCA, which is described as follows:

'The Gravesend Southern Fringe is a linear character area that runs along the southern edge of Gravesend with an additional area that feeds into the urban edge and is encompassed by Gravesend suburbs. The majority of the character area is sandwiched between the urban edge and the realigned A2 trunk road and the Channel Tunnel Rail Link (CTRL).

6.3.16 Key Characteristics:

- *Dominant settlement on urban edge of Gravesend*
- *Very gently undulating topography rising from north to south*
- *Small arable fields historically part of Istead Farmlands landscape*
- *Man-made golf course landscape acts as visual detractor*
- *Limited tree cover mostly consisting of small clumps of non-native tree material on golf course*
- *Wire Fence lines and gappy native hedgerows*
- *Landscape dominated by large roads, Channel Tunnel Rail Link and associated infrastructure'*

Local Landscape Character Areas

6.3.17 To identify local landscape character areas, the Chartered Landscape Architect identified (during a site visit in May 2016) landscape and townscape landscape character areas shown on Figure 6.6 within the study area.

North of the A2: Within Dartford and Gravesend Fringes LCA

- A: Former Eastern Quarry
- B: Bluewater Retail Park
- D: Urban Fringe of Dartford, Greenhithe and Swanscombe
- F: Urban Fringe of Gravesend and Northfleet
- G: A2 Corridor North

South of the A2: Southfleet Arable Lands LCA and Darenth Downs LCA

- C1 to C3 Darenth Wood and Bean Woods
- E: Southfleet Downland

- G: A2 Corridor South
- H: Bean Village

6.3.18 A description of these local landscape character areas and their sensitivity to change is provided in Section 6.4.

Relevant Landscape / Heritage / Environmental Designations

6.3.19 The landscape, townscape, heritage and other environmental designations within the study area are indicated on Figure 6.1 and are summarised below.

The Kent Downs Area of Outstanding Natural Beauty

6.3.20 The Kent Downs Area of Outstanding Natural Beauty Management Plan 2014 – 2019 (Ref 6-6) highlights the potential for the 'loss of and damage to the quality of views in and out of the Area of Outstanding Natural Beauty (AONB) through development' as an issue in relation to protection of the importance, qualities and sensitivity of the AONB landscape.

6.3.21 The Kent Downs AONB is located outside the study area, approximately 7 km south of Bean Junction. There is no visual connection between the A2 and the AONB because of dense woodland situated between.

Green Belt

6.3.22 The majority of the proposed development site falls within land designated as Green Belt.

Country Parks

6.3.23 Country Parks within the Landscape and Visual Impact Assessment study area include Swanscombe Heritage Park in the north (approx. 1.4 km from scheme limit), Beacon Wood in the south (approx. 0.75 km from scheme limit) and Darenth Country Park in the west (approx. 0.75 km from scheme limit).

Access Land

6.3.24 There is no Access Land situated within the study area.

Public Rights of Way (PRoW)

6.3.25 The following footpaths are situated on the southern side of and leading to the A2: DR18, DR19, DR20, DR128. The following footpaths are situated on the northern side of and leading to the A2: DR312, DS20, NU14, NU19. There are three By-ways located within the study area: southeast of Bean Junction DR129, south of Ebbsfleet Junction DR129, east of Ebbsfleet Junction NU20. Refer to Figure 6.2. Potential impacts on Rights of Way are addressed in Chapter 11 People and Communities, visual amenity from footpaths are considered in this chapter (refer to Viewpoint 4, 5, 7, 10, 11, 13, 18, 19) as shown in Figures 6.8 and 6.9.

Environmental Designations

6.3.26 Environmental Designations, located within the study area include the following as outlined below. The impact on ancient woodland is assessed in Chapter 5 Ecology and Nature Conservation and Chapter 9 Cultural Heritage addresses potential impacts on Scheduled Monuments, Conservation

Areas and Listed Buildings. This chapter considers the impact on these environmental designations in relation to landscape character and visual amenity.

Ancient Woodland:

6.3.27 Darenth Wood is situated within the A2 corridor, on the southern side of the A2 as well as west of Bean Junction. Thrift Wood is situated to the south of the A2 corridor, to the east of Bean Junction. Both are sitting within the scheme limit.

Visual Amenity

6.3.28 The approach to the visibility mapping studies and visual appraisal surveys undertaken to define the baseline visual conditions for this appraisal is outlined below.

6.3.29 The ZTV has been digitally mapped using a computer model to show areas within which the Scheme may be theoretically visible. The ZTV mapping uses elevation data to create a digital terrain model and calculate inter-visibility between points. The model does not take account of the screening effects of buildings, other structures and blocks of woodland/other areas of substantial vegetation that could influence potential visibility.

6.3.30 The ZTV mapping is used as a guide and is verified by site surveys. A final Zone of Visual Influence (ZVI), in accordance with DMRB, will be produced for the Stage 3 EAR. The initial representative viewpoints identified for this, Stage 1, appraisal are based on the May 2016 site survey. Originally, approximately 35 viewpoints have been checked during a site visit in May. Finally, the visual receptors within the study area have been considered in terms of 20 representative viewpoints.

6.3.31 20 representative viewpoints have been identified and are described in 6.4.8 to 6.4.49

6.4 Value (Sensitivity) of Resource

Environmental Designations

The Kent Downs Area of Outstanding Natural Beauty

6.4.1 The AONB is also located 7 km southeast of Ebbsfleet Junction. Due to minor changes in the layout of the junction with minimal level changes of the proposed roads, there would be no change in the visual setting between the A2 and the AONB. Therefore, the **AONB has not been considered further** for this Stage 1 assessment and is not included within Section 6.7 (Magnitude of Impacts and Significance of Effects).

Green Belt

6.4.2 The area that is covered by the Green Belt designation is of high quality for the openness and access of the land identified, therefore it is considered to have a **High Sensitivity**.

Country Parks

6.4.3 Swanscombe Heritage Park: Due to minor changes in the layout of the junction with minimal level changes of the proposed roads, there would be no change in the visual setting between the A2 and Swanscombe Heritage Park. Therefore, this asset **has not been considered further** for this Stage

1 assessment and is not included within Section 6.7 (Magnitude of Impacts and Significance of Effects).

6.4.4 Beacon Wood: The landscape area is dominated by high quality distinctive elements of woodland as well as other designations associated with the area, therefore it is considered to have a **High Sensitivity**.

6.4.5 Darenth Country Park: The landscape area is dominated by high quality distinctive elements of woodland as well as other designations associated with the area, therefore it is considered to have a **High Sensitivity**.

Open Access Land

6.4.6 There is no Open Access Land situated within the study area. Therefore this asset **has not been considered further** for this Stage 1 assessment and is not included within Section 6.7 (Magnitude of Impacts and Significance of Effects).

Landscape Resource

6.4.7 Summary descriptions of each local landscape and townscape resource (identified in Section 6.3, see Figures 6.4 to 6.6) are provided below and their sensitivity has been considered with reference to the descriptions and examples provided in Table 6.1.

North of the A2: Dartford and Gravesend Fringes LCA:

A: Former Eastern Quarry

6.4.8 The area north of the A2 falls within the Dartford and Gravesend Fringes landscape character area. Within this LCA and within the study area, the landscape is dominated by the Former Eastern Quarry Chalk Pits, north of the A2 and former Roman Road (A296).

6.4.9 The cultural background of the area started from 1900 some of the area was quarried for clay and from the 1930s it was quarried for chalk. The quarry has recently been decommissioned in preparation for re-development of 'Ebbsfleet Garden City'. Therefore, the area is currently in transformation.

6.4.10 The pattern of the landscape can be described as a large variation in levels across the Former Eastern Quarry with steep chalk cliffs rise from the quarry floor to enclose the former quarries, the northern edge comprises undulating landform of backfilled sand.

6.4.11 The landcover is dominated by areas of semi natural vegetation around the periphery and on top of the cliff faces. Two large water bodies are situated within the former quarry. The majority of the area is bare ground, and a mature tree belt separates the A2 and Roman Road from the Eastern Quarry.

6.4.12 A landscape of large scale. The presence of large bodies of water provides tranquillity over the area, which has been subject to significant human influence over the past century.

6.4.13 Views in and out of the former quarry are limited by vegetation and landform.

6.4.14 There are no environmental designations associated with this area.

6.4.15 As the area is in transformation and there are no environmental designations associated with the area, therefore it is considered to have a **Low Sensitivity**.

South and west of the A2: Southfleet Arable Lands LCA and Darenth Downs LCA

C1 to C3 Darenth Wood and Bean Woods

6.4.16 Darenth Wood and Bean Wood is a large character area and the busy A2 cuts west-east through Darenth Wood.

6.4.17 Culturally, this was one large area of woodland; some of the central part of the wood was lost to farmland since the late 1800s.

6.4.18 The pattern of this landscape character area is dominated by undulating land (between 45m-84m above ordnance datum (AOD) and large scale woodland which has a wide range of habitats and diversity of trees, shrubs and ground flora. Large expansive fields weave around the edges of the woods. The majority of these are arable. Many of the field boundaries lie open; some fields are bounded by hedgerows with trees.

6.4.19 In regards to tranquillity, despite the vastness of the area, the woods generate unity and produce vertical interest. The enclosure creates more intimate smaller scale areas.

6.4.20 Most views are contained by the woods and subtle changes in the landform. Trees along the A2 screen views to the north. However, some views are expansive across the open fields. Open views are possible to the south.

6.4.21 Darenth Wood is a designated SSSI and Local Wildlife Sites (LWS). Darenth Wood has Ancient Woodland status and retains a medieval woodland boundary designated as a Scheduled Monument. Parts of Bean Woods are classified as Ancient Woodland as well. Beacon Wood Country Park is situated south west of Bean. The park is distinguished as woodland with an industrial past featuring old clay pits and machinery. Local landscape character areas C1-3 are located within the Green Belt.

6.4.22 As the landscape area is dominated by high quality distinctive elements of woodland and there are designations associated with the area, therefore it is considered to have a **High Sensitivity.**

South and east of the A2: Southfleet Arable Lands LCA

E: Southfleet Downland

6.4.23 Southfleet Downland is a large scale area located on land south of the A2.

6.4.24 Southfleet and Betsham are historic villages with parts which have expanded across the 20th century decreasing the strength of the local vernacular. An area around the A2 is known to have dated back to the Romano-British period, known as Vagniacis (Springhead). Some field enclosures, are still present in today's landscapes. The historic core of settlements such as Southfleet and Betsham are completely or partial legible. Some scattered post-1871 scattered settlements are also legible.

6.4.25 The pattern of this landscape character area can be described as an open rural landscape; it predominantly consists of large arable fields. Many of the original hedgerow boundaries have been lost and replaced with open tracks for farm vehicles. Some shelterbelts demarcate field boundaries, generally sloping north with some undulation. Several public footpaths extend across the area. These mainly run along field boundaries to connect adjacent villages.

6.4.26 The tranquillity of the landscape is the contrast of working agricultural fields south of the A2 with the urban character north of the A2.

6.4.27 Visually, there are views to the top of Ebbsfleet Station, the chalk spine and railway infrastructure. Northfleet and the cranes at Tilbury Docks beyond are partially visible. Additionally, there are some long distance views to the Kent Downs to the south east.

6.4.28 There are two areas which lie on the southern edge of the A2 that are designated as the Springhead Roman Site Scheduled Monument and is located across the fields south of the A2. Several Listed Buildings are also scattered within this landscape character area. Local landscape character areas E is also located within the Green Belt.

6.4.29 The landscape area is dominated by high quality distinctive elements of downland and there are designations associated with the area, therefore it is considered to have a **High Sensitivity.**

Townscape Resource

6.4.30 Summary descriptions of each local landscape and townscape resource (Figure 6.4) are provided below and their sensitivity has been considered with reference to the descriptions and examples provided in Table 4-2.

North of the A2: Dartford and Gravesend Fringes LCA:

B: Bluewater Retail Park

6.4.31 Bluewater Retail Park is located west of the Former Eastern Quarry, bounded by several roads including: the B255 to the east; the A296 old Roman Road to the south; and the B2174 to the east.

6.4.32 Cultural background of and human interaction within the area is that it sits within a former quarried landscape. The chalk quarrying took place across the area from the early 1900s through to the 1990s.

6.4.33 Current landuse is commercial, Bluewater shopping centre opened in 1999. Public access: main access is gained by car or bus from an entrance off the B255. There are a number of cycle paths and walkways around the main shopping centre, designated for public use.

6.4.34 The layout is dominated by a flat area of land, which is surrounded by approximately 50m (AOD) high vegetated chalk cliffs. A popular out of town shopping mall in the centre comprising numerous stores, cafes, restaurants and a cinema. Car parks and roads dominate the landscape surrounding the centre. The cliffs are striking vertical landscape features that add scale to the landscape and are a reminder to the past.

6.4.35 Tree and shrub planting and some small areas of grassland break up the utilitarian appearance of the car parks, and associated features such as tall lamp posts, concrete walls and bollards. A substantial amount of parkland including six lakes and many semi-mature trees encompass the retail park, which soften the edges of the hard landscape. Overall, this landscape character area can be described as a large sunken shopping centre confined by dramatic white cliffs that provide a harmonious setting to the otherwise busy and chaotic use of the area.

6.4.36 The retail park opens out to the B255, which has direct views to the area. Otherwise views in and out of the area are restricted by the low setting of the retail park in the former quarry.

6.4.37 There are no environmental designations associated with this area.

6.4.38 There are no environmental designations associated with the area, therefore it is considered to have a **Low Sensitivity**.

D: Urban Fringe of Dartford, Greenhithe and Swanscombe

6.4.39 Dartford, Greenhithe and Swanscombe are small towns located north of the A2 corridor.

6.4.40 The cultural and historic core of Greenhithe and Swanscombe is still legible in the present day character of this area. The eastern edge of Dartford is situated west of Bean Junction. The built environment is of mixed age and was built for the cement industry.

6.4.41 This urban fringe character layout is of residential landuse, mixed pattern of houses, streets and open spaces.

6.4.42 Outward views are generally constrained by the built-up environment. The urban edges often have outward views to surrounding areas, albeit sometime oblique views.

6.4.43 The designated Parish Church of St Peter and St Paul is situated in the central area of Swanscombe. The edge of Swanscombe Heritage Park sits on the northern boundary of the area. Parts of local townscape character areas D are located within the Green Belt.

6.4.44 Several Listed Buildings are also scattered within this landscape character area, therefore it is considered to have a **Moderate Sensitivity**.

F: Urban Fringe of Gravesend and Northfleet

6.4.45 The Gravesend and Northfleet urban fringe form the eastern edge of the study area. The A2 marks the southern edge of the suburban area.

6.4.46 The historic background is largely residential area/landuse that was built up over the 20th century.

6.4.47 The layout is marked by many of the post-war housing developments featuring winding roads and cul-de-sac streets, these create quiet roads and less natural surveillance. There are minimal green spaces and street trees.

6.4.48 The minimalist and uniform built up area with contrasting interruptive and quiet roads defines the appearance of the area.

6.4.49 The undulating nature of the landform creates inter-visibility, including positive street vistas and views into neighbouring estates. Some extensive outward views to the southern countryside are possible.

6.4.50 In regards to designations, there are several Listed Buildings scattered on the eastern boundary of the Scheme within this townscape character area.

6.4.51 Several Listed Buildings are also scattered within this landscape character area; therefore it is considered to have a **Moderate Sensitivity**.

G: A2 Corridor

6.4.52 The A2 Road Corridor - Enclosed extends from Darenth Wood to the eastern edge of Stonewood. The A2 Road Corridor - Open, encompasses the stretch of road and immediate surroundings from the edge of Stonewood to the Pepperhill B262 junction.

6.4.53 Historically, the A2 transport corridor follows a similar route to that of a Celtic ancient route track and it was also an important Roman Road, and now forms part the A296. The A2 corridor was built in the 1970s and in 2008 this section of the roads was widened to four lanes.

6.4.54 The layout and appearance: a major road that connects London and the English Channel; it comprises eight lanes and several junctions leading to the close vicinity of the motorway. The road boundaries of the A2 Road Corridor are generally open: roadside vegetation includes a mix of grasses, wildflowers and shrubs. The slip roads and roundabouts associated with the A2 junction to Northfleet and Swanscombe form what is considered to be part of the vehicular 'entrance gateway' to the Ebbsfleet Valley. It has a manicured landscape with a central public art feature, mown grass, shrubs and birch trees. The road boundaries of the A2 Road Corridor - Enclosed vary from closeboard fence to narrow grassland edges and large grassland banks. Vegetation encloses the corridor; comprises wooded areas with a mixed understorey of shrubs and grasses, part of the wooded areas are designated Ancient Woodland.

6.4.55 The views from and to the A2 Road Corridor – Open, are generally long views, however, due to the undulating land surrounding this part of the A2 corridor the views are restricted. The views from and to the A2 Road Corridor – Enclosed, are short views due to the woodland surrounding this part of the A2 corridor, and therefore restricted views.

6.4.56 Ancient woodlands, and Scheduled Monuments are the designations within or adjacent to this character area. Parts of local townscape character areas G are located within the Green Belt.

6.4.57 The designations and views within the townscape character area are considered to have a **High Sensitivity.**

H: Bean Village

6.4.58 The rural Bean Village is located south of the A2 Bean Junction.

6.4.59 In regards to history, the village developed over the second half of the 20th century; much of its small scale uniform appearance is the result of rapid expansion during the 1970s.

6.4.60 The layout is formed by undulating land with many of the properties sit on sloping land.

6.4.61 There is a large amount of woodland cover within the vicinity which builds up the appearance of the area; this provides a dense wooded backdrop to the village. This is a small scale village with curved roads and uniform houses, the adjacent woodland and farmland give the village a hidden and tranquil setting.

6.4.62 There is a designated farmland building situated west of Bean and close to the A2 on the south.

6.4.63 Views in the area are very inward-looking due to the steep landform and built up character of the area. Although, some views are possible from properties south of the A2 towards Bean Junction.

6.4.64 The restricted designations and views within the townscape character area are considered to have a Moderate Sensitivity.

Visual Receptors

6.4.65 Originally, approximately 35 viewpoints have been checked during a site visit in May. Finally, the visual receptors within the study area have been considered in terms of 20 representative viewpoints. The locations and photos for these viewpoints are shown on Figure 6.8 and Figure 6.9 respectively. A summary description of each is provided below and their sensitivity has been considered with reference to the descriptions and examples provided in Table 6.2.

VP1:

6.4.66 A2: View looking east toward Bean Junction: These views are typically representative of vehicle travellers using the A2.

6.4.67 Taking the visual receptors of this view into consideration the visual sensitivity for users of the A2 is considered to be **low**.

VP2:

6.4.68 B255 bridge over A2: looking west along the A2: These views are typically representative of pedestrians using the footpath on the bridge and vehicle travellers using the A2 as well as the residents of Hope Cottages.

6.4.69 Taking the visual receptors of this view into consideration the visual sensitivity is considered to be **high.**

VP3:

6.4.70 B255 bridge over A2: looking east along the A2: These views are typically representative of pedestrians using the footpath on the bridge. Also, residential properties within the Bean Triangle due to screening not visible

6.4.71 Taking the visual receptors of this view into consideration the visual sensitivity of pedestrians on the bridge is considered to be **high**.

VP4:

6.4.72 A2: View looking west towards Bean Junction: These views are typically representative of vehicle travellers using the A2.

6.4.73 Taking the visual receptors of this view into consideration the visual sensitivity for users of the A2 is considered to be **low.**

VP5:

6.4.74 A2: View looking east, westbound slip road to Bean junction on the right: These views are typically representative of vehicle travellers using the A2. Also, residential properties within the Bean Triangle due to screening not visible

6.4.75 Taking the visual receptors of this view into consideration the visual sensitivity of pedestrians on the bridge is considered to be **high**.

VP6:

6.4.76 A296, Roman Road: View looking east, end of slip road towards the A2: These views are typically representative of vehicle travellers using the slip road and the A2.

6.4.77 Taking the visual receptors of this view into consideration the visual sensitivity is considered to be **low.**

VP7:

6.4.78 A2: View looking southeast towards Southfleet Arable Lands: These long views are typically representative of pedestrians using the footpath on the northern and southern side of the A2 and vehicle travellers using the A2.

6.4.79 Taking the visual receptors of this view into consideration the visual sensitivity of pedestrians on the footpath is considered to be **high**.

VP8:

6.4.80 B259/B2260 Roundabout: View looking south towards Ebbsfleet Junction: These views are typically representative of vehicle travellers using the road towards Ebbsfleet Junction.

6.4.81 Taking the visual receptors of this view into consideration the visual sensitivity is considered to be **low**.

VP9:

6.4.82 A2: View looking northwest towards Ebbsfleet Junction, in the background the southern part of Eastern Quarries: These views are typically representative of vehicle travellers using the A2.

6.4.83 Taking the visual receptors of this view into consideration the visual sensitivity for users of the A2 is considered to be **low**.

VP10:

6.4.84 Station Road Corner Foxhounds Lane, By Way through fields: View looking north towards Ebbsfleet Junction: These long views are typically representative of recreational users.

6.4.85 Taking the visual receptors of this view into consideration the visual sensitivity of pedestrians on the By Way is considered to be **high**.

VP11:

6.4.86 Betsham, Park Corner Road, public footpath next to Listed Building: View looking north towards Stonewood: View looking north towards Ebbsfleet Junction: These long views are typically representative of recreational users and from a heritage asset.

6.4.87 Taking the visual receptors of this view into consideration the visual sensitivity of pedestrians on the footpath is considered to be **high**.

VP12:

6.4.88 Roundabout south of Bean Junction: View looking south towards properties on the northern boundary of Bean: These views are typically representative of pedestrians using the footpath along the roundabout, vehicle travellers using the road. The properties in the back of the image on the hill, would have views towards the Bean Junction.

6.4.89 Taking the visual receptors, residents of north Bean, of this view into consideration, the visual sensitivity is considered to be **high**.

VP13:

6.4.90 B255 bridge over A2: looking southwest towards Bean Farm (Listed Building): These views are typically representative of pedestrians using the footpath on the bridge and vehicle travellers using the B255. The listed farm properties in the back of the image on the hill, would have views towards Bean Junction.

6.4.91 Taking the visual receptors, residents of Bean Farm, of this view into consideration, the visual sensitivity is considered to be **high.**

VP14:

6.4.92 Roundabout south of Bean Junction: View looking north towards Bean Junction, on the left Hope Cottages: These views are typically representative of pedestrians using the footpath along the roundabout, users of the NMU route and vehicle travellers using the road. The properties on the left of the image, would have views towards the south of the A2 Junction.

6.4.93 Taking the visual receptors, residents of Hope Cottages and Bean House (representative), of this view into consideration, the visual sensitivity is considered to be **high**

VP15:

6.4.94 Roundabout north of Bean Junction: View looking south towards Bean Junction, on the left Ightham Cottages: These views are typically representative of pedestrians using the footpath along the roundabout, users of the NMU route and vehicle travellers using the road. The properties on the left of the image, would have views towards the north of the A2 Junction.

6.4.95 Taking the visual receptors, residents of Ightham Cottages, of this view into consideration, the visual sensitivity is considered to be **high**.

VP16:

6.4.96 B255: View looking south towards A296 / B255 Roundabout: These views are typically representative of vehicle travellers using the B255.

6.4.97 Taking the visual receptors of this view into consideration the visual sensitivity for users of the B255 is considered to be **low**.

VP17:

6.4.98 A296, Roman Road: View towards entrance site of Eastern Quarry on the left: These views are typically representative of pedestrians using the footpath along the northern side of Roman Road and vehicle travellers using the slip road.

6.4.99 Taking the visual receptors of this view into consideration, the visual sensitivity is considered to be **low**.

VP 18:

6.4.100 Mount Road, Greenhithe: View looking south towards Eastern Quarry and A2: These views are typically representative of residents who would have views towards the north of the A2.

6.4.101 Taking the visual receptors, residents of Greenhithe, of this view into consideration, the visual sensitivity is considered to be **high**.

VP 19:

6.4.102 Swanscombe, Betham Road, public footpath: View looking south/southwest towards the A2: These views are typically representative of pedestrians using the footpath along the northern side of Eastern Quarry, and residents of south Swanscombe.

6.4.103 Taking the visual receptors of this view into consideration, the visual sensitivity is considered to be **high**.

VP 20:

6.4.104 Northfleet, Church Path, public footpath: View looking southwest towards A2 and Ebbsfleet Junction: These long views are typically representative of recreational users and from a heritage asset.

6.4.105 Taking the visual receptors of this view into consideration the visual sensitivity of pedestrians on the footpath and the heritage asset is considered to be **high**.

6.5 Regulatory/Policy Framework

Relevant Policy Framework

National Planning Policy Framework[i] (NPPF) (Ref 6-7)

6.5.1 The following NPPF policies are relevant to landscape / townscape and visual matters:

- Policy 9: Protecting Green Belt land
- Policy 11: Conserving and enhancing the natural environment
- Policy 12: Conserving and enhancing the historic environment

Policy 9: Protecting Green Belt Land

6.5.2 The proposed development site falls within land designated as Green Belt. National planning policy with regard to the protection of Green Belt land is set out in Section 9 of the NPPF.

6.5.3 Paragraph 79 states:

> 'The Government attaches great importance to Green Belts. The fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open; the essential characteristics of Green Belts are their openness and their permanence.'

6.5.4 Paragraph 80 states that the Green Belt serves five purposes:

- 'to check the unrestricted sprawl of large built-up areas;
- to prevent neighbouring towns merging into one another;
- to assist in safeguarding the countryside from encroachment;
- to preserve the setting and special character of historic towns; and
- to assist in urban regeneration, by encouraging the recycling of derelict and other urban land.'

6.5.5 Paragraph 87 states that:

'As with previous Green Belt policy, inappropriate development is, by definition, harmful to the Green Belt and should not be approved except in very special circumstances.'

6.5.6 In paragraph 88, the NPPF requires that:

'When considering any planning application, local planning authorities should ensure that substantial weight is given to any harm to the Green Belt. 'Very special circumstances' would not exist unless the potential harm to the Green Belt by reason of inappropriateness, and any other harm, is clearly outweighed by other considerations.'

6.5.7 However, paragraph 90 states that:

'Certain other forms of development are also not inappropriate in Green Belt provided they preserve the openness of the Green Belt and do not conflict with the purposes of including land in Green Belt. These are [inter alia]:

…local transport infrastructure which can demonstrate a requirement for a Green Belt location;…'

Policy 11: Conserving and enhancing the natural environment

6.5.8 National planning policy with regard to conserving and enhancing the natural environment is set out in Section 11 of the NPPF.

6.5.9 Paragraph 109 states that:

'The planning system should contribute to and enhance the natural and local environment by protecting and enhancing valued landscapes, geological conservation interests and soils…'

6.5.10 NPPF paragraph 115 states:

'Great weight should be given to conserving landscape and scenic beauty in National Parks, the Broads and Areas of Outstanding Natural Beauty, which have the highest status of protection in relation to landscape and scenic beauty.'

6.5.11 In respect to the landscape and visual impacts of light pollution, paragraph 125 of the NPPF states:

'By encouraging good design, planning policies and decisions should limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.'

Local Planning Policy

6.5.12 The following local planning policy documents are applicable to the study area:

- Dartford Local Plan Core Strategy, Adopted September 2011 (Ref 6-8)
- Dartford Local Plan 1995: Saved Policies Following Adoption of the Core Strategy (Ref 6-9)
- Gravesham Local Plan Core Strategy, Adopted September 2014 (Ref 6-10)
- The Kent Downs Area of Outstanding Natural Beauty Management Plan 2014 – 2019 (Ref 6-6)

Dartford Core Strategy

6.5.13 Policy CS13 – Green Belt

'1. In order to protect the openness of the Green Belt the Council will: -

a. Resist inappropriate development, in accordance with PPG2, through its development control decisions.

b. Work with its partners to actively manage the Green Belt as a recreational and ecological resource, through the provision of green recreational and biodiversity networks linked with the urban area. The following projects will be implemented:

- Enhancement of rural reaches of the Darenth Valley
- New Countryside Gateway at South Darenth Lakes
- Dartford Heath –restoration of heathland
- Darenth Country Park improvements
- Darenth Woods natural habitat enhancements
- Beacon Woods Country Park improvements
- Former Mabledon Hospital – enhancement of areas of ecological value
- Better connectivity between Dartford and Gravesham countryside through Ebbsfleet Valley and A2 corridor

2. Agricultural land uses within the Green Belt will be protected. More detailed policies will be set out in the Development Management DPD.'

Dartford Local Plan 1995 Saved Policies

6.5.14 Policy DL1 – Encouragement of restoration schemes

'The Council will encourage schemes for the full restoration of derelict, despoiled, and partially restored sites to appropriate, beneficial after-uses. Proposals for restoration (including land-filling) and after-uses should take due account of:

- any nature conservation interest;
- the impact of land-fill gas and its potential migration;
- the Environment Agency groundwater protection policy and possible pollution of the aquifer;
- impact on the highway network; and
- impact on local residential amenity.'

6.5.15 Policy C5 – Enhancement of the environmental quality and recreational value of the countryside:

'Proposals which enhance the environment quality of the countryside, especially in areas of landscape importance, will be encouraged, as will proposals which enhance the recreational value and nature conservation interest of the countryside.'

6.5.16 Policy B3 – Landscaping within new development:

'Development proposals should incorporate appropriate hard and soft landscaping measures and create a good environment. Where possible, existing trees should be retained and be integrated with the development proposals.'

Gravesham Core Strategy

6.5.17 Policy SO8 – Green Belt

'SO8 Preserve the openness of the Green Belt, maintain its national and local planning purposes and protect it from inappropriate development'.

6.5.18 Policy CS19 – Development and Design Principles

'New development will be visually attractive, fit for purpose and locally distinctive. It will conserve and enhance the character of the local built, historic and natural environment, integrate well with the surrounding local area and meet anti-crime standards.'

'…in line with the guidance set out in Kent Design, the design, layout and form of new development will be derived from a robust analysis of local context and character and will make a positive contribution to the street scene, the quality of the public realm and the character of the area. Account will be taken of the scale, height, building lines, layout, materials and other architectural features of adjoining buildings. Account will also be taken of the wider site context, including strategic views, site topography, the significance of heritage assets and features of townscape and landscape value which contribute to local character and sense of place;

New development will provide appropriate levels of private and public amenity space;

New development will include details of appropriate hard and soft landscaping, public art, street furniture, lighting and signage and will ensure that public realm and open spaces are well planned, appropriately detailed and maintained so they endure;

New development will protect and, where opportunities arise, enhance biodiversity and the Borough's Green Infrastructure network. Support will be given to environmental enhancements where opportunities arise;'

6.6 Design, Mitigation and Enhancement Measures (including monitoring requirements)

6.6.1 It has been considered that a reasonable level of mitigation will be in place as part of the Scheme. The following assessment will take into account appropriate mitigation and enhancement measures, listed below, to minimise the negative effects of the Scheme on the landscape and townscape resource and on the visual amenity of the study area and would include the following;

- Develop a sensitively routed and well-designed Scheme in line with DMRB Good Roads Guide to ensure good fit with the scale and character of the landscape and townscape resources;
- Develop a street lighting design strategy to minimise light pollution;
- Retaining and protect mature and healthy trees and hedges wherever possible
- Providing embankment planting wherever possible and match adjacent vegetation
- Providing gap planting to enhance screening
- Developing ecological enhancement areas
- Retaining natural character and enhance with local species
- Replanting of woodland edges
- Providing screening with vegetation or environmental barriers to help screen the Scheme in local views

These measures would also be considered as part of the development of a future CEMP.

6.7 Magnitude of Impacts & Significance of Effects

6.7.1 In assessing the scale of likely impacts of the Scheme, the junction options have been assessed separately in terms of the likely magnitude of impact they would have on the identified landscape and townscape resource, as well as the likely visual impact on the identified representative

viewpoints. A summary of the landscape and visual assessment, identifying overall effects for each of the Scheme options, is provided in Section 6.10.

6.7.2 The Scheme is likely to result in potential direct effects on the landscape and townscape resource and visual amenity through the following;

- Construction activities such as site clearance and vegetation removal, the installation and operation of construction compounds, batching plant and storage areas, haul routes, land re-profiling, installation of new structures, temporary lighting, traffic management, etc.
- Operation due to the introduction of new large scale features such as cuttings, embankments roundabouts, street lighting, new signs, traffic and traffic noise along with the along with the modification of the existing highway infrastructure; and
- Potential cumulative effects arising from other new development in the planning process and as yet not built. A preliminary cumulative assessment has been carried out as part of this appraisal in Section 6.9.

Bean Option 3

Construction

6.7.3 The following information was not available at the time of the assessment:

- The exact scale of site clearance and vegetation removal;
- The exact location of the installation and operation of construction compounds;
- The exact size and height of batching plant and storage areas;
- The exact location of haul routes;
- The exact scale of land re-profiling; and
- The exact location and scale of temporary lighting, traffic management.

Therefore, a detailed assessment of potential direct effects on the landscape and townscape resource and visual amenity during construction will take place in Stage 3 Preliminary Design.

Operation

6.7.4 This option proposes the modification of all four off/on slip roads and the building of another new bridge crossing east of the existing bridge over the A2. The new footprint of this option includes the widening of the A2 corridor, of Bean Junction and the Roman Road on slip layout.

Environmental Designations

Green Belt

6.7.5 Bean Option 3 would not affect the openness of and access to the Green Belt. The magnitude of impact is considered to be **no change**.

6.7.6 Taking into account the **high sensitivity** of this designation, the residual significance of effect is considered to be **neutral**.

Country Parks

6.7.7 Beacon Wood: Bean Option 3 would have no potential of physical or visual effect on Bean Wood due to the enclosed topography (Figure 6.3). The magnitude of impact is considered to be of **no change**.

6.7.8 Taking into account the high sensitivity of the receptors, the residual significance of effect is considered to be **neutral.**

6.7.9 Darenth Country Park: Bean Option 3 would have the potential to reduce some of the existing woodland on the southern side of the A2 as well as on the north western side of the new bridge crossing. Therefore, due to exposure of the Scheme to views, even with mitigation measures in place, the magnitude of impact is considered to be **major adverse**.

6.7.10 Taking into account the high sensitivity of this landscape and its characteristics, the residual significance of effect is considered to be **large adverse**.

Landscape Character

A: Former Eastern Quarry

6.7.11 Bean Option 3 would have the potential to reduce some of the existing landscape screening on the southern boundary of Eastern Quarry as a widening of the road to the north is proposed on the slip road to the A2 on Roman Road. The magnitude of impact is considered to be **minor adverse**.

6.7.12 Taking into account the **low sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **neutral**.

C1 to C3 Darenth Wood and Bean Woods

6.7.13 Bean Option 3 would have the potential to reduce some of the existing woodland on the southern of the A2 as well as on the north western side of the new bridge crossing. Even with mitigation measures in place, the magnitude of impact is considered to be **major adverse**.

6.7.14 Taking into account the **high sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **large adverse**.

E: Southfleet Downland

6.7.15 Bean Option 3 would have no potential of physical or visual effect on the Southfleet Downland landscape character area due the screening woodland and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change**.

6.7.16 Taking into account the **high sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

Townscape Character

B: Bluewater Retail Park

6.7.17 Bean Option 3 would have no potential of physical or visual effect on townscape character area B (Bluewater Retail Park) due to the enclosed topography. The magnitude of impact is considered to be of **no change.**

6.7.18 Taking into account the **low sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral**.

D: Urban Fringe of Dartford, Greenhithe and Swanscombe

6.7.19 Bean Option 3 would have no physical or visual effect on the townscape character of Dartford's, Greenhithe's and Swanscombe's Urban Fringe due the undulating land and the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change.**

6.7.20 Taking into account the **moderate sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

F: Urban Fringe of Gravesend and Northfleet

6.7.21 Bean Option 3 would have no potential of physical or visual effect on Townscape Character area F: Urban Fringe of Gravesend and Northfleet, due the distance to the Bean Junction and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change.**

6.7.22 Taking into account the **moderate sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

G: A2 Corridor

6.7.23 Bean Option 3 would have no potential of physical or visual effect on the A2 Corridor -Open townscape character area due the distance to the Bean Junction and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change**.

6.7.24 Taking into account the **high sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutra**l.

6.7.25 However, Bean Option 3 would have the potential to increase the footprint of the road and bridges on Roman Road and Bean Junction in the townscape character of A2 Corridor - Enclosed. Even with mitigation measures in place, the magnitude of impact is considered to be **moderate adverse.**

6.7.26 Taking into account the **high sensitivity** of this townscape and its characteristics, the residual significance of effect is considered to be **moderate adverse**.

H: Bean Village

6.7.27 Bean Option 3 would have the potential to increase the footprint of the road and bridges on the southern side of Bean Junction within the close vicinity of Listed Building Bean Farm and residential properties in South Bean. Even with mitigation measures in place, the magnitude of impact is considered to be **major adverse**.

6.7.28 Taking into account the **moderate sensitivity** of this townscape and its characteristics, the residual significance of effect is considered to be **large adverse**.

Visual Setting

VP1: A2: View looking east toward Bean Junction

6.7.29 As a result of the new roundabout and greater footprint of the slip roads, Bean Option 3 would result in the loss of A2 boundary and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **moderate**.

6.7.30 Taking into account the **low sensitivity** of users on the A585, the residual significance of effect is considered to be **slight adverse**.

VP2: B255 bridge over A2: looking west along the A2

6.7.31 As a result of the new bridge, the greater footprint of the slip roads and relocation in front of Hope Cottages, Bean Option 3 would result in the loss of A2 boundary and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.32 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP3: B255 bridge over A2: looking east along the A2

6.7.33 As a result of the greater footprint of the slip roads in the south, Bean Option 3 would result in the loss of A2 boundary woodland and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **major**.

6.7.34 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **moderate adverse.**

VP4: A2: View looking west towards Bean Junction

6.7.35 As a result of the greater footprint of the slip roads, Bean Option 3 would result in the loss of A2 boundary woodland and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **moderate.**

6.7.36 Taking into account the **low sensitivity** of users on the A2, the residual significance of effect is considered to be **slight adverse.**

VP5: A2: View looking east, westbound slip road to Bean junction on the right

6.7.37 Bean Option 3 would result in **no change** of this view.

6.7.38 Taking into account **the low sensitivity** of users on the A2, the residual significance of effect is considered to be **neutral.**

VP6: A296, Roman Road: View looking east, end of slip road towards the A2

6.7.39 Bean Option 3 would result in **no change** of this view.

6.7.40 Taking into account the **low sensitivity** of users on the A2, the residual significance of effect is considered to be **neutral.**

VP7: A2: View looking southeast towards Southfleet Arable Lands

6.7.41 Bean Option 3 would result in **minor adverse** of this view due to slight changes on the southern side of the A2 slopes and footpaths.

6.7.42 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse.**

VP8: B259/B2260 Roundabout: View looking south towards Ebbsfleet Junction

6.7.43 Bean Option 3 would result in **no change** of this view.

6.7.44 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP9: A2: View looking northwest towards Ebbsfleet Junction, in the background the southern part of Eastern Quarries:

6.7.45 Bean Option 3 would result in **no change** of this view.

6.7.46 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP10: Station Road Corner Foxhounds Lane, By Way through fields: View looking north towards Ebbsfleet Junction

6.7.47 Bean Option 3 would result in **no change** of this view.

6.7.48 Taking into account the high sensitivity of the receptors, the residual significance of effect is considered to be **neutral.**

VP11: Betsham, Park Corner Road, public footpath next to Listed Building

6.7.49 Bean Option 3 would result in **no change** of this view.

6.7.50 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP12: Roundabout south of Bean Junction: View looking south towards properties on the northern boundary of Bean

6.7.51 As a result of the new bridge, the greater footprint of the slip roads, Bean Option 3 would result in being a dominant and focal point in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.52 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP13: B255 bridge over A2: looking southwest towards Bean Farm (Listed Building)

6.7.53 As a result of the new bridge, the greater footprint of the slip roads and removal of existing screening along the A2, Bean Option 3 would result in being a dominant and focal point in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.54 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP14: Roundabout south of Bean Junction: View looking north towards Bean Junction, on the left Hope Cottages, also representative for Bean House property south of Hope Cottages.

6.7.55 As a result of the new bridge and roundabout, and relocation of the slip roads, Bean Option 3 would result in being a major dominant and focal point in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.56 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP15: Roundabout north of Bean Junction: View looking south towards Bean Junction, on the left Ightham Cottages

6.7.57 As a result of the layout of the roundabout coming closer to the existing cottages. Even with mitigation measures in place, Bean Option 3 would result in a magnitude of impact that is considered to be **major.**

6.7.58 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP16: B255: View looking south towards A296 / B255 Roundabout

6.7.59 As a result of minor alterations of the road layout, Bean Option 3 would result in the loss of screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **minor.**

6.7.60 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse**

VP17: A296, Roman Road: View towards entrance site of Eastern Quarry on the left

6.7.61 As a result of the widening of Roman Road, the loss of boundary vegetation and the new access to the Quarry, Bean Option 3 would result in being a noticeable new feature in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **moderate.**

6.7.62 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse**.

VP 18: Mount Road, Greenhithe: View looking south towards Eastern Quarry and A2

6.7.63 Bean Option 3 would result in **no change** of this view.

6.7.64 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP 19: Swanscombe, Betham Road, public footpath: View looking south/southwest towards the A2

6.7.65 As a result of the alterations of the A2 behind the dense woodland in the distance, Bean Option 3 would result in being barely a noticeable feature in the view. The magnitude of impact is considered to be **negligible.**

6.7.66 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP 20: Northfleet, Church Path, public footpath: View looking southwest towards A2 and Ebbsfleet Junction

6.7.67 As a result of the minor alterations of the A2 and Ebbsfleet Junction in the distance, Bean Option 3 would result in being a barely noticeable feature in the view. The magnitude of impact is considered to be **negligible.**

6.7.68 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

6.7.69 The summary tables of residual significance of effects for each option (see below) have considered that a reasonable level of design, mitigation and enhancements will be in place as part of the Scheme (see Section 6.6 for details) to minimise the negative effects of the Scheme on the landscape and townscape resource and on the visual amenity of the study area.

6.7.70 Descriptions of Designations, Local Landscape Character Areas and Viewpoints can be found in Section 6.3, Baseline.

6.7.71 Table 6-6 provides a summary of the significance of effects resulting from Bean Option 3.

6.7.72 Table 6-6 provides a summary of the landscape sensitivity, magnitude of change and residual significance of effect for the environmental designations, landscape and townscape resource and representative viewpoints associated with Bean Option 3.

Bean Option 4b

Construction

6.7.73 The following Information was not available at the time of the assessment:

- The exact scale of site clearance and vegetation removal;
- The exact location of the installation and operation of construction compounds;
- The exact size and height of batching plant and storage areas;
- The exact location of haul routes;
- The exact scale of land re-profiling;
- The exact location and scale of temporary lighting, traffic management.

Therefore, a detailed assessment of potential direct effects on the landscape and townscape resource and visual amenity during construction will take place in Stage 3 Preliminary Design.

Operation

6.7.74 This option proposes the modification of three direct off / on-slip roads to and off the A2, the demolishing of Bean overbridge, the building of a new bridge west of the existing bridge and the approach west of Hope Cottages. Also the building of a new on slip onto the A2. The new footprint of this option includes the widening of the A2 corridor east, west north and south of Bean Junction.

Environmental Designations

Green Belt

6.7.75 Bean Option 4b would no potential of effect on the openness of and access to the Green Belt. The magnitude of impact is considered to be of **no change**.

6.7.76 Taking into account the **high sensitivity** of this designation, the significance of effect is considered to be **neutral**.

Country Parks

6.7.77 Beacon Wood: Bean Option 4b would have no potential of physical or visual effect on Bean Wood due to the enclosed topography (Figure 6.3). The magnitude of impact is considered to be of **no change**. Taking into account the high sensitivity of the receptors, the significance of effect is considered to be **neutral.**

6.7.78 Darenth Country Park: Bean Option 4b would have the potential to reduce some of the existing woodland on the southern side of the A2. Therefore, due to exposure of the Scheme to views, even with mitigation measures in place, the magnitude of impact is considered to be **major adverse**. Taking into account the high sensitivity of this landscape and its characteristics, the significance of effect is considered to be **large adverse**.

Landscape Character

A: Former Eastern Quarry

6.7.79 Bean Option 4b would have the potential to reduce some of the existing landscape screening on the southern boundary of Eastern Quarry as a widening of the road to the north is proposed on the slip road to the A2 on Roman Road, on the eastern and western end. Even with mitigation measures in place, the magnitude of impact is considered to be **minor adverse**.

6.7.80 Taking into account the **low sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **neutral**.

C1 to C3 Darenth Wood and Bean Woods

6.7.81 Bean Option 4b would have the potential to cut into existing woodland/Ancient Woodland on the southern of the A2 as well as on the north western side of the new bridge crossing. Even with mitigation measures in place, the magnitude of impact is considered to be **major adverse**.

6.7.82 Taking into account the **high sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **large adverse**.

E: Southfleet Downland

6.7.83 Bean Option 4b would have no potential of physical or visual effect on Southfleet Downland landscape character area due the screening woodland and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change**.

6.7.84 Taking into account the **high sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

Townscape Character

B: Bluewater Retail Park

6.7.85 Bean Option 4b would have no potential of physical or visual effect on townscape character B due to the enclosed topography. The magnitude of impact is considered to be of **no change.**

6.7.86 Taking into account the **low sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral**.

D: Urban Fringe of Dartford, Greenhithe and Swanscombe

6.7.87 Bean Option 4b would have no potential of physical or visual effect on the townscape character of Dartford's, Greenhithe's and Swanscombe's Urban Fringe due the undulating land and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change.**

6.7.88 Taking into account the **moderate sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

F: Urban Fringe of Gravesend and Northfleet

6.7.89 Bean Option 4b would have no potential of physical or visual effect on the Urban Fringe of Gravesend and Northfleet townscape character area due the distance to the Bean Junction and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change.**

6.7.90 Taking into account the **moderate sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

G: A2 Corridor

6.7.91 Bean Option 4b would have no potential of physical or visual effect on the A2 Corridor -Open townscape character area due the distance to the Bean Junction and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change**.

6.7.92 Taking into account the **high sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutra**l.

6.7.93 However, Bean Option 4b would have the potential to increase the footprint of the road and bridges and slip road on Roman Road, Bean Triangle and Bean Junction in the townscape character of A2 Corridor - Enclosed. Even with mitigation measures in place, the magnitude of impact is considered to be **moderate adverse.**

6.7.94 Taking into account the **high sensitivity** of this townscape and its characteristics, the residual significance of effect is considered to be **moderate adverse**.

H: Bean Village

6.7.95 Bean Option 3 would have the potential to increase the footprint of the road and bridges on the southern side of Bean Junction within the close vicinity of Listed Building Bean Farm and residential properties in South Bean. Even with mitigation measures in place, the magnitude of impact is considered to be **major adverse**.

6.7.96 Taking into account the **moderate sensitivity** of this townscape and its characteristics, the residual significance of effect is considered to be **large adverse**.

Visual Setting

VP1: A2: View looking east toward Bean Junction

6.7.97 As a result of the new roundabout and greater footprint of the slip roads, Bean Option 4b would result in the loss of A2 boundary and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **moderate**.

6.7.98 Taking into account the **low sensitivity** of users on the A2, the residual significance of effect is considered to be **slight adverse**.

VP2: B255 bridge over A2: looking west along the A2

6.7.99 As a result of the new bridge, the greater footprint of the slip road and relocation in front of Hope Cottages, Bean Option 4b would result in the loss of A2 boundary and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.100 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP3: B255 bridge over A2: looking east along the A2

6.7.101 As a result of the greater footprint of the slip roads in the south and a new slip road on the north side of the A2, Bean Option 4b would result in the loss of A2 boundary woodland and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **major**.

6.7.102 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **Large adverse**

VP4: A2: View looking west towards Bean Junction

6.7.103 As a result of the greater footprint of the slip roads, Bean Option 4b would result in the loss of A2 boundary woodland and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.104 Taking into account the **low sensitivity** of users on the A2, the residual significance of effect is considered to be **moderate adverse.**

VP5: A2: View looking east, westbound slip road to Bean junction on the right

6.7.105 As a result of the new slip road on the northern side of the A2, Bean Option 4b would result in the loss of A2 boundary woodland and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **major**.

6.7.106 Taking into account **high sensitivity** of users on the A2, the residual significance of effect is considered to be **large adverse.**

VP6: A296, Roman Road: View looking east, end of slip road towards the A2

6.7.107 Bean Option 4b would result in **no change** of this view.

6.7.108 Taking into account the **low sensitivity** of users on the A2, the residual significance of effect is considered to be **neutral.**

VP7: A2: View looking southeast towards Southfleet Arable Lands

6.7.109 Bean Option 4b would result in **minor adverse, e**ven with mitigation measures in place, of this view due to slight changes on the southern side of the A2 slopes and footpaths.

6.7.110 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse**.

VP8: B259/B2260 Roundabout: View looking south towards Ebbsfleet Junction

6.7.111 Bean Option 4b would result in **no change** of this view.

6.7.112 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP9: A2: View looking northwest towards Ebbsfleet Junction, in the background the southern part of Eastern Quarries:

6.7.113 Bean Option 4b would result in **no change** of this view.

6.7.114 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP10: Station Road Corner Foxhounds Lane, By Way through fields: View looking north towards Ebbsfleet Junction

6.7.115 Bean Option 4b would result in **no change** of this view.

6.7.116 Taking into account the high sensitivity of the receptors, the residual significance of effect is considered to be **neutral.**

VP11: Betsham, Park Corner Road, public footpath next to Listed Building

6.7.117 Bean Option 4b would result in **no change** of this view.

6.7.118 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP12: Roundabout south of Bean Junction: View looking south towards properties on the northern boundary of Bean

6.7.119 As a result of the new bridge, the greater footprint of the slip roads, Bean Option 4b would result in being a dominant and focal point in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.120 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP13: B255 bridge over A2: looking southwest towards Bean Farm (Listed Building)

6.7.121 As a result of the new bridge, the greater footprint of the slip roads and removal of existing screening along the A2, Bean Option 4b would result in being a dominant and focal point in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.122 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP14: Roundabout south of Bean Junction: View looking north towards Bean Junction, on the left Hope Cottages, also representative for Bean House property south of Hope Cottages.

6.7.123 As a result of the new bridge and roundabout, and relocation of the slip roads, Bean Option 3 would result in being a major dominant and focal point in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **major.**

6.7.124 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse**.

VP15: Roundabout north of Bean Junction: View looking south towards Bean Junction, on the left Ightham Cottages

6.7.125 As a result of the new layout of the roundabout and the new slip road, even with mitigation measures in place, Bean Option 4b would result in a magnitude of impact that is considered to be **minor.**

6.7.126 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse**.

VP16: B255: View looking south towards A296 / B255 Roundabout

6.7.127 As a result of minor alterations of the road layout, Bean Option 4b would result in the loss of screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **minor.**

6.7.128 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse**.

VP17: A296, Roman Road: View towards entrance site of Eastern Quarry on the left

6.7.129 As a result of the minor alterations of the western and eastern end of Roman Road and associated the loss of boundary vegetation, even with mitigation measures in place, Bean Option 4b would result in a magnitude of impact that is considered to be **minor.**

6.7.130 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse**.

VP 18: Mount Road, Greenhithe: View looking south towards Eastern Quarry and A2

6.7.131 Bean Option 4b would result in **no change** of this view.

6.7.132 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP 19: Swanscombe, Betham Road, public footpath: View looking south/southwest towards the A2

6.7.133 As a result of the alterations of the A2 behind the dense woodland in the distance, Bean Option 4b would result in being barely a noticeable feature in the view. The magnitude of impact is considered to be **negligible.**

6.7.134 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP 20: Northfleet, Church Path, public footpath: View looking southwest towards A2 and Ebbsfleet Junction

6.7.135 As a result of the minor alterations of the A2 and Ebbsfleet Junction in the distance, Bean Option 3 would result in being a barely noticeable feature in the view. The magnitude of impact is considered to be **negligible.**

6.7.136 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

6.7.137 Table 6-7 provides a summary of the significance of effects resulting from Bean Option 4b.

6.7.138 Descriptions of Designations, Local Landscape Character Areas and Viewpoints can be found in Section 6.3, Baseline.

6.7.139 Table 6-7 provides a summary of the landscape sensitivity, magnitude of change and residual significance of effect for the environmental designations, landscape and townscape resource and representative viewpoints associated with Bean Option 4b.

Bean Option 5

Construction

6.7.140 The following information was not available at the time of the assessment:

- The exact scale of site clearance and vegetation removal;
- The exact location of the installation and operation of construction compounds;
- The exact size and height of batching plant and storage areas;
- The exact location of haul routes;
- The exact scale of land re-profiling;
- The exact location and scale of temporary lighting, traffic management.

Therefore, a detailed assessment of potential direct effects on the landscape and townscape resource and visual amenity during construction will take place in Stage 3 Preliminary Design.

Operation

6.7.141 This option proposes the modification of three direct off/ on-slip roads to and off the A2, the building of a new bridge east of the existing bridge. Also the building of a new on-slip onto the A2. The new footprint of this option includes the widening of the A2 corridor north and east.

Environmental Designations

Green Belt

6.7.142 Bean Option 5 would no potential of effect on the openness of and access to the Green Belt. The magnitude of impact is considered to be of **no change**.

6.7.143 Taking into account the **high sensitivity** of this designation, the significance of effect is considered to be **neutral**.

Country Parks

6.7.144 Beacon Wood: Bean Option 5 would have no potential of physical or visual effect on Bean Wood due to the enclosed topography (Figure 6.3). The magnitude of impact is considered to be of no change. Taking into account the high sensitivity of the receptors, the significance of effect is considered to be **neutral.**

6.7.145 Darenth Country Park: Bean Option 5 would have the potential to reduce some of the existing woodland on the southern side of the A2 as well as on the north western side of the new bridge crossing. The amount of woodland reduction is so minor that there will be no exposure of the Scheme to views, and therefore, even with mitigation measures in place, the magnitude of impact is considered to be **minor adverse**. Taking into account the high sensitivity of this landscape and its characteristics, the residual significance of effect is considered to be **moderate adverse**.

Landscape Character

A: Former Eastern Quarry

6.7.146 Bean Option 5 would have the potential to reduce some of the existing landscape screening on the southern boundary of Eastern Quarry as a widening of the road to the north is proposed on the slip road to the A2 on Roman Road, on the eastern and western end. Even with mitigation measures in place, the magnitude of impact is considered to be **minor adverse**.

6.7.147 Taking into account the **low sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **neutral**.

C1 to C3 Darenth Wood and Bean Woods

6.7.148 Bean Option 5 would have the potential to reduce some of the existing woodland on the northern side of the A2 as well as on the north western side of the new bridge crossing. Even with mitigation measures in place, the magnitude of impact is considered to be **minor adverse**.

6.7.149 Taking into account the **high sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **moderate adverse**.

E: Southfleet Downland

6.7.150 Bean Option 5 would have no potential of physical or visual effect on Southfleet Downland landscape character area due the screening woodland and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change**.

6.7.151 Taking into account the **high sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

Townscape Character

B: Bluewater Retail Park

6.7.152 Bean Option 5 would have no potential of physical or visual effect on townscape character B due to the enclosed topography. The magnitude of impact is considered to be of **no change.**

6.7.153 Taking into account the **low sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral**.

D: Urban Fringe of Dartford, Greenhithe and Swanscombe

6.7.154 Bean Option 5 would have no potential of physical or visual effect on the townscape character of Dartford's, Greenhithe's and Swanscombe's Urban Fringe due the undulating land and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change.**

6.7.155 Taking into account the **moderate sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

F: Urban Fringe of Gravesend and Northfleet

6.7.156 Bean Option 5 would have no potential of physical or visual effect on the Urban Fringe of Gravesend and Northfleet townscape character area due the distance to the Bean Junction and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change.**

6.7.157 Taking into account the **moderate sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral.**

G: A2 Corridor

6.7.158 Bean Option 5 would have no potential of physical or visual effect on the A2 Corridor -Open townscape character area due the distance to the Bean Junction and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change**.

6.7.159 Taking into account the **high sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutra**l.

6.7.160 However, Bean Option 5 would have the potential to increase the footprint of the road and bridges on Roman Road and Bean Junction in the townscape character of A2 Corridor - Enclosed. Even with mitigation measures in place, the magnitude of impact is considered to be **moderate adverse.**

6.7.161 Taking into account the **high sensitivity** of this townscape and its characteristics, the residual significance of effect is considered to be **moderate adverse**.

H: Bean Village

6.7.162 Bean Option 5 would have the potential to increase the footprint of the road and bridges on the southern side of Bean Junction within the close vicinity of Listed Building Bean Farm and residential properties in South Bean. Even with mitigation measures in place, the magnitude of impact is considered to be **minor adverse**.

6.7.163 Taking into account the **moderate sensitivity** of this townscape and its characteristics, the residual significance of effect is considered to be **slight adverse.**

Visual Setting

VP1: A2: View looking east toward Bean Junction

6.7.164 As a result of the new slightly greater footprint of the slip roads and bridges, even with mitigation measures in place, Bean Option 5 would result in a magnitude of impact that is considered to be **minor**.

6.7.165 Taking into account the **low sensitivity** of users on the A585, the residual significance of effect is considered to be **slight adverse**.

VP2: B255 bridge over A2: looking west along the A2

6.7.166 As a result of the new bridge, the greater footprint of the slip roads and relocation in front of Hope Cottages, Bean Option 5 would result in the loss of A2 boundary and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **Minor.**

6.7.167 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse.**

VP3: B255 bridge over A2: looking east along the A2

6.7.168 As a result of the greater footprint of the slip roads in the south and a new slip road on the north side of the A2, Bean Option 5 would result in the loss of A2 boundary woodland and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **major**.

6.7.169 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **large adverse.**

VP4: A2: View looking west towards Bean Junction

6.7.170 As a result of the minimal different footprint of the slip road on the south side of the A2, even with mitigation measures in place, Bean Option 5 would result in a magnitude of impact that is considered to be **minor.**

6.7.171 Taking into account the **low sensitivity** of users on the A2, the residual significance of effect is considered to be **slight adverse.**

VP5: A2: View looking east, westbound slip road to Bean junction on the right

6.7.172 As a result of the new slip road on the northern side of the A2, Bean Option 5 would result in the loss of A2 boundary woodland and screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **major**.

6.7.173 Taking into account **the high sensitivity** of users on the A2, the residual significance of effect is considered to be **large adverse.**

VP6: A296, Roman Road: View looking east, end of slip road towards the A2

6.7.174 Bean Option 5 would result in **no change** of this view.

6.7.175 Taking into account the **low sensitivity** of users on the A2, the residual significance of effect is considered to be **neutral.**

VP7: A2: View looking southeast towards Southfleet Arable Lands

6.7.176 Bean Option 5 would result in **no change** of this view.

6.7.177 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP8: B259/B2260 Roundabout: View looking south towards Ebbsfleet Junction

6.7.178 Bean Option 5 would result in **no change** of this view.

6.7.179 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP9: A2: View looking northwest towards Ebbsfleet Junction, in the background the southern part of Eastern Quarries:

6.7.180 Bean Option 5 would result in **no change** of this view.

6.7.181 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP10: Station Road Corner Foxhounds Lane, By Way through fields: View looking north towards Ebbsfleet Junction

6.7.182 Bean Option 5 would result in **no change** of this view.

6.7.183 Taking into account the high sensitivity of the receptors, the residual significance of effect is considered to be **neutral.**

VP11: Betsham, Park Corner Road, public footpath next to Listed Building

6.7.184 Bean Option 5 would result in **no change** of this view.

6.7.185 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP12: Roundabout south of Bean Junction: View looking south towards properties on the northern boundary of Bean

6.7.186 As a result of the slightly different footprint of the layout south of the A2, even with mitigation measures in place, Bean Option 5 would result in a magnitude of impact that is considered to be **minor.**

6.7.187 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **moderate adverse**.

VP13: B255 bridge over A2: looking southwest towards Bean Farm (Listed Building)

6.7.188 As a result of the slightly different footprint of the layout south of the A2, even with mitigation measures in place, Bean Option 5 would result in a magnitude of impact that is considered to be **minor.**

6.7.189 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **moderate adverse**.

VP14: Roundabout south of Bean Junction: View looking north towards Bean Junction, on the left Hope Cottages

6.7.190 As a result of the new bridge and relocation of the approaching road, even with mitigation measures in place, Bean Option 5 would result in a magnitude of impact that is considered to be **major.**

6.7.191 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **Large adverse**.

VP15: Roundabout north of Bean Junction: View looking south towards Bean Junction, on the left Ightham Cottages

6.7.192 Receptors removed in Bean Option 5, properties demolished, no receptor to assess. Therefore the residual significance of effect on visual amenity is **neutral**.

VP16: B255: View looking south towards A296 / B255 Roundabout

6.7.193 As a result of minor alterations of the road layout, Bean Option 5 would result in minor loss of screening vegetation. Even with mitigation measures in place, the magnitude of impact is considered to be **minor.**

6.7.194 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse.**

VP17: A296, Roman Road: View towards entrance site of Eastern Quarry on the left

6.7.195 As a result of the minor alterations of the western and eastern end of Roman Road and associated the loss of boundary vegetation, even with mitigation measures in place, Bean Option 5 would result in a magnitude of impact that is considered to be **minor.**

6.7.196 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse**.

VP 18: Mount Road, Greenhithe: View looking south towards Eastern Quarry and A2

6.7.197 Bean Option 5 would result in **no change** of this view. Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP 19: Swanscombe, Betham Road, public footpath: View looking south/southwest towards the A2

6.7.198 As a result of the alterations of the A2 behind the dense woodland in the distance, Bean Option 5 would result in being barely a noticeable feature in the view. The magnitude of impact is considered to be **negligible.**

6.7.199 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP 20: Northfleet, Church Path, public footpath: View looking southwest towards A2 and Ebbsfleet Junction

6.7.200 As a result of the minor alterations of the A2 and Ebbsfleet Junction in the distance, Bean Option 5 would result in being a barely noticeable feature in the view. The magnitude of impact is considered to be **negligible.**

6.7.201 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

6.7.202 Table 6-8 provides a summary of the landscape sensitivity, magnitude of change and residual significance of effect for the environmental designations, landscape and townscape resource and representative viewpoints associated with Bean Option 5.

Ebbsfleet Option 1b

Construction

6.7.203 The following Information was not available at the time of the assessment:

- The exact scale of site clearance and vegetation removal;
- The exact location of the installation and operation of construction compounds;
- The exact size and height of batching plant and storage areas;
- The exact location of haul routes;
- The exact scale of land re-profiling;
- The exact location and scale of temporary lighting, traffic management.

Therefore, a detailed assessment of potential direct effects on the landscape and townscape resource and visual amenity during construction will take place in Stage 3 Preliminary Design.

Operation

6.7.204 This option proposes the modification of two existing roundabouts and their approaches at Ebbsfleet Junction with minor footprint extensions.

Environmental Designations

Green Belt

6.7.205 Ebbsfleet Option 1b would no potential of effect on the openness of and access to the Green Belt. The magnitude of impact is considered to be of **no change**.

6.7.206 Taking into account the **high sensitivity** of this designation, the significance of effect is considered to be **neutral**.

Country Parks

6.7.207 Beacon Wood: Ebbsfleet Option 1b would have no potential of physical or visual effect on Bean Wood due to the enclosed topography (Figure 6.3). The magnitude of impact is considered to be of **no change**. Taking into account the high sensitivity of the receptors, the significance of effect is considered to be **neutral.**

6.7.208 Darenth Country Park: Ebbsfleet Option 1b would have no potential of physical or visual effect due to the enclosed topography (Figure 6.3). The magnitude of impact is considered to be of **no change**. Taking into account the high sensitivity of the receptors, the significance of effect is considered to be **neutral.**

Landscape Character

A: Former Eastern Quarry

6.7.209 Ebbsfleet Option 1b would have the potential to reduce some of the existing landscape screening on the eastern boundary of Eastern Quarry as a widening of the northbound A2260 is proposed. Even with mitigation measures in place, the magnitude of impact is considered to be **minor adverse**.

6.7.210 Taking into account the **low sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **neutral**.

C1 to C3 Darenth Wood and Bean Woods

6.7.211 Ebbsfleet Option 1b would have the potential to reduce little of the existing verge on the south of the A2 in the east of C3. The magnitude of impact is considered to be **no change**.

6.7.212 Taking into account the **high sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **neutral**

E: Southfleet Downland

6.7.213 Ebbsfleet Option 1b would have the potential to reduce little of the existing verge on the south of the A2. The magnitude of impact is considered to be **no change**.

6.7.214 Taking into account the **high sensitivity** of this landscape and its characteristics, the residual significance of effect is considered to be **neutral**

Townscape Character

B: Bluewater Retail Park

6.7.215 Ebbsfleet Option 1b would have no potential of physical or visual effect on Bluewater Retail Park due to the distance and topography. The magnitude of impact is considered to be of **no change.**

6.7.216 Taking into account the **low sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral**.

D: Urban Fringe of Dartford, Greenhithe and Swanscombe

6.7.217 Ebbsfleet Option 1b would have no potential of physical or visual effect on Bluewater Retail Park due to the distance and topography. The magnitude of impact is considered to be of **no change.**

6.7.218 Taking into account the **low sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutral**.

F: Urban Fringe of Gravesend and Northfleet

6.7.219 Ebbsfleet Option 1b would have some slight changes in the layout of the existing junctions with staying mainly within the existing road footprint. Even with mitigation measures in place, the magnitude of impact is considered to be of **minor adverse.**

6.7.220 Taking into account the **moderate sensitivity** of the visual receptors, the residual significance of effect is considered to be **slight adverse.**

G: A2 Corridor

6.7.221 Ebbsfleet Option 1b would have no potential of physical or visual effect on the A2 Corridor - Enclosed townscape character area due the distance to the Bean Junction and to the fact that there is no intervisibility between them. The magnitude of impact is considered to be of **no change**.

6.7.222 Taking into account the **high sensitivity** of the visual receptors, the residual significance of effect is considered to be **neutra**l.

6.7.223 However, Ebbsfleet Option 1b would have the potential to increase slightly the footprint of the roads and junctions T Ebbsfleet Junction of A2 Corridor - Open. Even with mitigation measures in place, the magnitude of impact is considered to be **minor adverse.**

6.7.224 Taking into account the **high sensitivity** of this townscape and its characteristics, the residual significance of effect is considered to be **neutral**.

H: Bean Village

6.7.225 Ebbsfleet Option 1b would have no potential of physical or visual effect on Bean Village due to the distance and topography. The magnitude of impact is considered to be of **no change**.

6.7.226 The residual significance of effect is therefore considered to be **neutral.**

Visual Setting

VP1 to VP6:

6.7.227 Ebbsfleet Option 1b would result in **no change** of these views due to no intervisibility with this option.

6.7.228 The residual significance of effect is therefore considered to be **neutral**.

VP7: A2: View looking southeast towards Southfleet Arable Lands

6.7.229 Ebbsfleet Option 1b, even with mitigation measures in place, would result in **Negligible** magnitude of change of this view due to minor changes in the new road layout and footprint.

6.7.230 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse.**

VP8: B259/B2260 Roundabout: View looking south towards Ebbsfleet Junction

6.7.231 As a result of the new slightly greater footprint of the roads and roundabouts, even with mitigation measures in place, Ebbsfleet Option 1b would result in a magnitude of impact that is considered to be **moderate.**

6.7.232 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse.**

VP9: A2: View looking northwest towards Ebbsfleet Junction, in the background the southern part of Eastern Quarries:

6.7.233 Ebbsfleet Option 1b would result in **no change** of this view due to no intervisibility with this option.

6.7.234 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP10: Station Road Corner Foxhounds Lane, By Way through fields: View looking north towards Ebbsfleet Junction

6.7.235 Ebbsfleet Option 1b would result in **Negligible** magnitude of change of this view due to minor changes in the new road layout and footprint.

6.7.236 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP11: Betsham, Park Corner Road, public footpath next to Listed Building

6.7.237 Ebbsfleet Option 1b would result in **Negligible** magnitude of change of this view due to minor changes in the new road layout and footprint.

6.7.238 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP12: Roundabout south of Bean Junction: View looking south towards properties on the northern boundary of Bean

6.7.239 Ebbsfleet Option 1b would result in **no change** of this view due to no intervisibility with this option.

6.7.240 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP13: B255 bridge over A2: looking southwest towards Bean Farm (Listed Building)

6.7.241 Ebbsfleet Option 1b would result in **no change** of this view due to no intervisibility with this option.

6.7.242 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP14: Roundabout south of Bean Junction: View looking north towards Bean Junction, on the left Hope Cottages

6.7.243 Ebbsfleet Option 1b would result in **no change** of this view due to no intervisibility with this option.

6.7.244 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP15: Roundabout north of Bean Junction: View looking south towards Bean Junction, on the left Ightham Cottages

6.7.245 Ebbsfleet Option 1b would result in **no change** of this view due to no intervisibility with this option.

6.7.246 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP16: B255: View looking south towards A296 / B255 Roundabout

6.7.247 Ebbsfleet Option 1b would result in **no change** of this view due to no intervisibility with this option.

6.7.248 Taking into account the **low sensitivity** of the receptors, the residual significance of effect is considered to be **neutral**.

VP17: A296, Roman Road: View towards entrance site of Eastern Quarry on the left

6.7.249 Ebbsfleet Option 1b would result in **no change** of this view due to no intervisibility with this option.

6.7.250 Taking into account the low sensitivity of the receptors, the residual significance of effect is considered to be **neutral**.

VP 18: Mount Road, Greenhithe: View looking south towards Eastern Quarry and A2

6.7.251 Ebbsfleet Option 1b would result in **no change** of this view due to no intervisibility with this option.

6.7.252 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **neutral.**

VP 19: Swanscombe, Betham Road, public footpath: View looking south/southwest towards the A2

6.7.253 As a result of the alterations of the A2 behind the dense woodland in the distance, Bean Option 3 would result in being barely a noticeable feature in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **negligible.**

6.7.254 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse.**

VP 20: Northfleet, Church Path, public footpath: View looking southwest towards A2 and Ebbsfleet Junction

6.7.255 As a result of the minor alterations of the A2 and Ebbsfleet Junction in the distance, Bean Option 3 would result in being a barely noticeable feature in the view. Even with mitigation measures in place, the magnitude of impact is considered to be **negligible.**

6.7.256 Taking into account the **high sensitivity** of the receptors, the residual significance of effect is considered to be **slight adverse.**

6.7.257 Table 6-9 provides a summary of the landscape sensitivity, magnitude of change and residual significance of effect for the environmental designations, landscape and townscape resource and representative viewpoints associated with Ebbsfleet Option 1b.

6.8 Summary of the significance of effects

6.8.1 The summary tables of residual significance of effects for each option (see below) have considered that a reasonable level of design, mitigation and enhancements will be in place as part of the Scheme (see Section 6.6 for details) to minimise the negative effects of the Scheme on the landscape and townscape resource and on the visual amenity of the study area.

6.8.2 Descriptions of Designations, Local Landscape Character Areas and Viewpoints can be found in Section 6.3, Baseline.

6.8.3 Table 6-6 provides a summary of the significance of effects resulting from Bean Option 3.

Table 6-6 Summary of the Significance of Effects – Bean Option 3

Bean Option 3	Landscape Sensitivity	Magnitude of Change	Residual Significance of Effect
Environmental Designations			

Bean Option 3	Landscape Sensitivity	Magnitude of Change	Residual Significance of Effect
Green Belt	High	No change	neutral
Country Park: Beacon Wood:	High	No change	neutral
Country Park: Darenth Country Park:	High	Major adverse	large adverse
Landscape and Townscape Resource of Local Landscape Character Areas			
A: Former Eastern Quarry	Low	Minor adverse	neutral
B: Bluewater Retail Park	Low	No change	neutral
C1 to C3 Darenth Wood and Bean Woods	High	Major adverse	large adverse
D: Urban Fringe of Dartford, Greenhithe and Swanscombe	Moderate	No change	neutral
E: Southfleet Downland	High	No change	neutral
F: Urban Fringe of Gravesend and Northfleet	Moderate	No change	neutral
G: A2 Corridor	High	Moderate adverse	moderate adverse
H: Bean Village	Moderate	Major adverse	Large adverse
Representative Viewpoints			
VP 1, 4, 16, 17	Low	Moderate	Slight adverse
VP 5, 6, 8, 9	Low	No change	neutral
VP3	Low	Major	Moderate adverse
VP 10, 11, 18	High	No change	neutral
VP 19, 20	High	negligible	neutral
VP 2	High	Major	Large adverse
VP 7	High	Minor	Slight adverse
VP 12, 13, 15, 14	High	Major	large adverse

6.8.4 Table 6-7**.** provides a summary of the significance of effects resulting from Bean Option 4b.

6.8.5 Descriptions of Designations, Local Landscape Character Areas and Viewpoints can be found in Section 6.3, Baseline.

Table 6-7 Summary of the Significance of Effects – Bean Option 4b

Bean Option 4b	Landscape Sensitivity	Magnitude of Change	Residual Significance of Effect
Environmental Designations			
Green Belt	High	No change	neutral
Country Park: Beacon Wood:	High	No change	neutral
Country Park: Darenth Country Park:	High	Major adverse	large adverse
Landscape & Townscape Resource of Local Landscape Character Areas			
A: Former Eastern Quarry	Low	Minor adverse	neutral
B: Bluewater Retail Park	Low	No change	neutral
C1 to C3 Darenth Wood and Bean Woods	High	Major adverse	Large adverse
D: Urban Fringe of Dartford, Greenhithe and Swanscombe	Moderate	No change	neutral
E: Southfleet Downland	High	No change	neutral
F: Urban Fringe of Gravesend and Northfleet	Moderate	No change	neutral
G: A2 Corridor	High	Moderate adverse	Moderate adverse
H: Bean Village	Moderate	Major adverse	Large adverse
Representative Viewpoints			
VP1	Low	Moderate	Slight adverse
VP2, 3, 5, 14	High	Major	Large adverse
VP12, 13	High	Major	large adverse
VP4, 5,	Low	Major	Moderate adverse
VP6, 8, 9,	Low	No change	neutral
VP10, 11, 18	High	No change	neutral
VP7, 15,	High	minor	Slight adverse
VP16, 17,	Low	minor	Slight adverse
VP19, 20	High	negligible	neutral

6.8.6 Table 6-8 provides a summary of the significance of effects resulting from Bean Option 5.

6.8.7 Descriptions of Designations, Local Landscape Character Areas and Viewpoints can be found in Section 6.3, Baseline.

Table 6-8 Summary of the Significance of Effects – Bean Option 5

Bean Option 5	Landscape Sensitivity	Magnitude of Change	Residual Significance of Effect
Environmental Designations			
Green Belt	High	No change	neutral
Country Park: Beacon Wood:	High	No change	neutral
Country Park: Darenth Country Park:	High	Minor adverse	Moderate adverse
Landscape and Townscape Resource of Local Landscape Character Areas			
A: Former Eastern Quarry	Low	Minor adverse	neutral
B: Bluewater Retail Park	Low	No change	neutral
C1 to C3 Darenth Wood and Bean Woods	High	Minor adverse	Moderate adverse
D: Urban Fringe of Dartford, Greenhithe and Swanscombe	Moderate	No change	neutral
E: Southfleet Downland	High	No change	neutral
F: Urban Fringe of Gravesend and Northfleet	Moderate	No change	neutral
G: A2 Corridor	High	Moderate adverse	Moderate adverse
H: Bean Village	Moderate	Minor adverse	Slight adverse
Representative Viewpoints			
VP1, 4, 16, 17	Low	Minor adverse	Slight adverse
VP6, 8, 9	Low	No change	neutral
VP7, 10, 11, 18	High	No change	neutral
VP19, 20	High	negligible	neutral
VP2	High	minor	Slight adverse
VP3, 5, 14	High	Major	Large adverse
VP15	n/a	n/a	n/a

Bean Option 5	Landscape Sensitivity	Magnitude of Change	Residual Significance of Effect
VP12, 13	High	Minor	Moderate adverse

6.8.8 Table 6-9 provides a summary of the significance of effects resulting from Ebbsfleet Option 1b.

Table 6-9 Summary of the Significance of Effects – Ebbsfleet Option 1b

Ebbsfleet Option 1b	Landscape Sensitivity	Magnitude of Change	Residual Significance of Effect
Environmental Designations			
Green Belt	High	No change	neutral
Country Park: Beacon Wood:	High	No change	neutral
Country Park: Darenth Country Park:	High	No change	neutral
Landscape and Townscape Resource			
A: Former Eastern Quarry	Low	Minor adverse	neutral
B: Bluewater Retail Park	Low	No change	neutral
C1 to C3 Darenth Wood and Bean Woods	High	No change	neutral
D: Urban Fringe of Dartford, Greenhithe and Swanscombe	Moderate	No change	neutral
E: Southfleet Downland	High	No change	neutral
F: Urban Fringe of Gravesend and Northfleet	Moderate	Minor adverse	Slight adverse
G: A2 Corridor	High	No change	neutral
H: Bean Village	Moderate	No change	neutral
Representative Viewpoints			
VP1, 4, 5, 6, 9, 16, 17	Low	No change	neutral
VP2, 3, 12, 13, 14, 15, 18	High	No change	neutral
VP7, 10, 11, 19, 20	High	Negligible	Slight adverse
VP8,	Low	Moderate	neutral

6.9 Cumulative Effects

6.9.1 As presented in Section 4.9, five approved developments within a 1km study area have been identified that are of a sufficient scale to be considered as cumulative developments.

1. Eastern Quarry Watling Street Swanscombe Kent
2. Eastern Quarry KCC/EDC waste water treatment works and ancillary
3. Bluewater West Village
4. Land at St Clements Way
5. Land at Ebbsfleet

6.9.2 Of these five, three of the proposed developments have been considered with regards to potential cumulative effects on environmental designations, landscape and townscape, and visual amenity as they are located within or adjacent to the Scheme. These are summarised in Table 6-10.

Table 6-10 Cumulative impacts on landscape and townscape

Planning application reference	Development summary	Distance from Scheme	Potential cumulative effects
DA/12/01451/EQVAR DA12/00758/EQVAR Approval of condition variations October 2012 Dartford app number: 03/01134/OUT	**Eastern Quarry Watling Street Swanscombe Kent** A mixed use development of up to 6250 dwellings & in addition up to 231,000 square metres of built floorspace. The development will include open space (including parks, play spaces, playing fields, allotments, lakes and water features, community woodland & formal and informal open space); landscaping; works to create ecological & nature reserves & refuge areas.	Land to the North of the A2, within the Ebbsfleet Eastern Quarry site – see attached detailed map for mixed use breakdown	Vegetation screening along Roman Road and along the A2 would be largely unaffected by the development with roadside planting retained to shield the development from the A2 and other roads. Poor lighting design for the junction improvements and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.

Planning application reference	Development summary	Distance from Scheme	Potential cumulative effects
15/00887/CPO Approved November 2015	**Eastern Quarry Wastewater Treatment Works** Wastewater treatment works and ancillary infrastructure to serve the development at Eastern Quarry	Land to the North of the A2, within the Ebbsfleet Eastern Quarry site – see attached detailed map for mixed use breakdown	Vegetation screening along Roman Road and along the A2 would be largely unaffected by the development with roadside planting retained to shield the development from the A2 and other roads. Poor lighting design for the junction improvements and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.
20150155 Application Permitted February 2016	**Land at Ebbsfleet Bounded by A2.**	Adjacent to Ebbsfleet Junction	Vegetation screening along the A2 and the eastern side of Eastern Quarry would be largely unaffected by the development with roadside planting retained to shield the development from the A2 Junction and other roads. Poor lighting design for the junction improvements, Land at Ebbsfleet and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.

6.10 Limitations of Assessment

6.10.1 At this early stage of the appraisal, the following points have not been assessed due to missing information and details which are currently subject to further project development in the future:

- The exact scale of site clearance and vegetation removal;
- The exact location of the installation and operation of construction compounds;
- The exact size and height of batching plant and storage areas;
- No drainage design has yet been developed for each of the Scheme options
- The exact location of haul routes;
- The exact scale of land re-profiling; and
- The exact location and scale of temporary lighting, traffic management.

6.10.2 The Local Planning Authority and other relevant stakeholders have not been consulted in relation to the study area and the selection of the representative viewpoints used in this appraisal. Further consultation will be undertaken during the next stages of the assessment. Further baseline information is required on Tree Preservation Orders. The visual appraisal is based only on late spring views, which is not considered a worst case scenario. If the next stages of assessment will take place in winter, the winter views will be considered.

6.10.3 Therefore, a detailed assessment of potential direct effects on the landscape and townscape resource and visual amenity during construction will take place in Stage 3 Preliminary Design.

6.10.4 However, the appraisal takes into account reasonable mitigation measures as described in Section 6.6.

6.11 Summary

6.11.1 This section of the Chapter draws together the results of the assessment of the 3 Route Options, namely Route Options B03E01b, B04bE01b and B05E01b. Each of the Scheme options pairs have been considered in relation to potential effects on the environmental designations, landscape and townscape resource and on initial representative viewpoints within the study area.

Environmental Designations

6.11.2 The key effects of the three Scheme options on Green Belt and Country Parks are summarised below:

- Option B03E01b would result in a very large adverse effect on Darenth Wood Country Park.
- Option B04bE01b would result in a very large adverse effect on Darenth Wood Country Park.
- Option B05E01b would result in a moderate adverse effect on Darenth Wood Country Park

The landscape resource

6.11.3 The landscape resource within the study area has been sub divided in to 3 local level landscape character areas. The key effects of the three Scheme options are summarised below;

- Option B03E01b would result in a very large adverse effect on local landscape character area Darenth Wood and Bean Woods
- Option B04bE01b would also result in a very large adverse effect on local landscape character area Darenth Wood and Bean Woods
- Option B05E01b would result in a moderate adverse effect on local landscape character

area Darenth Wood and Bean Woods

The townscape resource

6.11.4 The townscape resource within the study area has been sub divided in to 5 local level townscape character areas. The key effects of the three Scheme options are summarised below;

- Option B03E01b would result in a large adverse effect on Bean Village
- Option B04bE01b would also result in a large adverse effect on Bean Village
- Option B05E01b would result in a slight adverse effect on Bean Village

Visual Amenity

6.11.5 Twenty representative viewpoints have been selected for this appraisal. The effects of the three Scheme options on these viewpoints are summarised below;

- Option B03E01b would result in a very large adverse effect on residents of North Bean and Bean Farm, and a large adverse effect on residents of Ightham Cottages, Bean House and Hope Cottages.
- Option B04bE01b would also result in a very large adverse effect on residents of North Bean and Bean Farm and a large adverse effect on residents of Hope Cottages and Bean Triangle.
- Option B05E01b would result in a large adverse effect on Hope Cottages and Bean Triangle.

6.11.6 Summary of key significant effects, mitigation proposed and residual effects on Landscape and Townscape is shown below in Table 6-11.

Table 6-11 Summary of significant effect, mitigation proposed and residual effects on Landscape and Townscape

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Option B03E01b					
Landscape and Townscape	**2 Red/ Amber**	Residual significant large adverse effects on Darenth Wood Country Park and landscape character area Darenth Wood and Bean Woods. Residual significance large adverse effect on Bean Village, residents of North Bean, and Bean Farm. Residual significant large adverse effects on residents of Hope and Ightham Cottages and Bean House.	Country Park Designation under the Countryside Act 1968	Develop a sensitively routed and well-designed Scheme in line with DMRB Good Roads Guide to ensure good fit with the scale and character of the landscape and townscape resources; Develop landscape strategy for external hard and soft landscaped areas for highway corridors (to include use of native species of local provenance where possible) and for screening purposes including vegetation buffer and other visual barriers; Develop integrated strategy for landscape, habitat creation/enhancement and access improvement works;	Vegetation screening along the A2 and junctions would be largely unaffected by the development with roadside planting retained to shield the development from the A2 Junction and other roads. Poor lighting design for the junction improvements, Land at Ebbsfleet and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
				Develop lighting design strategy to minimize light pollution. Divert rights of way where appropriate	
Option B04bE01b					
Landscape and Townscape	**3** **Amber**	Residual significant large adverse effects on Darenth Wood Country Park and landscape character area Darenth Wood and Bean Woods Residual significance large adverse effect on Bean Village, residents of North Bean and Bean Farm Residual significant large adverse effects on residents of Hope Cottages and Bean House.	Country Park Designation under the Countryside Act 1968	Develop a sensitively routed and well-designed Scheme in line with DMRB Good Roads Guide to ensure good fit with the scale and character of the landscape and townscape resources; Develop landscape strategy for external hard and soft landscaped areas for highway corridors (to include use of native species of local provenance where possible) and for screening purposes including vegetation buffer and other visual barriers; Develop integrated strategy for landscape, habitat	Vegetation screening along the A2 and junctions would be largely unaffected by the development with roadside planting retained to shield the development from the A2 Junction and other roads. Poor lighting design for the junction improvements, Land at Ebbsfleet and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
				creation/enhancement and access improvement works; Develop lighting design strategy to minimize light pollution. Divert rights of way where appropriate.	
Option B05E01b					
Landscape and Townscape	**4** **Amber / Green**	Residual significant large adverse effects on Hope Cottages.		Develop a sensitively routed and well-designed Scheme in line with DMRB Good Roads Guide to ensure good fit with the scale and character of the landscape and townscape resources; Develop landscape strategy for external hard and soft landscaped areas for highway corridors (to include use of native species of local provenance where possible) and for screening purposes	Vegetation screening along the A2 and the eastern side of Eastern Quarry would be largely unaffected by the development with roadside planting retained to shield the development from the A2 Junction and other roads. Poor lighting design for the junction improvements, Land at Ebbsfleet and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
				including vegetation buffer and other visual barriers; Develop integrated strategy for landscape, habitat creation/enhancement and access improvement works; Develop lighting design strategy to minimize light pollution. Divert rights of way where appropriate.	

7 Air Quality

7.1 Introduction & Study Area

7.1.1 This chapter of the EAR presents an assessment of the potential impacts each option may have on air quality and considers whether the impacts are likely to be significant or not. Additionally, the chapter presents an assessment of the differences in impacts that the various options would have on local air quality. Summary findings are presented in Section 7.10.

7.1.2 This chapter should be read in conjunction with Figures 7.1-7.4 and Appendix 7-1.

7.1.3 The study area in relation to the Scheme is defined by the changes in traffic flows on the local road network (as per DMRB guidance). For the purposes of the air quality assessment, the operational impacts have been confined to the impacts at worse case sensitive receptors, which are likely to experience the highest pollutant concentrations and changes as a result of the changes in traffic flows predicted by the traffic model (provided by the transport team) for each option. The criteria defined in Paragraph 3.12 to 3.16 of DMRB HA207/07 (Ref 7-1) have been used to identify the roads that will be included in the assessment of the various options. The criteria used to determine the extent of the air quality study area is presented below;

- Road alignment will change by 5 metres or more; or
- Daily traffic flows will change by 1,000 Annual Average Daily Traffic (AADT) or more; or
- Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more; or
- Daily average speeds will change by 10 kilometre/hour or more; or
- Peak hour speed will change by 20 kilometre/hour or more.

7.1.4 If a road link meets any of the criteria above it is defined as an ‘affected road’. The affected road network (ARN) is a composite network of all the affected road links.

7.2 Methodology

Construction

7.2.1 There is the potential for fugitive dust emissions to occur as a result of construction phase activities. These have not been assessed within the options appraisal as effects will be mitigated and there will be no discernible difference between the options. Once the final route has been selected, a construction phase dust assessment will be undertaken in accordance with DMRB. It should be noted that, assuming the relevant mitigation measures are implemented, the residual effect from all dust generating activities would not be significant.

Operation

7.2.2 The air quality assessment provides a review of the options to determine whether any of the proposed routes are likely to lead to either a significant impact on air quality (which is determined following the advice laid out in Interim Advice Note (IAN 174/13) (Ref 7-2) or a risk to compliance with the EU Limit Values in relation to the EU Directive on ambient air quality and clean air for Europe (IAN 175/13) (Ref 7-3). Consideration is given to the National Networks National Policy Statement (NN NPS) which provides the decision maker with advice on whether a scheme should

receive consent or where substantial weight in relation to air quality is required in the decision making process.

7.2.3 The assessment of the Scheme options has been completed with regard to Volume 11, Section 3, Part 1 of the DMRB HA207/07. In addition, the following Interim Advice Notes (IAN) have been followed;

- IAN 170/12v3, Updated air quality advice on the assessment of future NOx and NO_2 projections for users of DMRB Volume 11, Section 3, Part 1, Air Quality (Ref. 7-5);
- IAN 174/13, Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA207/07); and
- IAN 175/13, Updated air quality advice on risk assessment related to compliance with the EU Directive on ambient air quality and on the production of Scheme Air Quality Action Plans for user of DMRB Volume 11, Section 3, Part 1 Air Quality.
- IAN 185/15, Updated traffic, air quality and noise advice on the assessment of link speeds and generation of vehicle data into 'speed-bands' for users of DMRB Volume 11, Section 3, Part 1 'Air Quality and Volume 11, Section 3. Part 7 (Ref 7-6)

7.2.4 Levels of pollutants have been predicted for the Base Year of 2011, and for the Do Minimum situation (the situation that would exist without the implementation of the Scheme) and Do Something situation (the situation that would exist with the implementation of the Scheme options) for the Opening Year of 2025. The predicted concentrations have been compared against the applicable Air Quality Strategy (AQS) Objectives (Section 7.7).

7.2.5 The traffic data for the options has been used to predict pollutant concentrations. The updated DMRB Air Quality model (provided by Highways England) has been used to predict the impact of the options at a number of representative receptors. These receptors are chosen as they are likely to experience the highest pollution concentrations and the largest changes in concentrations due to the change in traffic as a result of the various options. The receptors are chosen which are located closest to roads (triggering the DMRB criteria) and affected by multiple roads e.g. located close roundabouts and junctions. Only properties and designated sites within 200m of roads affected by the project need to be considered as pollutant concentrations will return to background concentrations at this distance. The modelling will determine whether any of the options are likely to lead to exceedances of AQS objectives and therefore have the potential to lead to a significant impact on air quality. The results will also be used to identify whether there are any significant differences between the impacts of the options on air quality, which may need to be considered when deciding on the preferred option.

7.2.6 These decisions were guided by review of the Screening Assessment Checklist provided in Annex B of IAN 125/15, further details of which are provided in Section 7-8. The air quality aspects to be considered as part of the screening checklist in IAN 125/15 are presented in section 7.2.18.

7.2.7 In relation to the traffic data, the Major Projects' Instruction (MPI) 29-082014 (Ref 7-7) has been followed which includes a traffic template that will be used when requesting traffic data and provides guidance on joint working between environmental and traffic teams.

NOx to NO_2 Conversion

7.2.8 In accordance with Local Air Quality Management Technical Guidance 2016 (LAQM.TG (16)) (Ref 7-8), all modelled road-based concentrations of NOx (modelled output) were converted to annual mean NO_2 using the Defra 'NOx to NO_2' calculator (Version 4.1) to enable comparison with the AQS objectives. The traffic mix and local authority data used for the conversion of NO_2 from NOx were selected depending on the receptor locations.

7.2.9 The assessment predicted concentrations of NO_2 at sensitive receptors, such as schools, hospitals, residential properties, for the Base Year (2011), Do Minimum and Do Something scenarios in the Opening Year (2025). The Defra website provided estimated background pollutant concentrations for each 1km x1km grid square in the UK (Ref 7-9). Further details of the background pollutant concentrations used are provided within Appendix 7-1.

Model Verification

7.2.10 As per guidance provided in Annex 3 of the LAQM.TG (16) document, modelled pollutant concentrations were verified against the local authority air quality monitoring results. The air quality monitoring data used for the model verification were selected using the criteria listed below (as per LAQM.TG (16) guidance):

- Monitoring sites were within 200 metres of roads within the air quality modelled area; the sites also need to be within 50m of a road represented in the traffic data;
- Data was used for sites with a data capture of 90% or more; and
- Monitoring data was excluded from verification if major sources were missing from the traffic model that may have influenced monitored concentrations and therefore could not be included in the air quality modelling (such as large car parks, industrial stacks in close proximity etc.). Also, sites where the location of the monitoring could not be confirmed to a satisfactory standard were omitted from the verification.

7.2.11 Following the removal of the monitoring locations with low data capture and locations which could not be described in the model, a total of 17 sites were used in the verification. Further details are provided within Appendix 7-1.

Long Term Trend Analysis

7.2.12 A report produced on behalf of Defra (Ref 7-10) considered NO_2 monitoring data from across the UK and suggests that reductions in concentrations have slowed in recent years; therefore, it is now agreed among many air quality professionals that future predictions of NO_2 concentrations may be underestimated. Defra updated the air quality tools in 2012 (including the new emission factor toolkit, background maps and NOx/NO_2 converter) which aimed to close this "gap" between forecast and monitored NO_2 trends. However, it is considered that future NO_2 levels based on these updated tools are still likely to be underestimated. Therefore, a long-term trend (LTT) gap analysis was carried out for NO_2, in accordance with IAN 170/12v3.

7.2.13 This LTT NO_2 gap analysis was based on adjustment of 2025 NO_2 modelled concentrations for both the Do Minimum and Do Something scenarios using 2011 modelled baseline NO_2 concentrations and an alternative projection factor (based on a projected Base Year, which is the Base Year traffic data with opening year emissions and backgrounds) as outlined in IAN 170/12v3. Highways England has provided a gap analysis tool to assist with the calculation which was used in the assessment. The gap analysis spreadsheet assuming benefits from Euro VI/6 vehicles have been used in this assessment.

Significance

7.2.14 To determine whether a road scheme gives rise to a significant air quality impact, the advice in IAN 174/13 has been considered. The advice provides a means of evaluating the significance of local air quality effects in line with the requirements of the existing Environmental Impact Assessment (EIA) Directive for road schemes.

7.2.15 The results from the air quality modelling at receptors are used to inform the overall significance of the scheme; the larger the change in concentrations, the more certainty there is that there will be an impact as a result of the scheme. Only receptors which exceed the AQS objective (annual mean of 40µg/m³ for NO_2) in either the Do-Minimum or Do-Something scenarios are used to inform significance. Where the differences in concentrations are less than 1% of the air quality threshold (e.g. less than 0.4µg/m³ for annual average NO_2), then the change at these receptors is considered to be imperceptible, and they are scoped out of the judgement on significance. The guidelines to inform significance are presented in Table 7-1.

7.2.16 It must be noted that to determine the significance of an option, all receptors which exceed the AQS Objective should be modelled. However, this assessment has only considered a selection of worst case receptors, and the updated DMRB air quality model used to predict concentrations. This assessment has therefore provided an indication of whether any of the options could lead to a significant impact based on the advice in IAN 174/13. The guidelines to inform the judgement in significance are presented in Table 7-1.

Table 7-1 Guidelines to Inform Significance (modified from IAN 174/13)

Magnitude of Change in Annual Average NO_2 or PM_{10} (µg/m³)	**Total Number of Receptors with:**	
	Worsening of air quality objective already above objective or creation of a new exceedance	**Improvement of an air quality objective already above objective or the removal of an existing exceedance**
Large (>4)	1 to 10	1 to 10
Medium (>2)	10 to 30	10 to 30
Small (>0.4)	30 to 60	30 to 60

7.2.17 Where the number of receptors fall below the guideline bands to inform significance, the scheme is deemed not to have a significant impact e.g. 20 small worsenings would not be classed as significant. If the number of receptors affected is greater than the upper guideline bands (60 for small, 30 for medium and 10 for large), then the scheme would be considered to have a significant impact on air quality. Schemes which affect receptors within the guideline bands require justification to determine whether the scheme is significant.

Screening Assessment Checklist

7.2.18 This assessment has been undertaken following consideration of the guidance provided in IAN125/15, which has the aim of securing effective and efficient environmental assessments that are proportionate and are reported in a focused manner. Table 7-2 reports on the air quality screening assessment that has been undertaken to guide the scope of this EAR.

Table 7-2 Exert of IAN125 Annex B Screening Checklists

Aspects to be Considered	**Yes/No/Uncertain? Briefly describe**	**Is this likely to result in significant effects (prior to mitigation)?**
Air Quality		
Will the Project release pollutants or any hazardous, toxic or noxious substances to air?	Yes. All options will result in vehicle emissions.	Potentially, this would require confirmation from Air Quality modelling.

Aspects to be Considered	Yes/No/Uncertain? Briefly describe	Is this likely to result in significant effects (prior to mitigation)?
Are there any areas which are already subject to pollution e.g. where existing legal environmental standards are exceeded, which could be affected by the project?	Yes, there are AQMAs within the study area. The presence of the AQMAs indicates potential exceedances of the air quality standards.	Potentially, this would require confirmation through detailed Air Quality modelling.

7.3 Baseline Conditions

7.3.1 The Scheme is located within the administrative boundaries of Dartford Borough Council and Gravesham Borough Council, the baseline air quality information in the locality of the Scheme has been collected and is presented in this section.

Dartford Borough Council

7.3.2 A review of the information held on Defra's website, and the Dartford Borough Council (DBC) website (Ref 7-11) indicates that there are four Air Quality Management Areas (AQMAs) designated within the DBC administrative area. These are:

- Dartford AQMA No.1 – a corridor approximately 250m wide along the A282 Dartford Tunnel Approach Road from junction 1a to 300m south of junction 1b (located approximately 2.4km north west of the Scheme at A2 Bean Interchange);
- Dartford AQMA No.2 – an area encompassing London Road, Dartford (located approximately 1.7km north of the Scheme at A2 Bean Interchange);
- Dartford AQMA No.3 – an area encompassing Dartford Town and a number of approach roads (located approximately 2.6km north west of the Scheme at A2 Bean Interchange), and;
- Dartford AQMA No.4 – an area encompassing the Bean Interchange between the A2 and A296 (overlaps with Scheme).

7.3.3 All of the Dartford AQMAs have been declared for exceeding annual mean NO_2 concentrations. Dartford AQMA No.1 also declared 24-hour PM_{10} exceedances. All of the Dartford AQMAs are located within the study area. The Scheme is located within the Dartford AQMA No.4 and therefore does have the potential to affect traffic flows within the AQMA. This will be investigated as part of the options appraisal. The Dartford AQMAs located within the vicinity of the study area are displayed in Figure 7-1.

7.3.4 Air quality monitoring results accessed from the Kent Air website (Ref 7-12) and contained within the DBC Air Quality Progress Reports and the Updating and Screening Assessments (Ref 7-13) report multiple exceedances of the AQS objectives outside of the aforementioned AQMAs from the most recent (2014) monitoring results. The majority of 2014 diffusion tube concentrations exceeded the AQS objective for annual mean NO_2, ranging from 29 to 80µg/m^3.

7.3.5 The closest monitoring locations to the Scheme are located at the Bean Interchange and include diffusion tube sites DA05 (A/B/C), DA70, DA75, DA87 and the Bean Interchange automatic monitoring station. The 2014 annual mean NO_2 concentration for these sites all exceeded the AQS objective of 40µg/m^3, with the NO_2 concentration ranging from 41 to 67µg/m^3. A summary of the

DBC monitoring data from 2009 to 2014 is presented in Table 7-3 to Table7-5. The locations of the Dartford monitoring sites within the study area are displayed in Figure 7-1.

7.3.6 Table 7-3 provides the bias adjusted annual mean NO_2 concentrations from the DBC diffusion tube monitoring. All results have a data capture of greater than 75% or have been annualised to represent a full data capture, in accordance with procedure stated in LAQM.TG (16) to ensure validity of data.

Table 7-3 Dartford Borough Council Diffusion Tube Monitoring Results (NO2 (µg/m3)) (Ref. 7-11 and Ref. 7-12)

Site Name	X	Y	2009	2010	2011	2012	2013	2014
DA01Lowfield Street	554190	173985	**47**	**43**	36	**43.8**	**49**	**51**
DA05 (A,B,C) Ightham Cotts	558622	172771	**58**	**53**	**53**	**61.8**	**59**	**67**
DA07 Summerhouse Drive	550749	171924	28	29	27	27.1	28	29
DA10 London Road	559189	174872	**46**	**45**	38	**40.8**	**44**	**51**
DA14 Bow Arrow Lane	555484	174441	**67**	**61**	**64**	**69.0**	**64**	**80**
DA16 Princes Road 2	554108	173318	**48**	**42**	**43**	**49.5**	**47**	**59**
DA17 Shepherds Lane	552732	173689	**47**	**44**	**43**	**46.8**	**40**	**40**
DA18 Alkerden Lane	559734	174077	29	31		27.7	31	31
DA20 Elliot Road	555660	174863	**52**	**48**	**48**	**47.6**	**50**	**62**
DA21 Brentfield Road	555497	174025	**41**	**44**	38	**40.5**	**44**	**48**
DA22 Brent Way	555600	174030	**65**	**52**	**58**	**60.9**	**52**	**69**
DA24 Wayville Rd	555632	173558	**40**	**40**	37	**40.4**	**42**	**49**
DA25 Queens Gardens	555801	173194	**40**	39			**40**	**45**
DA28 Ivy Villas	558472	174670	**53**	**50**				
DA34 The Brent II	555373	173763	**46**	**45**	**44**	**46.6**	**50**	**55**
DA35 Highfield Road	553848	173994	**46**	**43**	**45**	**44.3**	**48**	**54**
DA36 Burnham Road	553281	175290	38	39				
DA37 Watling Street	556734	173456	**44**	**40**				
DA38 London Road 3	558331	174596	**43**	**43**	39	**41.3**	**44**	**50**
DA39 Park Road	555129	173802	**42**	**45**	**40**	**45.1**	**48**	**52**
DA41 Church Hill	554123	172805	**45**	**43**	**41**	**41.0**	**45**	**51**
DA43 Overy Liberty	554580	173992	**64**	**61**	**57**	**62.1**	**76**	**78**
DA44 Brent Close	555656	174053	**47**	**45**	**47**	**50.4**	**49**	**58**
DA45 Milestone Road	555964	174098	39					
DA47 Westgate Road	553938	174308	39	38				
DA48 Hawley Road	555297	171327	**42**	**41**	38		**42**	**45**
DA49 St Albans Road	554902	173893	**44**	**40**	**41**	**43.4**	**45**	**51**
DA50 A2/Bridge	553783	172319	**45**	**43**	**43**	**47.0**	**48**	**50**
DA52 Grange Crescent	555605	174358	**45**					

Site Name	X	Y	2009	2010	2011	2012	2013	2014
DA53 Park (Swallow cl)	557693	174666	28	30	25	28.0	24	26
DA54 King Edward Avenue	553642	174616	33	31	27	31.6	32	33
Littlebrook Hospital	556012	174405	33					
DA56 Cranford Road	554222	173460	37	33	30	34.4	35	34
DA57 Park Road	555290	173585	**40**	**38**				
DA60 Burnham Road II	553895	174678	**42**	**40**	36	**40.0**	**41**	**45**
DA61 West Hill II	553578	174175	**52**	**46**	**45**	**52.3**	**53**	**61**
DA62 The Brent/London Rd	555796	173902	**49**	**47**	**49**		**47**	**58**
DA63 Churchill Close	555612	173210	34	38	36	35.8	37	**42**
DA66 Crossways	557607	174997	39	37				
DA67 Hill Rise	556900	171294		33	32	33.5	32	
DA68 Bow Arrow Lane II	555724	174377		38	37	39.6	38	**43**
DA69 Hawley Road ii	554338	172581		**45**	**40**	**46.8**	**46**	**52**
DA70 Hope Cottages	558687	172610		**40**	34	**40.2**	**42**	**41**
DA71 Dartford Road	552618	174410		36	31	34.7		
DA72 (A,B,C) Little Dale	556433	172124			**40**	**43.7**	**50**	**51**
DA73 Wilmington	552761	172183		28				
DA74 Hawley Road III	554597	172362						
DA75 (A,B,C,) Ightham Cottages	558593	172815			**43**	**49.7**		**43**
DA78 Burnham Road 3	553686	174905			38	36.0	**44**	**50**
DA80 Westgate Road	553909	174344			**40**	**40.0**	**43**	**51**
DA81 Green Street	556368	172344			35	36.0	**41**	**50**
DA83 Byron Road	555617	175330				34.0	37	**41**
DA85 Mount Pleasant Road	554556	174034				**59.0**	**56**	39
DA84 Brent Way 2	555574	174068				34.0	38	**71**
DA79 Watling Street 2	556230	173564				39.0	38	**42**
DA86 Brent Close 2	555776	174053				36.0	**40**	37
DA87 NO_2 Ightham Cotts	558617	172779				28.0	39	**51**
DA89 Garden Place	553793	172261				35.0	38	35
DA90 Gothic Close	553957	172275					39	**42**
DA92 Middleham Court	555601	174244					39	

Site Name	X	Y	2009	2010	2011	2012	2013	2014
DA93 13 Southfleet Road/lamp Post	560876	174002						
DA94 Lamp Post Nr 19 London Road	560532	174880						**52**
DA95 22 Galley Hill Road	561201	174907						**57**

Values in bold exceed the AQS objective

7.3.7 Table 7-4 provides the ratified annual mean NO_2 concentrations from the DBC automatic monitoring stations. Results from the automatic monitoring show that NO_2 concentrations exceeding the AQS objectives at all stations from 2009 to 2014.

Table 7-4 Dartford Borough Council Automatic Monitoring Results (NO2 (µg/m3)) (Ref 7-11 and Ref 7-12)

Site Name	Station Type	X	Y	2009	2010	2011	2012	2013	2014
St Clements	Roadside	558525	174709	**60**	**57**	**54**	**57**	**53**	***61***
Town Centre	Roadside	554117	173852	**45**	**51**	**40**	**42**	**49**	***44***
Bean Interchange	Roadside	558622	172752	**58**	**54**	**53**	**54**	**43**	***51***

Values in bold exceed the AQS objective
Values in italics have a less than 75% data capture

7.3.8 Table 7-5 provides the ratified annual mean PM_{10} concentrations from the DBC automatic monitoring stations. Results from the automatic monitoring report PM_{10} concentrations below the AQS objectives from 2009 to 2014.

Table 7-5 Dartford Borough Council Automatic Monitoring Results (PM10 (µg/m3)) (Ref 7-11 and Ref 7-12)

Site Name	Station Type	X	Y	2009	2010	2011	2012	2013	2014
St Clements Way/ Greenhithe	Roadside	558525	174709	31	28	28	22	24	*31*
Town Centre	Roadside	554117	173852	24	24	27	24	28	*29*

Site Name	Station Type	X	Y	2009	2010	2011	2012	2013	2014
Bean Interchange	Roadside	558622	172752	24	25	24	21	21	*32*

Values in italics have a less than 75% data capture

Gravesham Borough Council

7.3.9 A review of the information held on Defra's website, and the Gravesham Borough Council (GBC) website (Ref 7-14) indicates that there are seven AQMAs designated within the GBC administrative area. These are:

- Gravesham Parrock Street AQMA - an area encompassing Parrock Street (from the point at which it crosses the railway line, southwards to the junction of Christ Church Road), and Lord Street (from its junction with Parrock Street to its junction with Windmill Street) (located approximately 3.5km north east of the Scheme at the Ebbsfleet Junction);
- Echo Junction AQMA – on B261 Gravesend (located approximately 3.5km east of the Scheme at the Ebbsfleet Junction);
- Gravesham A227 Wrotham Road/ B261 Old Road West AQMA - an area encompassing the junction of the A227 Wrotham Road and B261 Old Road West extending south to a point just beyond the Woodlands Restaurant (located approximately 2.8km east of the Scheme at the Ebbsfleet Junction);
- Gravesham A226 One-way system AQMA - an area incorporating the entirety of the A226 One-way system in Gravesend (located approximately 3.1km north east of the Scheme at the Ebbsfleet Junction);
- Gravesham B262/B261 Pelham Arms Junction AQMA - an area encompassing the junction of the B262 Pelham Road, B262 Pelham Road South and the B261 Old Road West (located approximately 2.1km east of the Scheme at the Ebbsfleet Junction);
- Gravesham A2 AQMA - the A2 Trunk Road AQMA. An area extending either side of the length of the A2 within the borough (overlaps with the Scheme at the Ebbsfleet Junction), and;
- Northfleet Industrial Area AQMA - an area encompassing the Northfleet Industrial Area in Gravesham (located approximately 1.4km north of the Scheme at the Ebbsfleet Junction).

7.3.10 All of the Gravesham AQMAs have been declared for exceeding annual mean NO_2 concentrations. The Echo Junction AQMA, Gravesham A2 AQMA and the Northfleet Industrial Area AQMA also declared 24-hour PM_{10} exceedances. The Gravesham AQMAs located within the study area Gravesham A2 AQMA and Northfleet Industrial AQMA, are displayed in Figure 7-1. The Scheme is located within the Gravesham A2 AQMA and therefore does have the potential to affect traffic flows within the AQMA. This will be investigated as part of the options appraisal.

7.3.11 Air quality monitoring results accessed from the Kent Air website contained within the GBC Air Quality Progress Reports and the Updating and Screening Assessments (Ref 7-15) reported multiple exceedances of the AQS objectives outside of the aforementioned AQMAs from the most recent (2014) monitoring results. The majority of 2014 diffusion tube concentrations exceeded the AQS objective, ranging from 22.5 to 59.2µg/m^3.

7.3.12 The closest monitoring locations to the Scheme are located near the Ebbsfleet junction and include diffusion tubes GR92, GR109, GR104, GR08 and the Painters Ash School automatic monitoring station. The majority of 2014 annual mean NO_2 concentration for these sites exceeded the AQS

objective of 40µg/m³, with the NO_2 concentration ranging from 31.0 to 47.7µg/m³. A summary of the GBC monitoring data from 2009 to 2014 is presented in Table 7-6 to 7-8.

7.3.13 Table 7-6 provides the bias adjusted annual mean NO_2 concentrations from the Gravesham Borough Council diffusion tube monitoring (see Figure 7-1 for monitoring locations within the study area). All results have a data capture of greater than 75% or have been annualised to represent an annual mean.

Table 7-6 Gravesham Council Diffusion Tube Monitoring Results (NO2 (µg/m3)) (Ref 7-11 and Ref 7-14)

Site ID	Site Location	X	Y	2009	2010	2011	2012	2013	2014
GR08	Painters Ash School Northfleet, Northfleet	562589	172076	37	35	35	36.5	33.6	**40.4**
GR11	Cygnet Leisure Centre, Old Perry Street,	563187	172970	25	26	23	23.2		
GR13	88 West Street, Gravesend, Kent,	564696	174431	**51**	**48**	**46**	**48.2**	**45.2**	**51.2**
GR19	Lawn County Primary School, High Street,	562155	174360	30	29	25	26.5	28.7	27.3
GR21	9 Chaucer Road (lamp post), Northfleet,	562665	172207	34	33	31	29.8	30.2	34.3
GR24	28- 29 Milton Road (Lamp post),	565128	174049	**47**	**51**	**41**	**47.5**	**49.5**	**53.3**
GR31	32 Harmer Street GF, Gravesend, DA12 2AX	565053	174151	**49**	**48**	**46**	**47.6**	**48.9**	**59.2**
GR39	Stone Street (post), Gravesend, DA12 1AP	564730	174030	**40**	**40**	36	38.1	**40.7**	**43.9**
GR40	Somerset Public House, 10 Darnley	564484	174096	**45**	**46**	**40**	**44.0**	**48.8**	**53.8**
GR44	74 Pelham Road South, Northfleet, Kent,	563701	173220	36	38	32	36.0	36.0	39.5
GR45	Princes Street (Opp Jury Street),	564708	174266	32	33	28	31.6	31.3	33.9
GR47	29- 31 Harmer Street, Gravesend, DA12 2AP	565043	174173	**48**	**48**	**45**	**48.2**	**45.2**	**55.8**
GR51	Factory Road, High Street, Northfleet,	562087	174362	31	31	26	29.3	31.2	33.7
GR52	The Hill Shelter, The Hill, Northfleet,	562449	174191	35	37	31	34.9	39.2	39.2
GR54	197 Vale Road, Northfleet, Kent, DA11	563420	173073	33	32	29	30.9	32.2	33.6
GR55	Butchers 140 Pelham Road, Gravesend	563943	173378	36	37	33	35.8	36.5	**41.1**
GR56	Junies, Parrock Road, Gravesend, DA12 1QF	565210	172980	39	37	35	36.8	34.6	38.6
GR57	61 Old Road West (Antique Shop,	564472	173158	**41**	**42**	38	38.8	**40.9**	**47.0**
GR58	The Venue, Milton Road, Gravesend,	565166	174036	**40**	37	34	37.3	**40.4**	**41.0**

Site ID	Site Location	X	Y	2009	2010	2011	2012	2013	2014
GR59	44 Old Road West (Pharmacy),	564530	173171	**41**	**44**	38	**45.7**	**41.3**	**48.7**
GR60	Bookmakers, 188 Old Road West, Gravesend	563899	173368	**44**	**44**	38	**42.6**	**42.1**	**44.1**
GR61	62 New Road (Pounce), Gravesend,	564429	174152	**40**	**42**	36	38.6	**40.3**	**45.4**
GR62	The Terrace, Gravesend, DA12 2BB	565004	174324	38	36	36	37.4	34.0	35.8
GR66	Russell Quay, West Street, Gravesend,	564541	174442	34	36	30	36.3	34.3	36.5
GR67	Echo Public House, Old Road East,	565213	172958	**40**	**41**	34	35.9	35.7	**44.0**
GR68	Opp The Old Prince of Orange, Old Road	564810	173088	36	37	34	35.9	37.2	38.6
GR69	Golf Driving Range, Thong Lane,	567270	171925	26	25	21	24.4	22.6	22.5
GR72	Northfleet Cemetery, Northfleet, DA11 8HW	562404	173215	28	30	26	28.0	28.2	28.7
GR75	Gravesend Cemetery, Gravesend,	564087	173080	25		24	23.6	26.1	25.8
GR78	Canal Tavern Public House, Canal Road,	565658	174195	34	33	31	32.9	31.2	37.4
GR90	Ordnance Road, Gravesend, DA12 2SJ	565438	174126	35	35	33	33.8	37.2	38.0
GR92	1 Hall Road, Northfleet, Kent, DA11 8AW	562319	172581	**44**	**41**	39	**42.0**	39.8	**47.7**
GR94	Opp The George PH, Wrotham Road,	564392	166012		39	33	36.6	37.0	**44.1**
GR96	Parrock Street, Gravesend, DA12 1EZ	564961	173722	35	38	33	35.1	35.9	36.6
GR98	The Leather Bottle PH, Dover Road, Northfleet,	562528	174048	36	36	30	34.0	38.2	**41.0**
GR99	Fountain Walk, Northfleet, DA11 9JS	563416	174102	31	32	28	30.4	32.2	34.4
GR104	8 Roman Road (Downpipe), Northfleet	562466	172152	39	38	36	37.8	36.6	**43.3**
GR105	9 Chaucer Road (façade), Northfleet,	562671	172202	27	27	24	25.4	25.8	29.3
GR109	30 Old Road East (Façade) DA11 8EP	562272	172281	36	34	31	32.1	38.8	38.4
GR110	Nells Café, Valley Drive, Gravesend	565229	172955	**46**	**41**	**42**	**41.9**	32.1	**46.8**
GR107	46 Pepper Hill (Façade), Northfleet	566148	170420	**44**	39	38	**41.4**	39.7	**45.8**
GR111	The George PH (Façade), Wrotham	564378	166005	35	34	30	32.7	33.9	**40.3**
GR112	50 Stonebridge Road (Façade), Northfleet	561502	174682	38	38	34	36.8	38.4	**44.1**

Site ID	Site Location	X	Y	2009	2010	2011	2012	2013	2014
GR113	7-16 Orchard Road (façade)	562281	173031		29	28	29.6	29.9	33.3
GR114	Elizabeth House, The Street, Meopham	564407	166018		31	31	32.4	30.7	36.4
GR116	Saxon Close, Northfleet, Lamp post	562478	172240			34	35.8	34.8	39.9
GR117	Bembridge (façade), Watling Street	564638	171130			25	26.2	24.7	28.0
GR118	40 Windmill Street, Gravesend DA12 1BA	564755	173862			34	36.4	37.1	**42.1**
GR119	Woodville Place (lamp post)	564729	173824			**45**	**50.6**	**50.1**	**56.8**
GR122	King & Taylor 10-12 Wrotham Road	564667	173891			35	37.2	37.2	**42.0**
GR123	City Praise Centre (façade), Lower	566538	173109					24.8	31.2

Values in bold exceed the AQS objective

7.3.14 Table 7-7 provides the ratified annual mean NO_2 concentrations from the Gravesham Borough Council automatic monitoring stations. All results have a data capture of greater than 75%. Results from the automatic monitoring report NO_2 concentrations below the AQS objectives from 2009 to 2014.

Table 7-7 Gravesham Council Automatic Monitoring Results (NO2 (µg/m3)) (Ref 7-11 and Ref 7-14)

Site Name	Station Type	X	Y	2009	2010	2011	2012	2013	2014
Painters Ash School, Masefield Rd, Northfleet	Roadside	562589	172076	38	37	34	35.2	31.4	31.0
Lawn Primary School, High Street, Northfleet	Industrial Background	562155	174360	30	28	26	27.0	31.1	24.4

7.3.15 Table 7-8 provides the ratified annual mean PM_{10} concentrations from the Gravesham Borough Council automatic monitoring stations. All results have a data capture of greater than 75%. Results from the automatic monitoring report PM_{10} concentrations below the AQS objectives from 2009 to 2014.

Table 7-8 Gravesham Council Automatic Monitoring Results (PM10 (µg/m3)) (Ref 7-11 and Ref 7-14)

Site Name	Station Type	X	Y	2009	2010	2011	2012	2013	2014
Painters Ash School, Masefield Rd, Northfleet	Roadside	562589	172076	24	24	17	18.4	19.7	21.1
Lawn Primary School, High Street, Northfleet	Industrial Background	562155	174360	30	26	24	20.1	20.0	23.3

Highways England Air Quality Monitoring

7.3.16 Highways England undertook air quality monitoring specifically for the scheme for a twelve-month period between September 2013 and August 2014. The results have been annualised, following the procedure set out in LAQM (TG(16)) (as detailed in Appendix 7-1), to represent a full data capture for the year 2014. The results of the monitoring indicated that concentrations of nitrogen dioxide (NO_2) ranged from 12.6 to 56.6µg/m³. Highways England air quality monitoring data is presented in Table 7-9.

7.3.17 Table 7-9 provides the monthly results from the diffusion tube monitoring. The locations of the monitoring within the study area are presented on Figure 7-1.

Table 7-9 Highways England Diffusion Tube Monitoring Results (NO2)

Site ID	X	Y	2014 adjusted NO_2 concentration (µg/m³)
A2BN_001	555592	173376	**46.7**
A2BN_002	555824	173363	**41.3**
A2BN_003	556462	172137	36.6
A2BN_004	556819	173369	30.0
A2BN_005	556750	173445	39.2
A2BN_006	558670	172652	39.4
A2BN_007	558811	172323	24.2
A2BN_008	558425	174632	37.8
A2BN_009	558468	174671	**45.0**
A2BN_010	556832	171333	25.1
A2BN_011	560903	173988	23.8
A2BN_012	562219	172312	35.8
A2BN_013	562501	172126	31.8
A2BN_014	562340	172686	37.7
A2BN_015	559260	171843	23.7
A2BN_016	562746	169089	12.6

Site ID	X	Y	2014 adjusted NO_2 concentration (µg/m³)
A2BN_017	564633	170962	35.7
A2BN_018	564633	170962	34.2
A2EBB_001	563412	171770	21.0
A2EBB_002	564235	171457	33.1
A2EBB_003	564009	170312	26.3
A2EBB_004	564233	171600	32.5
A2EBB_005	564413	172432	31.2
A2EBB_006	563702	172023	21.5
A2EBB_007	563595	172265	23.6
A2EBB_008	563998	172571	24.4
A2EBB_009	564454	172767	30.9
A2EBB_010	564788	171048	24.2
A2EBB_011	565347	170778	27.4
A2EBB_012	565740	170586	26.8
A2EBB_013	566125	170465	36.6
A2EBB_014	566150	170290	21.9
A2EBB_015	570584	169550	27.8
A2EBB_016	570726	169411	29.7
A2EBB_017	561290	171720	17.9
A2EBB_018	561336	171966	25.0
M25J30_001	557238	180322	33.7
M25J30_002	557611	181061	29.5
M25J30_003	557829	180609	34.6
M25J30_004	558793	180659	33.5
M25J30_005	560046	179881	33.8
M25J30_006	560604	180391	36.1
M25J30_007	561036	180530	30.3
M25J30_008	559554	179546	31.6
M25J30_009	560347	179782	**45.9**
M25J30_010	561642	179407	32.7
M25J30_011	555383	179910	31.4
M25J30_012	556144	179609	32.3
M25J30_013	556794	178688	28.0
M25J30_014	559011	178966	**42.5**
M25J30_015	555643	174871	36.8
M25J30_016	555493	174441	**52.9**
M25J30_017	555432	174454	**40.1**
M25J30_026	553767	183343	22.0

Site ID	X	Y	2014 adjusted NO_2 concentration (µg/m³)
M25J30_027	557545	180407	**54.6**
M25J30_028	557545	180407	**56.6**
M25J30_029	569389	182697	24.5
M25J30_030	569389	182697	23.0
M25J30_031	569389	182697	23.9

Values in bold exceed the AQS objective

7.3.18 The air quality monitoring from the local authorities and Highways England illustrates that there are multiple exceedances of the air quality strategy objectives/EU limit Values for the main traffic related pollutant, NO_2. The largest exceedance was at M25J30_028 (56.6 µg/m³) which is located approximately 7.5km north of the Scheme next to junction 30 of the M25. The closest exceeding diffusion tube to the Scheme is A2BN_009 (located a distance of approximately 1.5km north of the scheme) which measured a 2014 NO_2 concentration of 45.0µg/m³, which is located in Greenhithe immediately adjacent to the A206/A226 roundabout.

Defra EU Compliance Reporting

7.3.19 Defra is responsible for reporting on the UKs compliance with the EU Directive on Ambient Air Quality (2008/60/EC). The UK is split into a number of zones/agglomerations for the purpose of the reporting, a zone is deemed compliant with the Directive when pollutants are predicted or measured to be below the EU Limit Values. Defra currently undertakes modelling using their Pollution Climate Mapping (PCM) model. Defra chooses representative links in the zone to predict pollutant concentrations. The Scheme is located in an area where the Greater London Urban Area and the South East zones intersect. There are PCM modelled links on the following affected roads within the study area (Ref 7-16);

- A225/A296 Princes Road;
- A206 Crossways Boulevard;
- A226 Galley Hill Road; and
- B262 Springhead Road.

7.3.20 The links are predicted to be well below the EU Limit Values in 2014 and therefore the Scheme is unlikely to impact on compliance with the Directive in the opening year.

7.4 Value (Sensitivity) of Resource

Air Quality Criteria

7.4.1 For the pollutants of concern (NO_2 and PM_{10}), there are two sets of ambient air quality criteria for the protection of public health, namely those set by the EU and transposed in to UK law by The Air

Quality Standards Regulations 2010 and those implementing the UK National Air Quality Strategy (Ref 7-17).

7.4.2 The criteria set out in the AQS include standards and objectives for local authorities to work towards achieving. These apply in locations with relevant public exposure which are defined in the LAQM.TG(16).

7.4.3 The standards set by the EU are legally binding, mandatory limit values (LV) requiring national Government compliance. Failure in compliance (for a compliance agglomeration zone) can lead to infraction proceedings by the EU against the Member State.

7.4.4 Local air quality criteria relevant to the air quality assessment for the Scheme are summarised in Table 7-12. It should be noted that $PM_{2.5}$ is not currently assessed and reported as part of the DMRB HA207/07 air quality assessment, so only NO_2 and PM_{10} are to be included in the air quality assessment for the Scheme.

Receptors

7.4.5 Receptors that are potentially sensitive to changes in air quality are defined in DMRB HA207/07 as housing, schools, hospitals and designated species or habitats within a designated ecological site, located within 200m of the Affected Road Network (ARN) (as defined in 7.2.1). It should be noted that the air quality assessment methodology in accordance with DMRB does not assign a value or sensitivity to a receptor.

7.4.6 Receptors sensitive to potential operational phase road vehicle exhaust emission impacts were identified from a desk-top study and are summarised in Table 7-10 and Table 7-11 and displayed in Figures 7.2, 7.3 and 7.4. Table 7-10 details a list of 35 representative receptors.

Table 7-10 Representative Receptor Locations

Receptor		**NGR (m)**	
		X	**Y**
R1	Residential property on Princes Road	555866	173352
R2	Residential property on Cadogan Avenue	556813	173443
R3	Residential property on Littledale	556406	172145
R4	Residential property on Green Street Green Road	556394	172322
R5	Residential property, Igtham Cottages on Bean Lane	558620	172774
R6	Residential property, Igtham Cottages on Bean Lane	558596	172815
R7	Residential property, Hope Cottages on Bean Lane	558664	172638
R7a	Residential property, Hope Cottages on Bean Lane	558675	172619
R8	Residential property on Roman Road	558979	172883
R9	Residential property on Littledale	559316	172765
R10	Residential property, Bean House on Bean Lane	558748	172417
R11	Residential property off Watling Street	561422	172724
R12	Residential property off Watling Street	561513	172717
R13	Residential property on Pepper Hill	562207	172332
R14	Residential property on Painters Ash Lane	562490	172139
R15	Residential property on Station Road	561373	171955

Receptor		NGR (m)	
		X	Y
R16	Residential property on Station Road	560712	171600
R17	Residential property on Hall Road	562618	172526
R18	Residential property on Springhead Road	562324	172589
R19	Residential property on Haldane Gardens	562283	173072
R20	Residential property on Coldharbour Road	563280	172883
R21	Residential property on Station Road	558394	174970
R22	Residential property on Church Hill	553771	172319
R23	Residential property on Oakfield Lane	553167	172545
R24	Residential property on Oakwood Close	555624	173392
R25	Residential property on Churchill Close	555667	173214
R26	Residential property on Beacon Drive	558808	172335
R27	Residential property, Hope Cottages on Bean Lane	558717	172534
R28	Residential property on Roman Road	559366	172711
R29	Residential property off Henhurst Road	566158	170293
R30	Residential property on Franklin Road	566149	170421
R31	Residential property on Charles Street	558111	174991
R32	Residential property on Gore Road	556793	173378
R33	Residential property on Stonebridge Road	561502	174682
R34	Residential property on Lower Road	561340	174928
R35	Future Receptor off Roman Road	559346	172855

7.4.7 A designated ecological site (Darenth Wood, a designated SSSI) was identified within 200m of the ARN. Table 7-11 details a list of ecological receptor locations modelled as two transects up to 200m north and south of the A2 within the SSSI.

Table 7-11 Ecological Receptor Locations

Receptor		NGR (m)	
		X	Y
S1_14m	Ecological transect location 14m (closest distance) south of A2	557778	172417
S2_20m	Ecological transect location 20m south of A2	557779	172410
S3_30m	Ecological transect location 30m south of A2	557783	172401
S4_40m	Ecological transect location 40m south of A2	557786	172392
S5_50m	Ecological transect location 50m south of A2	557790	172382
S6_60m	Ecological transect location 60m south of A2	557793	172373
S7_70m	Ecological transect location 70m south of A2	557796	172363
S8_80m	Ecological transect location 80m south of A2	557800	172354
S9_90m	Ecological transect location 90m south of A2	557803	172345
S10_100m	Ecological transect location 100m south of A2	557806	172335
S11_110m	Ecological transect location 110m south of A2	557810	172325
S12_120m	Ecological transect location 120m south of A2	557813	172316

Receptor		NGR (m)	
		X	Y
S13_130m	Ecological transect location 130m south of A2	557817	172306
S14_140m	Ecological transect location 140m south of A2	557820	172297
S15_150m	Ecological transect location 150m south of A2	557824	172287
S16_160m	Ecological transect location 160m south of A2	557827	172278
S17_170m	Ecological transect location 170m south of A2	557830	172268
S18_180m	Ecological transect location 180m south of A2	557834	172259
S19_190m	Ecological transect location 190m south of A2	557837	172250
S20_200m	Ecological transect location 200m south of A2	557840	172240
N1_10m	Ecological transect location 10m (closest distance) north of A2	558060	172584
N2_20m	Ecological transect location 20m north of A2	558056	172593
N3_30m	Ecological transect location 30m north of A2	558052	172602
N4_40m	Ecological transect location 40m north of A2	558048	172610
N5_50m	Ecological transect location 50m north of A2	558044	172619
N6_60m	Ecological transect location 60m north of A2	558040	172628
N7_70m	Ecological transect location 70m north of A2	558036	172637
N8_80m	Ecological transect location 80m north of A2	558032	172646
N9_90m	Ecological transect location 90m north of A2	558028	172655
N10_100m	Ecological transect location 100m north of A2	558024	172664
N11_110m	Ecological transect location 110m north of A2	558020	172673
N12_120m	Ecological transect location 120m north of A2	558016	172681
N13_130m	Ecological transect location 130m north of A2	558012	172690
N14_140m	Ecological transect location 140m north of A2	558008	172698
N15_150m	Ecological transect location 150m north of A2	558004	172707
N11_160m	Ecological transect location 160m north of A2	558000	172716
N12_170m	Ecological transect location 170m north of A2	557996	172725
N13_180m	Ecological transect location 180m north of A2	557992	172734
N14_190m	Ecological transect location 190m north of A2	557988	172743
N15_200m	Ecological transect location 200m north of A2	557984	172752

7.4.8 The sensitive receptors identified in Table 7-10 are presented on Figures 7.2, 7.3, and 7.4.

7.5 Regulatory/Policy Framework

European

7.5.1 The EU Directive on ambient air quality (2008/50/EC) (Ref 7-19) sets out a range of mandatory LV for different pollutants including NO_2 and PM_{10}, the key traffic related pollutants. The directive consolidated previous air quality directives (apart from the Fourth Daughter Directive), setting Limit Values or Target Values for the concentrations of specific air pollutants and providing a new

regulatory framework for particulate matter smaller than 2.5µm in diameter ($PM_{2.5}$). It also allows Member States to seek postponement of attainment deadlines.

7.5.2 Defra is responsible for assessing and reporting annually on compliance with the Limit Values (Table 7-12) to the European Commission. For the purposes of their reporting, the UK is divided in to 43 zones or agglomerations (hereafter referred to as zones). The status of each zone in relation to a Limit Value is determined within the compliance assessment by the maximum measured or maximum modelled concentrations in the zone. The main pollutants of concern with respect to compliance are NO_2 and PM_{10}. The EU Limit Values are presented in Table 7-12. The Air Quality (Standards) Regulations 2010 (Ref 7-20) transpose into English law the requirements of Directives 2008/50/EC on ambient air quality.

7.5.3 EU Limit Values apply throughout the zones and agglomerations, the zone/agglomerations achieve compliance when everywhere within the zone/agglomeration is below the EU Limit Value (although there are exceptions to where the EU Limit Value applies in Annex III of the Air Quality Directive, locations where members of the public cannot access or there is no fixed habitation, industrial premises etc.).

National Legislation

7.5.4 Part IV of the Environment Act (1995) (Ref 7-21) requires the UK Government to produce a national AQS which contains standards, objectives and measures for improving ambient air quality. The AQS sets out objectives that are maximum ambient concentrations that are not to be exceeded either without exception or with a permitted number of exceedances over a specified timescale.

7.5.5 The ambient air quality standards and objectives are given statutory backing in England through the Air Quality (England) Regulations 2000, the Air Quality (England) (Amendment) Regulations 2002 (Ref 7-22). The AQS objectives for the protection of human health and applicable to this assessment are presented in Table 7-12.

Table 7-12 Air Quality Objectives and EU Limit Values for NO2 and PM10 (Modified from Air Quality (England) Regulations 2000, Ref 7-22)

Air Quality Objectives				**EU Limit Values**	
Pollutant	**Concentration**	**Averaging Period**	**Compliance Date**	**Concentration**	**Compliance Date**
NO_2	200 µg/m^3	1-hour mean (not to be exceeded more than 18 times per year)	31 December 2005	200 µg/m^3 (18 Exceedances)	1 January 2010
	40 µg/m^3	annual mean	31 December 2005	40 µg/m^3	1 January 2010
PM_{10}	50 µg/m^3	24-hour mean (not to be exceeded more than 35 times per year)	31 December 2010	50 µg/m^3 (35 Exceedances)	1 January 2005

Air Quality Objectives				EU Limit Values	
Pollutant	**Concentration**	**Averaging Period**	**Compliance Date**	**Concentration**	**Compliance Date**
	40 µg/m^3	annual mean	31 December 2004	40 µg/m^3	1 January 2005

7.5.6 The Air Quality Objectives only apply where members of the public are likely to be regularly present for the averaging time of the objective (i.e. where people will be exposed to pollutants). The annual mean objectives apply to all locations where members of the public might be regularly exposed; these include building façades of residential properties, schools, hospitals, care homes, etc. The 24 hour mean objective applies to all locations where the annual mean objective would apply, together with hotels and gardens of residential properties. The 1 hour mean objective also applies at these locations as well as at any outdoor location where a member of the public might reasonably be expected to stay for 1 hour or more, such as shopping streets, parks and sports grounds, as well as bus stations and railway stations that are not fully enclosed.

7.5.7 The AQS objectives and EU Limit Values for the protection of vegetation and ecosystems applicable to this assessment are presented in Table 7-13.

Table 7-13 Air Quality Objectives and EU Limit Value for the Protection of Vegetation (Modified from Air Quality (England) Regulations 2000, Ref 7-22)

Air Quality Objectives				EU Limit Values	
Pollutant	**Concentration**	**Averaging Period**	**Compliance Date**	**Concentration**	**Compliance Date**
NOx	30 µg/m^3	annual mean	31 December 2000	30 µg/m^3	19 July 2001

7.5.8 Local authorities have no legal requirement to comply with AQS objectives. They are however required to demonstrate best efforts to work towards achieving AQS objectives.

7.5.9 Under the LAQM regime, local authorities have a duty to make periodic reviews of local air quality against the AQS objectives. Where a local authority's review and assessment of local air quality indicates that AQS objectives are not expected to be achieved, local authorities are required to designate an AQMA. An Air Quality Action Plan (AQAP) must then be formulated, outlining a plan of action to meet AQS objectives in the AQMA.

AQS Objectives/EU Limit Values

7.5.10 Whilst AQS Objectives and EU Limit Values are identical in relation to the concentrations that are applied, they are different and it is important to understand how they are interpreted and therefore assessed. Local authorities are required to demonstrate best efforts to achieve the AQS Objectives whereas the UK government is required to achieve EU Limit Values.

7.5.11 Reporting against compliance with EU Limit Values is undertaken by Defra and reported at a zonal/agglomeration level. Zones/agglomerations only comply when everywhere in the zone is below the EU Limit Value and this is the basis of Defra's reporting, which is designed to determine what the maximum concentration is within the zone and hence determine the date the zone will

comply with the Limit Value. AQS Objectives are assessed at a much more local level where an AQMA can be designated as a result of exceedance at individual properties.

7.5.12 The air quality assessment will consider the impacts on both AQS Objectives (does the Scheme lead to a significant impact on air quality at individual properties) and EU Limit Values (will the Scheme impact on Defra's plans to achieve compliance with the Limit Values).

Environmental Protection Act 1990

7.5.13 Generally dust is only a cause of annoyance but when of sufficient scale and frequency it may become a statutory nuisance. The relevant legislation dealing with statutory nuisance is given in Part III of the Environmental Protection Act 1990. A statutory nuisance in relation to dust and deposits is defined under Section 79 of the act as follows:

- (d) Any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance.
- (e) any accumulation or deposit which is prejudicial to heath or a nuisance.

7.5.14 Under the provisions of the Act where a local authority is satisfied that a Statutory Nuisance exists, it is under a mandatory duty to serve an Abatement Notice requiring abatement or cessation of one or more activities deemed to be causing the nuisance. In the absence of any kind of standard, identification of a nuisance is dependent on the professional judgment of the local authority as to whether Best Practical Means (BPM) are being employed to control emissions. Where BPM is evident or can be clearly demonstrated then a particular activity cannot be deemed to be causing a Statutory Nuisance.

Policy

National Planning Policy Framework

7.5.15 The National Planning Policy Framework (NPPF) published in 2012 (Ref 7-18) sets out the Government's planning policies for England and how these are expected to be applied. The NPPF revokes forty-four planning documents including: Planning Policy Statement 23: Planning and Pollution Control. Paragraph 124 considers impacts of developments on air quality:

'Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan.'

7.5.16 The NPPF therefore requires;

- Consideration of the scheme air quality impacts on the UK's ability to comply with the Air Quality Directive; and
- Consideration of scheme air quality impacts on national objectives for pollutants.

7.5.17 However, the NPPF does not provide guidance on how to come to a judgement on sustaining compliance with the Air Quality Directive.

National Networks National Policy Statement (NN NPS)

7.5.18 The NN NPS (Ref 7-4) sets out the Government's policies to deliver the development of nationally significant infrastructure projects (NSIPs) on the national road and rail networks in England. The SoS uses the NN NPS as the primary basis for making decisions on development consent applications for national networks nationally significant infrastructure projects in England.

7.5.19 Paragraph 5.11 of the NN NPS provides context of where the decision maker should consider substantive weight judgements or whether they should recommend refusal is described in paragraph 5.12 and 5.13.

7.5.20 Paragraph 5.11 states that air quality considerations are likely to be particularly relevant where schemes are proposed:

Within or adjacent to Air Quality Management Areas (AQMA); roads identified as being above Limit Values or nature conservation sites (including Natura 2000 sites and SSSIs, including those outside England); and

Where changes are sufficient to bring about the need for a new AQMAs or change the size of an existing AQMA; or bring about changes to exceedances of the Limit Values, or where they may have the potential to impact on nature conservation sites.

7.5.21 Paragraph 5.12 and 5.13 provides the advice to the decision maker which should be used when determining whether a scheme should receive consent;

5.12 The Secretary of State must give air quality considerations substantial weight where, after taking into account mitigation, a project would lead to a significant air quality impact in relation to EIA and / or where they lead to a deterioration in air quality in a zone/agglomeration.

5.13 The Secretary of State should refuse consent where, after taking into account mitigation, the air quality impacts of the scheme will:

- Result in a zone/agglomeration which is currently reported as being compliant with the Air Quality Directive becoming non-compliant; or
- Affect the ability of a non-compliant area to achieve compliance within the most recent timescales reported to the European Commission at the time of the decision.

7.5.22 Although the NN NPS relates to NSIPs the policy in relation to advice to the decision maker should be applied to the assessment of all Highways England's road schemes.

Regional Planning Policy

Kent and Medway Air Quality Partnership Air Quality and Planning Technical Guidance (Ref 7-23)

7.5.23 The guidance provides technical advice on how to deal with planning applications that could have an impact on air quality and human health. The guidance states:

"Development that has the potential to result in a deterioration of air quality will only be acceptable if appropriate mitigation measures can be implemented to ensure that, no deterioration in air quality occurs as a result of the proposal."

Local Planning Policy

The Borough of Dartford Local Plan 1995 Saved Policies

7.5.24 The Local Plan adopted in 1995 has been largely updated by the Core Strategy (2011) (Ref 7-24). There are no policies in the Core Strategy related to air quality. Relevant saved policies from the 1995 Local Plan are detailed below.

Policy T18

Traffic management measures will be carried out where they are a cost-effective way of reducing congestion, improving the environment or improving road safety. Traffic regulation orders will be

made where practicable to prohibit or restrict the use of heavy goods vehicles or through traffic in sensitive environmental areas or on roads where it is desirable to conserve or improve local amenity.

Policy T28

Environmental improvements and traffic management schemes will be encouraged, particularly in residential areas, to enhance amenity and conditions of safety.
The quality of the environment, particularly in residential areas, and conditions of safety for pedestrians are often compromised by the presence of extraneous traffic or traffic moving at excessive speed. Environmental improvements, including 'traffic-calming' measures such as speed humps, pinch points and rumble strips, can help reduce these problems and the Council will press for resources to be made available where appropriate.

Gravesham Local Plan Core Strategy

7.5.25 The Gravesham Local Plan Core Strategy (Ref 7-25) was adopted in 2014 and contains the current policies that have replaced the policies from the Local Plan First Review (1994). This, along with some saved policies from the Local Plan First Review (1994), make up the Council's current Local Plan for the Borough.

7.5.26 Strategic Objective SO17 in the Core Strategy (2014) states to "Increase accessibility, minimise congestion and improve air quality through the improved provision of local public transport and the provision of local jobs and services." The relevant polices related to this objective are detailed below.

Policy CS19

7.5.27 Policy CS19: Development and Design Principles, outlined in the Core Strategy (2014) states:

New development will be visually attractive, fit for purpose and locally distinctive. It will conserve and enhance the character of the local built, historic and natural environment, integrate well with the surrounding local area and meet anticrime standards. The design and construction of new development will incorporate sustainable construction standards and techniques, be adaptable to reflect changing lifestyles, and be resilient to the effects of climate change. This will be achieved through the criteria set out below:

[…]

New development will be located, designed and constructed to […] avoid adverse environmental impacts from pollution, including noise, air, odour and light pollution, and land contamination.

Gravesham Local Plan First Review Saved Policies

7.5.28 Relevant saved policies from the Local Plan First review (1994) are detailed below.

Policy T1

7.5.29 The Local Planning and Highway Authorities will consider the impact on the transport system and on the environment of traffic generated by new development and will wish to ensure that all proposed developments are adequately served by the highway network identified on the Proposals Map.

7.6 Design, Mitigation and Enhancement Measures (including monitoring requirements)

7.6.1 In terms of construction dust, best practice mitigation measures, would minimise any construction dust effects. These would be included in the Construction Environmental Management Plan (CEMP) prior to construction of the Option that is progressed. A full dust construction impact assessment is not undertaken at this stage.

7.6.2 No exceedances have been predicted, and air quality concentrations are generally well below the air quality objective for the opening year of 2025 (Section 7.9). As such, it is considered unlikely that mitigation measures for the operational phase of the Scheme would be required. This would be confirmed following assessment of the final option.

7.6.3 No additional monitoring is required at this stage given the extent of the existing monitoring that has been undertaken in the locality of the Scheme.

7.7 Magnitude of Impacts

B03E01b

7.7.1 In accordance with guidance outlined in DMRB HA207/07, potential air quality impacts relating to the proposed option were assessed at a total of 35 representative receptors, which were selected at sites located within 200 metres of the associated ARN. The localised study area is presented in Figure 7.2. R7 is to be demolished for Option 3, therefore predictions for this receptor are not included in this option.

7.7.2 Table 7-14 details the annual mean PM_{10} concentrations predicted by the DMRB air quality model at all receptors for the Do Minimum scenario and the Do Something scenario (B03E01b) and reflects the change in mean annual PM_{10} concentrations projected for 2025 between the Do Minimum and Do Something.

Table 7-14 Predicted Annual PM10 Concentrations at Receptors within 200 Metres of Affected Road Network for B03E01b

Receptor ID	Receptor Co-ordinates		2025 Annual Mean PM_{10} Concentrations (µg/m³)		Difference between Projected Do Minimum and Do Something (B03E01b) Concentration
	X (m)	Y (m)	Do Minimum	Do Something (B03E01b)	
R1	555866	173352	21.5	21.5	0.0
R2	556813	173443	20.8	20.7	-0.1
R3	556406	172145	21.1	21.1	0.0
R4	556394	172322	21.0	21.0	0.0
R5	558620	172774	23.1	22.0	-1.1
R6	558596	172815	22.1	21.4	-0.7
R7a	558675	172619	22.5	21.7	-0.8
R8	558979	172883	21.1	21.1	0.0
R9	559316	172765	21.0	21.0	0.0
R10	558735	172409	20.3	20.5	0.2
R11	561422	172724	22.0	21.9	-0.1
R12	561513	172717	21.5	21.9	0.4

Receptor ID	Receptor Co-ordinates		2025 Annual Mean PM_{10} Concentrations (µg/m³)		Difference between Projected Do Minimum and Do Something (B03E01b) Concentration
	X (m)	Y (m)	Do Minimum	Do Something (B03E01b)	
R13	562207	172332	20.3	20.3	0.0
R14	562490	172139	19.6	19.6	0.0
R15	561373	171955	18.1	18.1	0.0
R16	560712	171600	17.4	17.5	0.1
R17	562618	172526	19.5	19.5	0.0
R18	562324	172589	20.6	20.4	-0.2
R19	562283	173072	18.4	18.2	-0.2
R20	563280	172883	17.7	17.6	-0.1
R21	558394	174970	19.9	19.8	-0.1
R22	553771	172319	20.3	20.0	-0.3
R23	553167	172545	20.6	20.2	-0.4
R24	555624	173392	22.5	22.2	-0.3
R25	555667	173214	21.2	20.9	-0.3
R26	558808	172335	20.7	20.8	0.1
R27	558717	172534	20.9	20.2	-0.7
R28	559366	172711	20.7	20.6	-0.1
R29	566158	170293	20.2	20.1	-0.1
R30	566149	170421	20.2	20.1	-0.1
R31	558111	174991	22.2	21.7	-0.5
R32	556793	173378	19.9	19.9	0.0
R33	561502	174682	18.7	18.5	-0.2
R34	561340	174928	18.0	17.8	-0.2
R35	559346	172855	20.9	20.7	-0.2

7.7.3 Table 7-15 details the annual mean NO_2 concentrations predicted by the DMRB air quality model at the representative receptors for the Do Minimum scenario, the Do Something scenario (B03E01b) and reflects the change in mean annual NO_2 concentrations projected for 2025 between the Do Minimum and Do Something.

Table 7-15 Predicted Annual NO2 Concentrations at Receptors within 200 Metres of Affected Road Network for B03E01b

Receptor ID	Receptor Co-ordinates		LTT Adjusted 2025 Annual Mean NO_2 Concentrations (µg/m³) [1]		Difference between Projected Do Minimum and Do Something (B03E01b) Concentration [2]
	X (m)	Y (m)	Do Minimum	Do Something (B03E01b)	
R1	555866	173352	27.5	27.5	0.0

Receptor ID	Receptor Co-ordinates		LTT Adjusted 2025 Annual Mean NO_2 Concentrations (µg/m³) [1]		Difference between Projected Do Minimum and Do Something (B03E01b) Concentration [2]
	X (m)	Y (m)	Do Minimum	Do Something (B03E01b)	
R2	556813	173443	23.2	23.1	-0.1
R3	556406	172145	27.3	27.2	-0.1
R4	556394	172322	25.7	25.7	0.0
R5	558620	172774	31.5	28.6	-2.9
R6	558596	172815	27.1	25.3	-1.8
R7a	558675	172619	29.7	26.4	*-3.3*
R8	558979	172883	23.4	23.7	0.3
R9	559316	172765	25.4	25.8	0.4
R10	558735	172409	20.2	20.5	0.3
R11	561422	172724	29.6	30.4	0.8
R12	561513	172717	27.1	28.0	0.9
R13	562207	172332	24.5	24.5	0.0
R14	562490	172139	22.0	22.0	0.0
R15	561373	171955	14.2	14.2	0.0
R16	560712	171600	15.5	15.8	0.3
R17	562618	172526	19.6	19.6	0.0
R18	562324	172589	23.4	22.7	-0.7
R19	562283	173072	19.4	19.0	-0.4
R20	563280	172883	17.7	17.5	-0.2
R21	558394	174970	23.8	23.5	-0.3
R22	553771	172319	28.7	28.9	0.2
R23	553167	172545	29.7	29.8	0.1
R24	555624	173392	33.4	32.9	-0.5
R25	555667	173214	30.7	30.9	0.2
R26	558808	172335	21.3	21.6	0.3
R27	558717	172534	22.4	20.5	-1.9
R28	559366	172711	26.7	26.9	0.2
R29	566158	170293	23.2	23.3	0.1
R30	566149	170421	22.7	22.8	0.1
R31	558111	174991	29.2	28.8	-0.4
R32	556793	173378	20.8	20.7	-0.1
R33	561502	174682	22.5	21.8	-0.7
R34	561340	174928	20.4	19.7	-0.7
R35	559346	172855	24.0	24.0	0.0

[1] LTT=Long Term Trend. Predicted NO_2 concentrations were adjusted using a Gap Factor based on the long term adjustment factor calculated by the Highways England's "INTERIM Highways Agency Alternative Long Term Gap Analysis Calculator v1.1". All values reflect predicted concentrations for the future year 2025.

Potential Future Exceedances of Air Quality Strategy NO_2 Objectives

7.7.4 Impacts of B03E01b on local air quality were evaluated by determining the number of the worst case receptors likely to result in an improvement or deterioration in air quality and the associated risk of exceeding the annual NO_2 AQS objective in the Scheme opening year.

7.7.5 For B03E01b, the largest predicted change in mean annual NO_2 concentration occurred at receptor R7a (located at Hope Cottages on Bean Lane), which showed a predicted decrease of 3.3µg/m^3, as a result of decreases in traffic on the A2 and due to the realignment of the junction has led to a greater distance between traffic flows and this receptor.

7.7.6 All concentrations are predicted to be well below 40µg/m^3, with the highest concentration predicted to be 32.9µg/m^3 at R24, which indicates there are unlikely to be any exceedances of AQS objective criteria as a result of the option.

B03E01b Assessment of Ecologically Designated Site

7.7.7 The predicted nitrogen deposition rates for the Do Minimum and Do Something (B03E01b) scenarios in the Opening Year (2025) at Darenth Wood SSSI as predicted from the DMRB modelling are presented in Table 7-16.

Table 7-16 Verified Modelled N Dry Deposition Rates at Darenth Wood SSSI for B03E01b

Receptor ID	Do Minimum (2025)		Do Something (2025) B03E01b		Difference between Do Something (B03E01b) and Do Minimum Scenarios	
	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	% Change in Relation to lowest Critical Load Level for Darenth Wood SSSI
S1_14m	15.30	22.51	15.38	22.52	0.01	0.08
S2_20m	10.10	21.99	10.16	22.00	0.01	0.06
S3_30m	7.04	21.69	7.08	21.69	0.00	0.04
S4_40m	5.60	21.54	5.63	21.55	0.01	0.03
S5_50m	4.72	21.46	4.75	21.46	0.00	0.03
S6_60m	4.12	21.40	4.15	21.40	0.00	0.03
S7_70m	3.65	21.35	3.68	21.35	0.00	0.03
S8_80m	3.28	21.31	3.30	21.31	0.00	0.02
S9_90m	2.95	21.28	2.97	21.28	0.00	0.02
S10_100m	2.68	21.25	2.70	21.25	0.00	0.02

Receptor ID	Do Minimum (2025)		Do Something (2025) B03E01b		Difference between Do Something (B03E01b) and Do Minimum Scenarios	
	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	% Change in Relation to lowest Critical Load Level for Darenth Wood SSSI
S11_110m	2.45	21.23	2.46	21.23	0.00	0.01
S12_120m	2.25	21.21	2.27	21.21	0.00	0.02
S13_130m	2.08	21.19	2.10	21.19	0.00	0.02
S14_140m	1.94	21.18	1.95	21.18	0.00	0.01
S15_150m	1.81	21.16	1.82	21.17	0.01	0.01
S16_160m	1.70	21.15	1.71	21.15	0.00	0.01
S17_170m	1.60	21.14	1.61	21.14	0.00	0.01
S18_180m	1.50	21.13	1.51	21.13	0.00	0.01
S19_190m	1.42	21.13	1.43	21.13	0.00	0.01
S20_200m	1.35	21.12	1.36	21.12	0.00	0.01
N1_10m	20.84	23.07	20.69	23.05	-0.02	-0.15
N2_20m	10.57	22.04	10.45	22.03	-0.01	-0.12
N3_30m	7.28	21.71	7.19	21.70	-0.01	-0.09
N4_40m	5.75	21.56	5.68	21.55	-0.01	-0.07
N5_50m	4.83	21.47	4.78	21.46	-0.01	-0.05
N6_60m	4.20	21.40	4.15	21.40	0.00	-0.05
N7_70m	3.72	21.36	3.68	21.35	-0.01	-0.04
N8_80m	3.34	21.32	3.31	21.31	-0.01	-0.03
N9_90m	3.00	21.28	2.98	21.28	0.00	-0.02
N10_100m	2.72	21.26	2.70	21.25	-0.01	-0.02
N11_110m	2.48	21.23	2.47	21.23	0.00	-0.01
N12_120m	2.28	21.21	2.27	21.21	0.00	-0.01
N13_130m	2.11	21.19	2.10	21.19	0.00	-0.01
N14_140m	1.96	21.18	1.95	21.18	0.00	-0.01
N15_150m	1.83	21.17	1.82	21.17	0.00	-0.01
N16_160m	1.71	21.15	1.71	21.15	0.00	0.00
N17_170m	1.61	21.14	1.61	21.14	0.00	0.00
N18_180m	1.52	21.14	1.52	21.14	0.00	0.00
N19_190m	1.44	21.13	1.43	21.13	0.00	-0.01
N20_200m	1.36	21.12	1.36	21.12	0.00	0.00

7.7.1 The results in Table 7-16 show that the N total deposition rates in the Opening Year scenarios are above the UNECE critical load range of 10-20kg/N/ha/year, both with and without the Project. There are no predicted increases of N total deposition rates, all N total deposition rates are predicted to either have no change or a minor decrease. Therefore, there are no significant predicted changes in total N deposition rates as a result of the Project.

7.7.2 The predicted NOx concentrations for the Do Minimum and Do Something (B03E01b) scenarios in the Opening Year (2025) at Darenth Wood SSSI as predicted from the DMRB modelling are presented in Table 7-17.

Table 7-17 Verified Modelled NOx Concentrations at Darenth Wood SSSI for B03E01b

Receptor ID	Do Minimum (2025)		Do Something (2025) B03E01b		Difference between Do Something (B03E01b) and Do Minimum Scenarios	
	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Total NOx Concen-tration (µg/m³)	% Change in Relation to Critical Level for Vegetation (30µg/m³)
S1_14m	**34.18**	**54.95**	**34.40**	**55.17**	0.22	0.72
S2_20m	21.69	**42.46**	21.83	**42.60**	0.14	0.47
S3_30m	14.79	**35.56**	14.89	**35.65**	0.09	0.32
S4_40m	11.65	**32.41**	11.72	**32.49**	0.08	0.25
S5_50m	9.77	**30.53**	9.83	**30.60**	0.07	0.21
S6_60m	8.49	29.26	8.55	29.31	0.05	0.19
S7_70m	7.51	28.27	7.56	28.32	0.05	0.16
S8_80m	6.72	27.49	6.76	27.53	0.04	0.15
S9_90m	6.04	26.81	6.08	26.85	0.04	0.13
S10_100m	5.47	26.24	5.51	26.27	0.03	0.12
S11_110m	4.99	25.76	5.02	25.79	0.03	0.11
S12_120m	4.59	25.35	4.62	25.38	0.03	0.10
S13_130m	4.24	25.01	4.27	25.03	0.02	0.09
S14_140m	3.94	24.70	3.96	24.73	0.03	0.09
S15_150m	3.67	24.44	3.70	24.46	0.02	0.08
S16_160m	3.44	24.21	3.46	24.23	0.02	0.08
S17_170m	3.23	24.00	3.26	24.02	0.02	0.07
S18_180m	3.05	23.82	3.07	23.84	0.02	0.07
S19_190m	2.88	23.65	2.90	23.67	0.02	0.06
S20_200m	2.73	23.50	2.75	23.52	0.02	0.06
N1_10m	**48.79**	**69.55**	**48.36**	**69.13**	-0.42	-1.42
N2_20m	22.79	**43.55**	22.49	**43.25**	-0.30	-1.00
N3_30m	15.32	**36.09**	15.12	**35.89**	-0.20	-0.67
N4_40m	11.97	**32.74**	11.83	**32.60**	-0.14	-0.46

Receptor ID	Do Minimum (2025)		Do Something (2025) B03E01b		Difference between Do Something (B03E01b) and Do Minimum Scenarios	
	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Total NOx Concen-tration (µg/m³)	% Change in Relation to Critical Level for Vegetation (30µg/m³)
N5_50m	9.99	**30.76**	9.88	**30.65**	-0.11	-0.36
N6_60m	8.66	29.42	8.56	29.32	-0.10	-0.33
N7_70m	7.64	28.41	7.56	28.33	-0.08	-0.27
N8_80m	6.84	27.61	6.78	27.55	-0.06	-0.21
N9_90m	6.14	26.91	6.09	26.86	-0.05	-0.17
N10_100m	5.55	26.32	5.51	26.28	-0.04	-0.14
N11_110m	5.06	25.83	5.03	25.80	-0.03	-0.11
N12_120m	4.65	25.41	4.62	25.39	-0.02	-0.09
N13_130m	4.29	25.06	4.27	25.04	-0.02	-0.08
N14_140m	3.99	24.75	3.97	24.73	-0.02	-0.06
N15_150m	3.72	24.48	3.70	24.47	-0.01	-0.05
N16_160m	3.48	24.25	3.47	24.23	-0.02	-0.05
N17_170m	3.27	24.03	3.26	24.02	-0.01	-0.04
N18_180m	3.08	23.85	3.07	23.84	-0.01	-0.03
N19_190m	2.91	23.68	2.90	23.67	-0.01	-0.03
N20_200m	2.76	23.52	2.75	23.52	0.00	-0.02

Bold font indicates NOx concentration exceeds AQS objective of 30µg/m³ for vegetation at associated receptor.

7.7.3 The results in Table 7-17 show that the NOx concentrations exceed the AQS Objective for vegetation (30µg/m³) at a distance of up to 50 metres from the road centre line in the Do Minimum and Do Something scenarios.

7.7.4 The difference in NOx concentrations between the Do-Minimum and Do-Something scenarios, as presented in Table 7-17, are small. In the Do Something Scenario for B03E01b, total NOx concentrations at distances closer to the road are predicted to be marginally higher than the Do Minimum Scenario for the locations south of the road, and marginally lower than the Do Minimum for north of the road.

B04bE01b

7.7.5 In accordance with guidance outlined in DMRB, potential air quality impacts relating to the proposed option were assessed at a total of 35 representative receptors, which were selected at

sites located within 200 metres of the associated ARN. The localised study area is presented in Figure 7.3.

7.7.6 Table 7-18 details the annual mean PM_{10} concentrations predicted by the DMRB air quality model at all receptors for the Do Minimum scenario and the Do Something scenario (B04bE01b) and reflects the change in mean annual PM_{10} concentrations projected for 2025 between the Do Minimum and Do Something.

Table 7-18 Predicted Annual PM10 Concentrations at Receptors within 200 Metres of Affected Road Network for B04bE01b

Receptor ID	Receptor Co-ordinates		2025 Annual Mean PM_{10} Concentrations (µg/m³)		Difference between Projected Do Minimum and Do Something (B0bE01b) Concentration
	X (m)	Y (m)	Do Minimum	Do Something (B04bE01b)	
R1	555866	173352	21.5	21.5	0.0
R2	556813	173443	20.8	20.8	0.0
R3	556406	172145	21.1	21.1	0.0
R4	556394	172322	21.0	21.0	0.0
R5	558620	172774	23.1	22.3	-0.8
R6	558596	172815	22.1	21.3	-0.8
R7	558664	172638	23.2	21.5	-1.7
R7a	558675	172619	22.5	21.3	-1.2
R8	558979	172883	21.1	20.7	-0.4
R9	559316	172765	21.0	20.5	-0.5
R10	558735	172409	20.3	21.2	0.9
R11	561422	172724	22.0	22.0	0.0
R12	561513	172717	21.5	21.9	0.4
R13	562207	172332	20.3	20.3	0.0
R14	562490	172139	19.6	19.6	0.0
R15	561373	171955	18.1	18.1	0.0
R16	560712	171600	17.4	17.3	-0.1
R17	562618	172526	19.5	19.5	0.0
R18	562324	172589	20.6	20.6	0.0
R19	562283	173072	18.4	18.3	-0.1
R20	563280	172883	17.7	17.6	-0.1
R21	558394	174970	19.9	19.9	0.0
R22	553771	172319	20.3	20.3	0.0
R23	553167	172545	20.6	20.6	0.0
R24	555624	173392	22.5	22.5	0.0
R25	555667	173214	21.2	21.2	0.0
R26	558808	172335	20.7	20.7	0.0
R27	558717	172534	20.9	21.5	0.6
R28	559366	172711	20.7	20.6	-0.1

Receptor ID	Receptor Co-ordinates		2025 Annual Mean PM_{10} Concentrations (µg/m³)		Difference between Projected Do Minimum and Do Something (B0bE01b) Concentration
	X (m)	Y (m)	Do Minimum	Do Something (B04bE01b)	
R29	566158	170293	20.2	20.2	0.0
R30	566149	170421	20.2	20.2	0.0
R31	558111	174991	22.2	22.4	0.2
R32	556793	173378	19.9	19.9	0.0
R33	561502	174682	18.7	18.7	0.0
R34	561340	174928	18.0	18.0	0.0
R35	559346	172855	20.9	20.6	-0.3

7.7.7 Table 7-19 details the annual mean NO_2 concentrations predicted by the DMRB air quality model at all receptors for the Do Minimum scenario and the Do Something scenario (B04bE01b) and reflects the change in mean annual NO_2 concentrations projected for 2025 between the Do Minimum and Do Something.

Table 7-19 Predicted Annual NO2 Concentrations at Receptors within 200 Metres of Affected Road Network for B04bE01b

Receptor ID	Receptor Co-ordinates		LTT Adjusted 2025 Annual Mean NO_2 Concentrations (µg/m³) [1]		Difference between Projected Do Minimum and Do Something (B04bE01b) Concentration [2]
	X (m)	Y (m)	Do Minimum	Do Something (B04bE01b)	
R1	555866	173352	27.5	27.5	0.0
R2	556813	173443	23.2	23.3	0.1
R3	556406	172145	27.3	27.2	-0.1
R4	556394	172322	25.7	25.7	0.0
R5	558620	172774	31.5	28.7	-2.8
R6	558596	172815	27.1	24.5	-2.6
R7	558664	172638	32.3	26.2	-6.1
R7a	558675	172619	29.7	25.2	-4.5
R8	558979	172883	23.4	22.5	-0.9
R9	559316	172765	25.4	24.5	-0.9
R10	558735	172409	20.2	22.3	2.1
R11	561422	172724	29.6	30.6	1.0
R12	561513	172717	27.1	28.0	0.9
R13	562207	172332	24.5	24.5	0.0
R14	562490	172139	22.0	22.0	0.0
R15	561373	171955	14.2	14.2	0.0
R16	560712	171600	15.5	15.4	-0.1
R17	562618	172526	19.6	19.6	0.0
R18	562324	172589	23.4	23.3	-0.1

Receptor ID	Receptor Co-ordinates		LTT Adjusted 2025 Annual Mean NO_2 Concentrations (µg/m³) [1]		Difference between Projected Do Minimum and Do Something (B04bE01b) Concentration [2]
	X (m)	Y (m)	Do Minimum	Do Something (B04bE01b)	
R19	562283	173072	19.4	19.4	0.0
R20	563280	172883	17.7	17.6	-0.1
R21	558394	174970	23.8	23.9	0.1
R22	553771	172319	28.7	28.7	0.0
R23	553167	172545	29.7	29.7	0.0
R24	555624	173392	33.4	33.4	0.0
R25	555667	173214	30.7	30.7	0.0
R26	558808	172335	21.3	21.3	0.0
R27	558717	172534	22.4	23.3	0.9
R28	559366	172711	26.7	26.7	0.0
R29	566158	170293	23.2	23.3	0.1
R30	566149	170421	22.7	22.7	0.0
R31	558111	174991	29.2	29.6	0.4
R32	556793	173378	20.8	20.8	0.0
R33	561502	174682	22.5	22.5	0.0
R34	561340	174928	20.4	20.4	0.0
R35	559346	172855	24.0	23.4	-0.6

[1] LTT=Long Term Trend. Predicted NO_2 concentrations were adjusted using a Gap Factor based on the long term adjustment factor calculated by the Highways England's "INTERIM Highways Agency Alternative Long Term Gap Analysis Calculator v1.1". All values reflect predicted concentrations for the future year 2025.

Potential Future Exceedances of Air Quality Strategy NO_2 Objectives

7.7.8 Impacts of B04bE01b on local air quality were evaluated by determining the number of the worst case receptors likely to result in an improvement or deterioration in air quality and the associated risk of exceeding the annual NO_2 AQS objective in the Scheme opening year.

7.7.9 For B04bE01b, the largest predicted change in mean annual NO_2 concentration occurred at receptor R7 (located at Hope Cottages on Bean Road) which showed a predicted decrease of 6.1µg/m³. This is due to realignment of the A2 bean junction. The closest road would be more than 50m further away from receptor R7 with this option.

7.7.10 An increase in annual mean NO_2 concentrations greater than 2µg/m³ was predicted to occur at receptor R10 (located at Bean House on Bean Road), with a predicted increase in concentrations of 2.1µg/m³. This increase in concentration is attributable to the construction of the new roundabout

linking the B255 with the A2, which would be located approximately 120m closer to receptor R10 as a result of this option.

7.7.11 All concentrations are predicted to be well below 40µg/m³, with the highest concentration predicted to be 33.4µg/m³ at R24, which indicates there are unlikely to be any exceedances of AQS objective criteria as a result of the option.

B04bE01b Designated Site Assessment

7.7.12 The predicted nitrogen deposition rates for the Do Minimum and Do Something (B04bE01b) scenarios in the Opening Year (2025) at Darenth Wood SSSI as predicted from the DMRB modelling are presented in Table 7-20.

Table 7-20 Verified Modelled N Dry Deposition Rates at Darenth Wood SSSI for B04bE01b

Receptor ID	Do Minimum (2025)		Do Something (2025) B04bE01b		Difference between Do Something (B04bE01b) and Do Minimum Scenarios	
	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	% Change in Relation to lowest Critical Load Level for Darenth Wood SSSI
S1_14m	15.30	22.51	14.90	22.47	-0.04	-0.40
S2_20m	10.10	21.99	9.84	21.97	-0.02	-0.26
S3_30m	7.04	21.69	6.86	21.67	-0.02	-0.18
S4_40m	5.60	21.54	5.46	21.53	-0.01	-0.14
S5_50m	4.72	21.46	4.61	21.44	-0.02	-0.11
S6_60m	4.12	21.40	4.02	21.39	-0.01	-0.10
S7_70m	3.65	21.35	3.57	21.34	-0.01	-0.08
S8_80m	3.28	21.31	3.20	21.30	-0.01	-0.08
S9_90m	2.95	21.28	2.88	21.27	-0.01	-0.07
S10_100m	2.68	21.25	2.61	21.24	-0.01	-0.07
S11_110m	2.45	21.23	2.39	21.22	-0.01	-0.06
S12_120m	2.25	21.21	2.20	21.20	-0.01	-0.05
S13_130m	2.08	21.19	2.03	21.19	0.00	-0.05
S14_140m	1.94	21.18	1.89	21.17	-0.01	-0.05
S15_150m	1.81	21.16	1.77	21.16	0.00	-0.04
S16_160m	1.70	21.15	1.66	21.15	0.00	-0.04
S17_170m	1.60	21.14	1.56	21.14	0.00	-0.04
S18_180m	1.50	21.13	1.47	21.13	0.00	-0.03
S19_190m	1.42	21.13	1.39	21.12	-0.01	-0.03
S20_200m	1.35	21.12	1.32	21.12	0.00	-0.03

Receptor ID	Do Minimum (2025)		Do Something (2025) B04bE01b		Difference between Do Something (B04bE01b) and Do Minimum Scenarios	
	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	% Change in Relation to lowest Critical Load Level for Darenth Wood SSSI
N1_10m	20.84	23.07	20.52	23.04	-0.03	-0.32
N2_20m	10.57	22.04	10.38	22.02	-0.02	-0.19
N3_30m	7.28	21.71	7.13	21.70	-0.01	-0.15
N4_40m	5.75	21.56	5.63	21.55	-0.01	-0.12
N5_50m	4.83	21.47	4.72	21.46	-0.01	-0.11
N6_60m	4.20	21.40	4.11	21.39	-0.01	-0.09
N7_70m	3.72	21.36	3.64	21.35	-0.01	-0.08
N8_80m	3.34	21.32	3.26	21.31	-0.01	-0.08
N9_90m	3.00	21.28	2.94	21.28	0.00	-0.06
N10_100m	2.72	21.26	2.66	21.25	-0.01	-0.06
N11_110m	2.48	21.23	2.43	21.23	0.00	-0.05
N12_120m	2.28	21.21	2.23	21.21	0.00	-0.05
N13_130m	2.11	21.19	2.06	21.19	0.00	-0.05
N14_140m	1.96	21.18	1.92	21.18	0.00	-0.04
N15_150m	1.83	21.17	1.79	21.16	-0.01	-0.04
N16_160m	1.71	21.15	1.68	21.15	0.00	-0.03
N17_170m	1.61	21.14	1.58	21.14	0.00	-0.03
N18_180m	1.52	21.14	1.49	21.13	-0.01	-0.03
N19_190m	1.44	21.13	1.40	21.12	-0.01	-0.04
N20_200m	1.36	21.12	1.33	21.12	0.00	-0.03

7.7.13 The results in Table 7-20 show that the N total deposition rates in the Opening Year scenarios are above the UNECE critical load range of 10-20kg/N/ha/year, both with and without the Project. There are no predicted increases of N total deposition rates, all N total deposition rates are predicted to either have no change or a minor decrease. Therefore, there are no predicted changes in total N deposition rates as a result of the Project.

7.7.14 The predicted NOx concentrations for the Do Minimum and Do Something (B04bE01b) scenarios in the Opening Year (2025) at Darenth Wood SSSI as predicted from the DMRB modelling are presented in Table 7-21.

Table 7-21 Verified Modelled NOx Concentrations at Darenth Wood SSSI for B04bE01b

Receptor ID	Do Minimum (2025)		Do Something (2025) B04bE01b		Difference between Do Something (B04bE01b) and Do Minimum Scenarios	
	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Total NOx Concen-tration (µg/m³)	% Change in Relation to Critical Level for Vegetation (30µg/m³)
S1_14m	**34.18**	**54.95**	**33.19**	**53.95**	-1.00	-3.32
S2_20m	21.69	**42.46**	21.10	**41.86**	-0.60	-1.98
S3_30m	14.79	**35.56**	14.41	**35.17**	-0.39	-1.28
S4_40m	11.65	**32.41**	11.35	**32.12**	-0.29	-0.99
S5_50m	9.77	**30.53**	9.52	**30.29**	-0.24	-0.81
S6_60m	8.49	29.26	8.28	29.05	-0.21	-0.70
S7_70m	7.51	28.27	7.32	28.09	-0.18	-0.62
S8_80m	6.72	27.49	6.56	27.32	-0.17	-0.55
S9_90m	6.04	26.81	5.89	26.66	-0.15	-0.49
S10_100m	5.47	26.24	5.34	26.10	-0.14	-0.45
S11_110m	4.99	25.76	4.87	25.64	-0.12	-0.41
S12_120m	4.59	25.35	4.47	25.24	-0.11	-0.37
S13_130m	4.24	25.01	4.14	24.90	-0.11	-0.34
S14_140m	3.94	24.70	3.84	24.61	-0.09	-0.32
S15_150m	3.67	24.44	3.59	24.35	-0.09	-0.30
S16_160m	3.44	24.21	3.36	24.12	-0.09	-0.28
S17_170m	3.23	24.00	3.16	23.92	-0.08	-0.26
S18_180m	3.05	23.82	2.98	23.74	-0.08	-0.25
S19_190m	2.88	23.65	2.81	23.58	-0.07	-0.23
S20_200m	2.73	23.50	2.67	23.43	-0.07	-0.22
N1_10m	**48.79**	**69.55**	**47.91**	**68.68**	-0.87	-2.92
N2_20m	22.79	**43.55**	22.33	**43.10**	-0.45	-1.52
N3_30m	15.32	**36.09**	15.00	**35.76**	-0.33	-1.08
N4_40m	11.97	**32.74**	11.71	**32.48**	-0.26	-0.87
N5_50m	9.99	**30.76**	9.77	**30.54**	-0.22	-0.74
N6_60m	8.66	29.42	8.46	29.23	-0.19	-0.65
N7_70m	7.64	28.41	7.47	28.24	-0.17	-0.57
N8_80m	6.84	27.61	6.69	27.45	-0.16	-0.51

Receptor ID	Do Minimum (2025)		Do Something (2025) B04bE01b		Difference between Do Something (B04bE01b) and Do Minimum Scenarios	
	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Total NOx Concen-tration (µg/m³)	% Change in Relation to Critical Level for Vegetation (30µg/m³)
N9_90m	6.14	26.91	6.01	26.77	-0.14	-0.46
N10_100m	5.55	26.32	5.43	26.19	-0.13	-0.42
N11_110m	5.06	25.83	4.95	25.71	-0.12	-0.38
N12_120m	4.65	25.41	4.54	25.31	-0.10	-0.35
N13_130m	4.29	25.06	4.20	24.96	-0.10	-0.33
N14_140m	3.99	24.75	3.89	24.66	-0.09	-0.30
N15_150m	3.72	24.48	3.63	24.40	-0.08	-0.28
N16_160m	3.48	24.25	3.40	24.17	-0.08	-0.27
N17_170m	3.27	24.03	3.19	23.96	-0.07	-0.25
N18_180m	3.08	23.85	3.01	23.78	-0.07	-0.24
N19_190m	2.91	23.68	2.84	23.61	-0.07	-0.22
N20_200m	2.76	23.52	2.69	23.46	-0.06	-0.21

Bold font indicates NOx concentration exceeds AQS objective of 30µg/m³ for vegetation at associated receptor.

7.7.15 The results in Table 7-21 show that the NOx concentrations exceed the AQS Objective for vegetation (30µg/m³) at a distance of up to 50 metres from the road centre line in the Do Minimum and Do Something scenarios.

7.7.16 The difference in NOx concentrations between the Do-Minimum and Do-Something scenarios, as presented in Table 7-21, are small. In the Do Something Scenario for B04bE01b, total NOx concentrations at distances closer to the road are predicted to be marginally lower than the Do Minimum Scenario, for both the north and south sides.

B05E01b

7.7.17 In accordance with guidance outlined in DMRB, potential air quality impacts relating to the proposed option were assessed at a total of 35 representative receptors, which were selected at sites located within 200 metres of the associated ARN. The localised study area is presented in Figure 7.4.

7.7.18 Table 7-22 details the annual mean PM_{10} concentrations predicted by the DMRB air quality model at all receptors for the Do Minimum scenario and the Do Something scenario (B05E01b) and

reflects the change in mean annual PM_{10} concentrations projected for 2025 between the Do Minimum and Do Something.

Table 7-22 Predicted Annual PM10 Concentrations at Receptors within 200 Metres of Affected Road Network for B05E01b

Receptor ID	Receptor Co-ordinates		2025 Annual Mean PM_{10} Concentrations (µg/m³)		Difference between Projected Do Minimum and Do Something (B05E01b) Concentration
	X (m)	Y (m)	Do Minimum	Do Something (B05E01b)	
R1	555866	173352	21.5	21.4	-0.1
R2	556813	173443	20.8	20.8	0.0
R3	556406	172145	21.1	21.1	0.0
R4	556394	172322	21.0	21.0	0.0
R5	558620	172774	23.1	n/a	n/a
R6	558596	172815	22.1	n/a	n/a
R7	558664	172638	23.2	22.8	-0.4
R7a	558675	172619	22.5	22.4	-0.1
R8	558979	172883	21.1	20.7	-0.4
R9	559316	172765	21.0	20.5	-0.5
R10	558735	172409	20.3	20.5	0.2
R11	561422	172724	22.0	22.0	0.0
R12	561513	172717	21.5	21.9	0.4
R13	562207	172332	20.3	20.3	0.0
R14	562490	172139	19.6	19.6	0.0
R15	561373	171955	18.1	18.1	0.0
R16	560712	171600	17.4	17.3	-0.1
R17	562618	172526	19.5	19.5	0.0
R18	562324	172589	20.6	20.6	0.0
R19	562283	173072	18.4	18.3	-0.1
R20	563280	172883	17.7	17.6	-0.1
R21	558394	174970	19.9	19.9	0.0
R22	553771	172319	20.3	20.3	0.0
R23	553167	172545	20.6	20.6	0.0
R24	555624	173392	22.5	22.5	0.0
R25	555667	173214	21.2	21.2	0.0
R26	558808	172335	20.7	20.7	0.0
R27	558717	172534	20.9	20.6	-0.3
R28	559366	172711	20.7	20.6	-0.1
R29	566158	170293	20.2	20.2	0.0
R30	566149	170421	20.2	20.2	0.0
R31	558111	174991	22.2	22.2	0.0
R32	556793	173378	19.9	19.9	0.0

Receptor ID	Receptor Co-ordinates		2025 Annual Mean PM_{10} Concentrations (µg/m³)		Difference between Projected Do Minimum and Do Something (B05E01b) Concentration
	X (m)	Y (m)	Do Minimum	Do Something (B05E01b)	
R33	561502	174682	18.7	18.7	0.0
R34	561340	174928	18.0	18.0	0.0
R35	559346	172855	20.9	20.7	-0.2

7.7.19 Table 7-23 details the annual mean NO_2 concentrations predicted by the DMRB air quality model at all receptors for the Do Minimum scenario and the Do Something scenario (Option 5) and reflects the change in mean annual NO_2 concentrations projected for 2025 between the Do Minimum and Do Something.

Table 7-23 Predicted Annual NO2 Concentrations at Receptors within 200 Metres of Affected Road Network for B05E01b

Receptor ID	Receptor Co-ordinates		LTT Adjusted 2025 Annual Mean NO_2 Concentrations (µg/m³) [1]		Difference between Projected Do Minimum and Do Something (B05E01b) Concentration [2]
	X (m)	Y (m)	Do Minimum	Do Something (B05E01b)	
R1	555866	173352	27.5	27.3	-0.2
R2	556813	173443	23.2	23.2	0.0
R3	556406	172145	27.3	27.3	0.0
R4	556394	172322	25.7	25.8	0.1
R5	558620	172774	31.5	n/a	n/a
R6	558596	172815	27.1	n/a	n/a
R7	558664	172638	32.3	29.4	-2.9
R7a	558675	172619	29.7	27.9	-1.8
R8	558979	172883	23.4	22.5	-0.9
R9	559316	172765	25.4	24.4	-1.0
R10	558735	172409	20.2	20.8	0.6
R11	561422	172724	29.6	30.6	1.0
R12	561513	172717	27.1	28.1	1.0
R13	562207	172332	24.5	24.5	0.0
R14	562490	172139	22.0	22.0	0.0
R15	561373	171955	14.2	14.2	0.0
R16	560712	171600	15.5	15.4	-0.1
R17	562618	172526	19.6	19.6	0.0
R18	562324	172589	23.4	23.3	-0.1
R19	562283	173072	19.4	19.3	-0.1
R20	563280	172883	17.7	17.6	-0.1
R21	558394	174970	23.8	23.9	0.1
R22	553771	172319	28.7	28.8	0.1

Receptor ID	Receptor Co-ordinates		LTT Adjusted 2025 Annual Mean NO_2 Concentrations (µg/m³) [1]		Difference between Projected Do Minimum and Do Something (B05E01b) Concentration [2]
	X (m)	Y (m)	Do Minimum	Do Something (B05E01b)	
R23	553167	172545	29.7	29.8	0.1
R24	555624	173392	33.4	33.3	-0.1
R25	555667	173214	30.7	30.7	0.0
R26	558808	172335	21.3	21.2	-0.1
R27	558717	172534	22.4	21.0	-1.4
R28	559366	172711	26.7	26.8	0.1
R29	566158	170293	23.2	23.3	0.1
R30	566149	170421	22.7	22.8	0.1
R31	558111	174991	29.2	29.3	0.1
R32	556793	173378	20.8	20.7	-0.1
R33	561502	174682	22.5	22.4	-0.1
R34	561340	174928	20.4	20.3	-0.1
R35	559346	172855	24.0	23.5	-0.5

[1] LTT=Long Term Trend. Predicted NO_2 concentrations were adjusted using a Gap Factor based on the long term adjustment factor calculated by the Highways England's "INTERIM Highways Agency Alternative Long Term Gap Analysis Calculator v1.1". All values reflect predicted concentrations for the future year 2025.

[2] Bold font indicates projected changes in mean annual NO_2 concentration between Do Minimum and Do Something options were greater than 2 µg/m³ at associated receptor.

Potential Future Exceedances of Air Quality Strategy NO_2 Objectives

7.7.20 Impacts of B05E01b on local air quality were evaluated by determining the number of the worst case receptors likely to result in an improvement or deterioration in air quality and the associated risk of exceeding the annual NO_2 AQS objective criteria in a future assessment (acknowledging that this assessment is limited to the information available at the time of the assessment).

7.7.21 For B05E01b, the largest predicted change in mean annual NO_2 concentration occurred at receptor R7 (located at Hope Cottages on Bean Road), which showed a predicted decrease of 2.9µg/m³, as a result of a decrease in flows on these roads.

7.7.22 All concentrations are predicted to be well below 40µg/m³, with the highest concentration predicted to be 33.3µg/m³ at R24, which indicates there are unlikely to be any exceedances of AQS objective criteria as a result of the option.

B05E01b Designated Site Assessment

7.7.23 The predicted nitrogen deposition rates for the Do Minimum and Do Something (B05E01b) scenarios in the Opening Year (2025) at Darenth Wood SSSI as predicted from the DMRB modelling are presented in Table 7-24.

Table 7-24 Verified Modelled N Dry Deposition Rates at Darenth Wood SSSI for B05E01b

Receptor ID	Do Minimum (2025)		Do Something (2025) B05E01b		Difference between Do Something (B05E01b) and Do Minimum Scenarios	
	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	% Change in Relation to lowest Critical Load Level for Darenth Wood SSSI
S1_14m	15.30	22.51	15	22.51	0.00	-0.07
S2_20m	10.10	21.99	10.06	21.99	0.00	-0.04
S3_30m	7.04	21.69	7.01	21.68	-0.01	-0.03
S4_40m	5.60	21.54	5.57	21.54	0.00	-0.03
S5_50m	4.72	21.46	4.7	21.45	-0.01	-0.02
S6_60m	4.12	21.40	4.11	21.39	-0.01	-0.01
S7_70m	3.65	21.35	3.64	21.35	0.00	-0.01
S8_80m	3.28	21.31	3.27	21.31	0.00	-0.01
S9_90m	2.95	21.28	2.94	21.28	0.00	-0.01
S10_100m	2.68	21.25	2.67	21.25	0.00	-0.01
S11_110m	2.45	21.23	2.44	21.23	0.00	-0.01
S12_120m	2.25	21.21	2.24	21.21	0.00	-0.01
S13_130m	2.08	21.19	2.08	21.19	0.00	0.00
S14_140m	1.94	21.18	1.93	21.18	0.00	-0.01
S15_150m	1.81	21.16	1.8	21.16	0.00	-0.01
S16_160m	1.70	21.15	1.69	21.15	0.00	-0.01
S17_170m	1.60	21.14	1.59	21.14	0.00	-0.01
S18_180m	1.50	21.13	1.5	21.13	0.00	0.00
S19_190m	1.42	21.13	1.42	21.13	0.00	0.00
S20_200m	1.35	21.12	1.34	21.12	0.00	-0.01
N1_10m	20.84	23.07	20.55	23.04	-0.03	-0.29
N2_20m	10.57	22.04	10.37	22.02	-0.02	-0.20
N3_30m	7.28	21.71	7.13	21.70	-0.01	-0.15
N4_40m	5.75	21.56	5.64	21.55	-0.01	-0.11
N5_50m	4.83	21.47	4.74	21.46	-0.01	-0.09

Receptor ID	Do Minimum (2025)		Do Something (2025) B05E01b		Difference between Do Something (B05E01b) and Do Minimum Scenarios	
	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Increase in N Dry Deposition Rate due to Road (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	Total N Deposition Rate (kg N/ha/year)	% Change in Relation to lowest Critical Load Level for Darenth Wood SSSI
N6_60m	4.20	21.40	4.12	21.40	0.00	-0.08
N7_70m	3.72	21.36	3.65	21.35	-0.01	-0.07
N8_80m	3.34	21.32	3.28	21.31	-0.01	-0.06
N9_90m	3.00	21.28	2.95	21.28	0.00	-0.05
N10_100m	2.72	21.26	2.68	21.25	-0.01	-0.04
N11_110m	2.48	21.23	2.45	21.23	0.00	-0.03
N12_120m	2.28	21.21	2.25	21.21	0.00	-0.03
N13_130m	2.11	21.19	2.08	21.19	0.00	-0.03
N14_140m	1.96	21.18	1.93	21.18	0.00	-0.03
N15_150m	1.83	21.17	1.81	21.16	-0.01	-0.02
N16_160m	1.71	21.15	1.69	21.15	0.00	-0.02
N17_170m	1.61	21.14	1.59	21.14	0.00	-0.02
N18_180m	1.52	21.14	1.5	21.13	-0.01	-0.02
N19_190m	1.44	21.13	1.42	21.13	0.00	-0.02
N20_200m	1.36	21.12	1.35	21.12	0.00	-0.01

7.7.1 The results in Table 7-23 show that the N total deposition rates in the Opening Year scenarios are above the UNECE critical load range of 10-20kg/N/ha/year, both with and without the Project. There are no predicted increases of N total deposition rates, all N total deposition rates are predicted to either have no change or a minor decrease. Therefore, there are no predicted changes in total N deposition rates as a result of the Project.

7.7.2 The predicted NOx concentrations for the Do Minimum and Do Something (B05E01b) scenarios in the Opening Year (2025) at Darenth Wood SSSI as predicted from the DMRB modelling are presented in Table 7-25.

Table 7-25 Verified Modelled NOx Concentrations at Darenth Wood SSSI for B05E01b

Receptor ID	Do Minimum (2025)		Do Something (2025) B05E01b		Difference between Do Something (B05E01b) and Do Minimum Scenarios	
	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Total NOx Concen-tration (µg/m³)	% Change in Relation to Critical Level for Vegetation (30µg/m³)
S1_14m	**34.18**	**54.95**	**34.02**	**54.79**	-0.16	-0.55
S2_20m	21.69	**42.46**	21.59	**42.36**	-0.10	-0.32
S3_30m	14.79	**35.56**	14.73	**35.49**	-0.07	-0.21
S4_40m	11.65	**32.41**	11.60	**32.36**	-0.05	-0.16
S5_50m	9.77	**30.53**	9.73	**30.49**	-0.04	-0.13
S6_60m	8.49	29.26	8.46	29.22	-0.04	-0.11
S7_70m	7.51	28.27	7.48	28.24	-0.03	-0.10
S8_80m	6.72	27.49	6.69	27.46	-0.03	-0.09
S9_90m	6.04	26.81	6.02	26.78	-0.03	-0.08
S10_100m	5.47	26.24	5.45	26.21	-0.03	-0.07
S11_110m	4.99	25.76	4.97	25.74	-0.02	-0.07
S12_120m	4.59	25.35	4.57	25.33	-0.02	-0.06
S13_130m	4.24	25.01	4.22	24.99	-0.02	-0.06
S14_140m	3.94	24.70	3.92	24.69	-0.01	-0.05
S15_150m	3.67	24.44	3.66	24.43	-0.01	-0.05
S16_160m	3.44	24.21	3.43	24.19	-0.02	-0.04
S17_170m	3.23	24.00	3.22	23.99	-0.01	-0.04
S18_180m	3.05	23.82	3.04	23.80	-0.02	-0.04
S19_190m	2.88	23.65	2.87	23.64	-0.01	-0.04
S20_200m	2.73	23.50	2.72	23.49	-0.01	-0.04
N1_10m	**48.79**	**69.55**	**47.98**	**68.74**	-0.81	-2.70
N2_20m	22.79	**43.55**	22.31	**43.08**	-0.47	-1.58
N3_30m	15.32	**36.09**	15.00	**35.77**	-0.32	-1.07
N4_40m	11.97	**32.74**	11.74	**32.50**	-0.24	-0.79
N5_50m	9.99	**30.76**	9.80	**30.56**	-0.20	-0.64
N6_60m	8.66	29.42	8.48	29.25	-0.17	-0.58
N7_70m	7.64	28.41	7.50	28.26	-0.15	-0.48
N8_80m	6.84	27.61	6.72	27.49	-0.12	-0.41
N9_90m	6.14	26.91	6.04	26.81	-0.10	-0.35

Receptor ID	Do Minimum (2025)		Do Something (2025) B05E01b		Difference between Do Something (B05E01b) and Do Minimum Scenarios	
	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Increase in NOx due to Road (µg/m³)	Total NOx Concen-tration (µg/m³)	Total NOx Concen-tration (µg/m³)	% Change in Relation to Critical Level for Vegetation (30µg/m³)
N10_100m	5.55	26.32	5.46	26.23	-0.09	-0.30
N11_110m	5.06	25.83	4.98	25.75	-0.08	-0.26
N12_120m	4.65	25.41	4.58	25.35	-0.06	-0.23
N13_130m	4.29	25.06	4.23	25.00	-0.06	-0.21
N14_140m	3.99	24.75	3.93	24.70	-0.05	-0.19
N15_150m	3.72	24.48	3.67	24.43	-0.05	-0.17
N16_160m	3.48	24.25	3.43	24.20	-0.05	-0.15
N17_170m	3.27	24.03	3.23	23.99	-0.04	-0.14
N18_180m	3.08	23.85	3.04	23.81	-0.04	-0.13
N19_190m	2.91	23.68	2.88	23.64	-0.04	-0.12
N20_200m	2.76	23.52	2.72	23.49	-0.03	-0.11

Bold font indicates NOx concentration exceeds AQS objective of 30µg/m³ for vegetation at associated receptor.

7.7.3 The results in Table 7-25 show that the NOx concentrations exceed the AQS Objective for vegetation (30µg/m³) at a distance of up to 50 metres from the road centre line in the Do Minimum and Do Something scenarios.

7.7.4 The difference in NOx concentrations between the Do-Minimum and Do-Something scenarios, as presented in Table 7-25, are small. In the Do Something Scenario for B04bE01b, total NOx concentrations at distances closer to the road are predicted to be marginally lower than the Do Minimum Scenario, for both the north and south sides.

7.8 Significance of Effect (Including Cumulative Effects)

7.8.1 The results of the DMRB air quality model assessment predicted concentrations for all pollutants well below the AQS Objectives both with and without the options at all representative receptor locations. The options are therefore unlikely to lead to a significant impact on air quality in accordance with IAN 174/13. There is also unlikely to be a risk in regards to compliance with the EU Limit Values in accordance with IAN175/13 based on Defra's latest predictions that they have reported to the European Commission.

7.9 Limitations of Assessment

7.9.1 Uncertainty in modelling predictions can be associated with a variety of factors, including:

- Model uncertainty - due to model limitations;
- Data uncertainty - due to errors in input data, including emission estimates and operational procedures; and,
- Variability - randomness of measurements used.

7.9.2 Potential uncertainties in model results were minimised as far as practicable. This included the following:

- Results have been verified to ensure predictions are as accurate as possible;
- An LTT gap analysis was carried out for NO_2, in accordance with IAN 170/12v3 to account for uncertainty in projection factors;
- Background concentrations have been obtained from the Defra website and are considered suitable for an assessment of this nature; and
- Receptor points were included at worst case sensitive locations to predict pollutant concentrations.

7.9.3 It should be noted that this assessment has been completed in order to indicate the potential of there being any significant differences in the options in terms of air quality impacts and the potential for the AQS objectives being exceeded. The air quality assessment is based on the DMRB air quality model which is considered appropriate and proportionate at this stage of the Scheme development. The Scheme is however located close to a complex junction and as such ADMS (roads) would be utilised in the assessment of the preferred option.

7.9.4 It must also be noted that this assessment has been undertaken based on the traffic data available for the options appraisal. The traffic modelling is to be updated for future stages of the scheme development so the assessment and the air quality assessment will be re-assessed as outlined in section 4.3.1 for Stage 2.

7.9.5 Additionally, it would be expected that the base year traffic will be updated from 2009 to a more up to date year. This re-basing of the traffic model is likely to produce traffic data which is different to the base year traffic data used in the options appraisal. Different base year would have two main impacts on the air quality assessment. Firstly, the base year is a key variable when calculating the 'gap factor' as part of IAN 170/12v3 (please refer to paragraph 7.2.12), therefore if the base year traffic data changes the gap factors will be affected, which in turn would affect the total predicted concentrations. Secondly, the base year traffic dataset is used as the basis of the air quality model verification whereby observed concentrations in the base year are compared against modelled concentrations (calculated from the base year traffic dataset).

7.9.6 Defra periodically update their emissions projections that dictate the emissions rates embedded in the DMRB air quality model and in Defra tools used in the assessment such as the background maps. It is understood that new emissions factors are due to be released, therefore the results in this assessment are subject to change.

7.10 Summary

7.10.1 This section of the Chapter draws together the results of the assessment of the 3 Route Options, namely Route Options B03E01b, B04bE01b and B05E01b.

7.10.2 Within all three options considered, no NO_2 or PM_{10} concentrations were predicted to exceed the AQS Objectives at any of the worst case receptors modelled.

7.10.3 The largest predicted increase in concentrations at any of the options was 2.1µg/m^3 (NO_2) which occurred in B04bE01b at R10 (located in close proximity to Bean Road), due to the alignment of the new roundabout associated with this option. It should be noted that concentrations increased at this receptor in all three options considered.

7.10.4 The option which resulted in the greatest number of receptors predicted to experience a deterioration in air quality was B03E01b (13 deteriorating receptors for B03E01b, 8 for B04bE01b and 11 for B05E01b). B05E01b had the largest number of receptors with an improvement in air quality (15 improving receptors for B03E01b, 11 for B04bE01b and 16 for B05E01b).

7.10.5 Modelled concentrations in the Do Minimum and Do Something Scenarios showed that NO_2 and PM_{10} concentrations were well below the AQS Objectives indicating the options are unlikely to lead to significant impacts on air quality.

7.10.6 Results for the three options are summarised in Table 7-26. However, based on the current assessment none of the options are likely to lead to a significant impact on air quality or impact on compliance with the EU Directive. Therefore, in line with the NN NPS air quality would not require substantive weight to be attached in relation to whether the Scheme would receive consent.

Table 7-26 Summary of significant effect, mitigation proposed and residual effects on Air Quality

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
B03E01b					
Air Quality	4 **Amber / Green**	The Scheme is not predicted to cause any exceedances of the AQS objectives for NO_2 and PM_{10}. Additionally, there are no receptors in exceedance which increase in concentration as a result of the Scheme. All 'with Scheme' concentrations at receptors are well below the annual mean AQS objectives for NO_2 and PM_{10}. 13 receptors would have an increase in concentrations with the Scheme, and 15 receptors would have a decrease with the Scheme. No significant impacts at ecological receptors.	Compliance reported to EU by Defra. Government AQS objectives	Operational Phase: At this stage mitigation is unlikely as no significant impacts are predicted. The assessment would be further refined at future stages to incorporate updated traffic data etc.	Adjacent developments have been taken into account in the traffic data.
B04bE01b					
Air Quality	4 **Amber / Green**	The Scheme is not predicted to cause any exceedances of the AQS objectives for NO_2 and PM_{10}. Additionally, there are no receptors in exceedance which increase in	Compliance reported to EU by Defra.	Operational Phase: At this stage mitigation is unlikely as no significant impacts are predicted. The assessment would be further refined at	Adjacent developments have been taken into account in the traffic data.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
		concentration as a result of the Scheme. All 'with Scheme' concentrations at receptors are well below the annual mean AQS objectives for NO_2 and PM_{10}. 8 receptors would have an increase in concentrations with the Scheme, and 11 receptors would have a decrease with the Scheme. No significant impacts at ecological receptors.	Government AQS objectives	future stages to incorporate updated traffic data etc.	
B05E01b					
Air Quality	4 **Amber / Green**	The Scheme is not predicted to cause any exceedances of the AQS objectives for NO_2 and PM_{10}. Additionally, there are no receptors in exceedance which increase in concentration as a result of the Scheme. All 'with Scheme' concentrations at receptors are well below the annual mean AQS objectives for NO_2 and PM_{10}. 11 receptors would have an increase in concentrations with the Scheme,	Compliance reported to EU by Defra. Government AQS objectives	Operational Phase: At this stage mitigation is unlikely as no significant impacts are predicted. The assessment would be further refined at future stages to incorporate updated traffic data etc.	Adjacent developments have been taken into account in the traffic data.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
		and 16 receptors would have a decrease with the Scheme. No significant impacts at ecological receptors.			

8 Noise and Vibration

8.1 Introduction & Study Area

8.1.1 This chapter of the EAR presents the findings of the noise assessment undertaken to consider the three Scheme Options. Summary findings are presented in Section 8.10.

8.1.2 This chapter should be read in conjunction with Figure 8.1.

8.1.3 It sets out the methodology used to establish existing and future baseline information, considers potentially affected receptors, identifies noise sources, and assesses environmental design measures and predicted residual effects.

Study Area

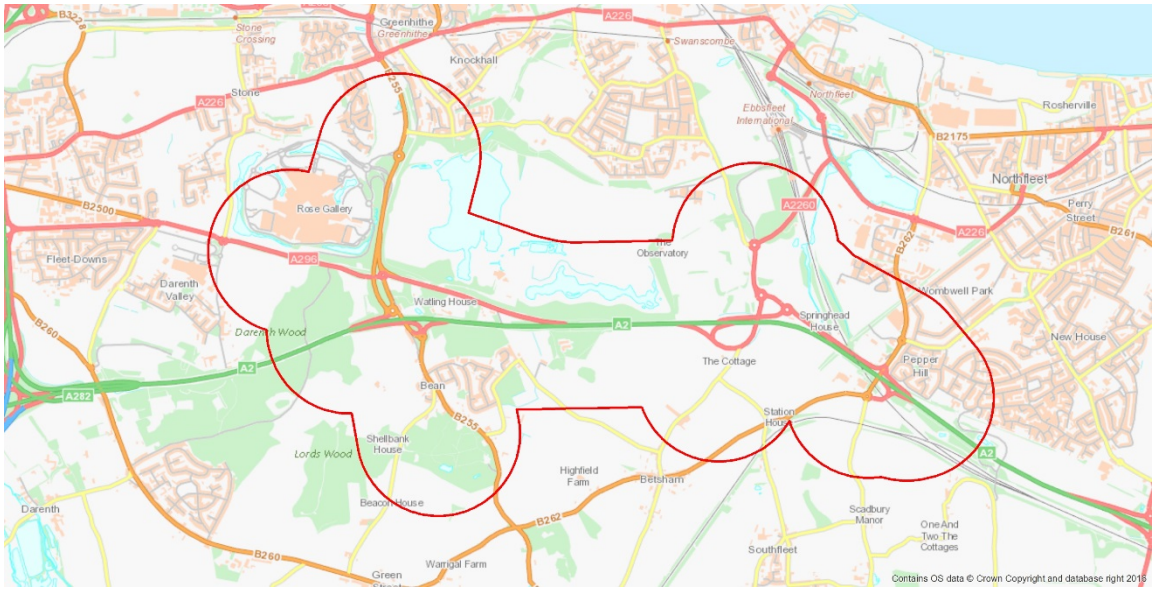
8.1.4 The study area used within the scope of the study has been defined in accordance with DMRB Volume 11, Section 3, Part 7, HD 213/11 (HD213/11) (Ref 8-1) by the following process, as presented in Table 8-1.

Table 8-1 Determining Road Traffic Noise Study Area (Modified from DMRB Vol 11, Section 3, Part 7, HD 213/11)

A	Identify the start and end points of the physical works associated with the road project.
B	Identify the existing routes that are being bypassed or improved, and any proposed new routes, between the start and end points.
C	Define a boundary one kilometre from the carriageway edge of the routes identified in (B) above.
D	Define a boundary 600m from the carriageway edge around each of the routes identified in (B) above and also 600m from any other affected routes within the boundary defined in (C) above. The total area within these 600m boundaries is termed the 'calculation area'. An affected route is one where there is the possibility of a change of 1dB(A) or more between the Do Minimum and Do Something scenarios in the short-term or 3dB(A) or more in the long term.

8.1.5 The Study Area for the noise assessment is presented within Insert 8-1 below and accounts for a total of 2,257 residential dwellings and 3 identified other sensitive receptors. The other sensitive receptors identified in the DMRB defined Study Area are listed to below:

- Bean Primary School;
- Hasington Residential Home; and,
- Rosewood (Care Home Facility).



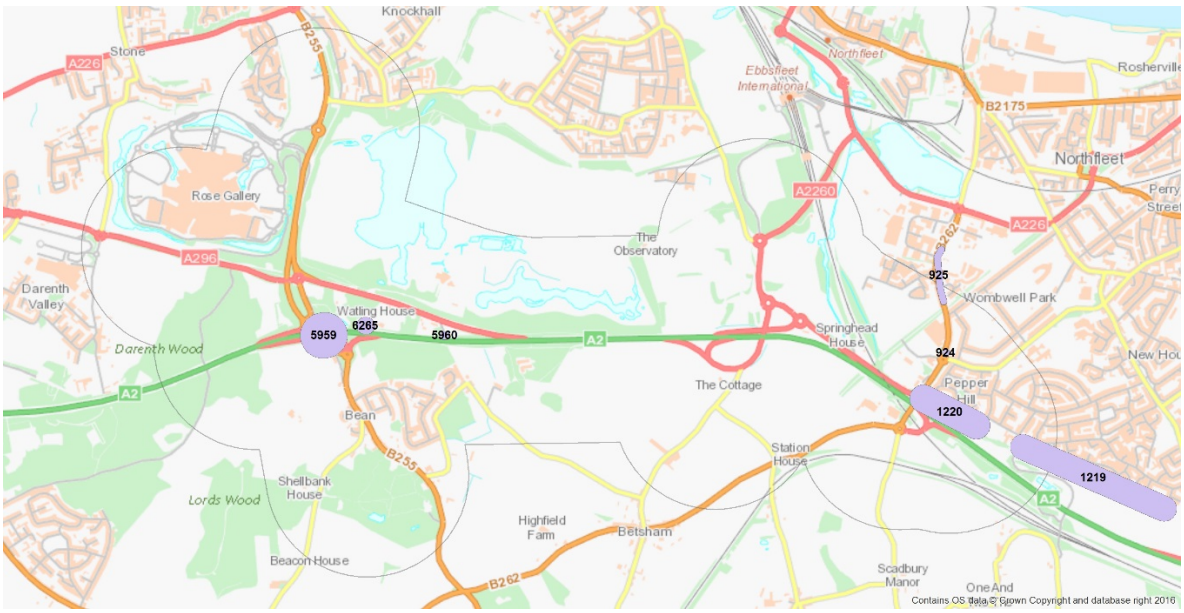
Insert 8-1 Noise Study area

8.1.6 DEFRA Noise Important Areas (which are identified as areas where the 1% of people that are affected by the highest noise levels reside, as identified by the strategic noise mapping) have been considered within the vicinity of the proposed Scheme.

8.1.7 These DEFRA Noise Important Areas (NIA) have been identified within the vicinity of the Scheme as below:

A2 (between Bean and Ebbsfleet)	DEFRA NIA ref: 5959 DEFRA NIA ref: 6265 DEFRA NIA ref: 5960
B262	DEFRA NIA ref: 924 DEFRA NIA ref: 925
Roman Road	DEFRA NIA ref: 1219 DEFRA NIA ref: 1220

8.1.8 The Noise Important Areas are presented in detail on the Defra Noise Action Plans as presented in Insert 8-2 and on Figure 8.1:



Insert 8-2 Noise important areas

8.2 Methodology

General Approach

8.2.1 The assessment methodology follows the guidance provided in DMRB / IAN 125/15 (Ref 8-2).

Consultation

8.2.2 At this stage no consultation has been undertaken. When a stage is reached where baseline monitoring will be undertaken consultation will be undertaken with the relevant authorities to agree a suitable methodology during Stage 2 and 3 of the EAR.

Establishing Baseline Conditions

8.2.3 On site baseline noise monitoring has not been considered to be required as part of this Route Option comparison. Baseline surveys would however, be undertaken as part of the Environmental Statement for the favoured Route Option where necessary under the requirements of the DMRB methodology.

8.2.4 The baseline road traffic noise climate within the area has been estimated for assessment purposes through predictive modelling, in line with DMRB assessment methodology.

8.2.5 As such the baseline road traffic noise climate, “Do minimum” Scenario, has been modelled, using the Department for Transport ‘Calculation of Road Traffic Noise’ (CRTN) (Ref 8-3) prediction method to calculate a dB $L_{A10,\ 18\ hour}$ value for the existing baseline road traffic noise contribution at identified sensitive receptors within the Study Area. This has been undertaken using the commercially available software package IMMI, and has been based upon traffic flow, speed and composition data provided by Traffic Engineers to the project.

Road Traffic Noise Predictions and Assumptions

8.2.6 As previously detailed, road traffic noise calculations have been undertaken in accordance with the CRTN (Ref 8-3) prediction methodology, which has been used to calculate a dB $L_{A10, 18\ hour}$ value for road traffic noise contribution at identified sensitive receptors within the Study Area (as defined within Section 8.1). Within the scope of this Route Option comparison study overnight road traffic noise levels have not been considered, as the assessment and consideration of daytime road traffic noise levels would be sufficient to inform the conclusion of the different noise impacts of the three Scheme options proposed.

8.2.7 Calculations have been undertaken using the commercially available noise modelling software IMMI, which has been validated to follow the prediction procedures set out in the CRTN document (Ref 8-3). At this stage of the Scheme design a spatially coarse model has been produced which does not account for topography or vertical alignment. However, it is considered that the level of detail within the noise model would be sufficient to inform the conclusion of the different noise impacts of the three Scheme options proposed.

8.2.8 Traffic data used in the assessment has been provided by the Traffic Engineers to the project, and contains the following data. Information has been provided for both the Opening Year (2015) and Future Assessment Year (2030) "Do-minimum" (without Scheme) and "Do-something" (with Scheme) scenarios on the basis of the following.

- 18 hour annual average weekday traffic (AAWT) flow;
- 18 hour average speed (kph); and
- Percentage HGV content of total 18 hour AAWT flow.

8.2.9 Residential receptors have been identified using Ordnance Survey post code point data, with all buildings within the noise model assumed to be an arbitrary height of 7m. Individual receptor (calculation) points have been assumed to be 4.0m above ground level as required by DMRB for situations where dwellings have a first floor.

8.2.10 All new/altered road surfaces in the opening year of the Scheme have been assumed to have a low noise surface with a correction of -2.5dB applied (for links with a speed in excess of 75kmph). In the future assessment year all roads within the study area have been assumed to have a low noise surface.

Magnitude of Impacts

8.2.11 The assessment methodology for the evaluation of the three Route Options has followed the 'Simple' assessment methodology outlined in DMRB (Ref 8-1).

8.2.12 At the DMRB 'Simple' level of assessment, the following two comparisons are required to be made in order to determine the impact of the Scheme in both the short term, and the long term. These comparisons have been undertaken separately for each of the considered Route Options.

- Do-minimum scenario in the baseline year (2025) against Do-something scenario in the baseline year (2025): short term impact comparison.
- Do-minimum scenario in the baseline year (2025) against Do-something scenario in the future assessment year (2041): long term impact comparison.

8.2.13 DMRB provides classifications for the magnitude of changes in predicted road traffic noise as outlined below.

- A change in road traffic noise of 1dB(A) (Do-minimum to Do-something in the baseline year) is the smallest that is considered perceptible in the short term.
- A change in road traffic noise of 3dB(A) (Do-minimum in the baseline year to Do-something in the future assessment year) is considered to be perceptible in the long term.

8.2.14 The magnitudes of impact in the short and long term are therefore considered differently within the DMRB methodology. For road traffic noise the classification of magnitude of change is reproduced from DMRB in Table 8-2 for both the short and long terms.

Table 8-2 Classification of Magnitude for Noise Impacts (Modified from DMRB Vol 11, Section 3, Part 7, HD 213/11)

Short Term Impact Classification	**Change Road Traffic Noise Level dB $L_{A10,18\ hour}$**	**Long Term Impact Classification**
No Change	0 dB	No Change
Negligible	> 0 dB and < 0.9 dB	Negligible
Minor	≥ 1 dB and < 2.9 dB	
Moderate	≥ 3 dB and < 4.9 dB	Minor
Major	≥ 5 dB and < 9.9 dB	Moderate
	≥ 10 dB	Major

8.3 Baseline Conditions

8.3.1 From a review of commercial mapping, and discussions with Engineers that have attended the site, it has been concluded that road traffic noise is likely to be the dominant source of noise within the study area. This is concluded due to the presence of the busy A2 Dual Carriageway which is one of the main routes in the area linking the busy port of Dover with Canterbury, Rochester and London, and on to the wider UK. As such the predictive quantification of the prevailing baseline road traffic noise climate of the area is considered to be representative.

8.3.2 However, once a final route option has been selected a full suite of onsite noise monitoring surveys will be undertaken across the Study Area to quantify the specific baseline noise climate. Noise monitoring locations will be agreed with the Environmental Health Departments at both Gravesham and Dartford at the time, and prior to monitoring taking place.

8.4 Value of Resource/Receptors

8.4.1 Exclusively residential dwellings have been considered in the assessment as they are of a high value in terms of noise change. Within the study area for all three Route Options, and including the other sensitive receptors a total of 2,260 receptors have been considered.

8.4.2 In addition, three other noise sensitive receptors (as defined within DMRB A1.13) have also been assessed, these are receptors which are non-residential yet still considered of a high value with

reference to noise change. The other sensitive receptors present within the Study Area, and the distance from the Scheme, are listed in Table 8-3 below.

Table 8-3 Noise sensitive receptors (as defined within DMRB A1.13)

Receptor	Type	Distance from Scheme (m)
Bean Primary School	School	730
Hasington Residential Home	Care Home	1460
Rosewood	Care Home	1560

8.5 Regulatory/Policy Framework

8.5.1 The Route Option comparison assessment has been undertaken in accordance with current national legislation, referencing national, regional and local plans and policies relating to noise and vibration where relevant in the context of the Scheme.

8.5.2 A summary of the relevant legislation and policies and the requirements of these policies has been provided in Table 8-4.

Table 8-4 Relevant Policy and Legislation

Policy / Legislation	Summary of Requirements
National	
Environmental Protection Act 1990 (Ref 8-4)	Under Part III of the Environmental Protection Act 1990 local authorities have a duty to investigate noise complaints from premises (land and buildings) and vehicles, machinery or equipment in the street. It does not apply to road traffic noise but may be applicable to some construction activities. The Noise and Statutory Nuisance Act 1993 amended Part III of the Environmental Protection Act 1990 by placing additional definitions in the list of statutory nuisances in Section 79 of the Environmental Protection Act. The definitions relate to nuisance caused by vehicles, machinery and equipment in the road.
Control of Pollution Act 1974 (Ref 8-5)	Section 60 and Section 61 of the Control of Pollution Act 1974 (Ref 2) cover noise and vibration from construction sites. Section 72 of the Act also empowers the Secretary of State to approve statutory Codes of Practice for the control of specific noise types, which local authorities and contractors can be expected to take into account. Section 60 of the Act allows local authorities to serve notices restricting the hours of operation and the plant that can be used on a construction site, and to set noise level limits for noise emitted from a construction site. Section 61 of the Act allows contractors to apply to a local authority for prior approval of construction works based on a description of the works and the measures that will be put in place to control noise and vibration impacts.
Land Compensation Act 1973 (Ref 8-6)	Part I of the Land Compensation Act provides a means by which compensation can be paid to owners of land or property which has experienced a loss in value caused by the use of public works, such as new or improved roads. Noise and vibration are two of the factors which would be considered in any claims for compensation, but the claim should consider all changes and effects, including betterment. Claims can be made under Part I of the Act from 1 to 7 years after the opening of a road project. However, consideration of the likely extent of claims may be made during the design phase of a road project following the completion of statutory processes.
The Noise Insulation Regulations 1975 (as amended 1988) (Ref 8-7)	The Noise Insulation Regulations (NIR) 1975 (amended 1988) provide criteria for assessing the eligibility for noise mitigation or properties based on variations in traffic noise due to a new or improved road project.

Policy / Legislation	Summary of Requirements
	Under Regulation 3 of the NIR, noise from a new or altered highway that conditionally exceeds 68dB $L_{A10,18\text{-hour}}$ requires a highway authority to make offers of insulation to eligible dwellings. The Regulations require an eligible building to possess all of the following criteria • A dwelling or a building used for residential purposes; • Within 300 m of the edge of a new or altered highway; • Occupied prior to the opening to traffic of the new or altered highway; • Not subject to a compulsory purchase or demolition order, or be within a clearance area; • Not receiving a grant for noise insulation work under any other statutory scheme; • By future assessment year the noise level at the façade of a dwelling reaches or exceeds 68 dB $L_{A10,18\text{-hour}}$; • By future assessment year the noise level is at least 1dB greater than the pre-Project level; and • Noise from the new or altered highway contribute at least 1dB to the overall noise level. In the case of noise from new or altered highways, the NIR provide certain mandatory and discretionary powers in relation to the provision of noise insulation to affected dwellings. In the situation where development leads to traffic growth on existing roads, where there would not be any physical change to the road, there is no obligation within the NIR to offer noise insulation where noise levels are raised.
National Networks National Policy Statement (2014) (Ref 8-8)	Paragraph 5.189 sets out the aspects that should be considered within the scope of any noise assessment necessary to support an Environmental Statement for any development where there is the potential for noise impacts to arise. The document further sets out appropriate guidance methodologies that should be followed in the prediction of road traffic noise. In addition, paragraph 5.195 states that The Secretary of State should not grant development consent unless satisfied that the proposals will meet the following aims within the context of Government policy on sustainable development: • Avoid significant adverse impacts on health and quality of life from noise as a result of the new development; • Mitigate and minimise other adverse impacts on health and quality of life from noise from the new development; and • Contribute to improvements to health and quality of life through the effective management and control of noise, where possible.
National Planning Policy Framework (NPPF) (8-9)	The NPPF determines the government's planning policy for development within England. Under the NPPF Planning policies and decisions should aim to: • Avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development; • Mitigate and reduce to a minimum other adverse impacts on health and quality of life arising from noise from new development, including through the use of conditions; • Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; • Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.
Noise Policy Statement for England (NPSE) (8-10)	The Noise Policy Statement for England (NPSE) covers all forms of noise other than occupational noise and serves to provide policy on the need to avoid and mitigate adverse noise effects on health arising from and impacting on new development. In line with the NPPF, the NPSE determines three aims:

Policy / Legislation	Summary of Requirements
	• Avoid significant adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. • Mitigate and minimise adverse impacts on health and quality of life from environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development. • Where possible, contribute to the improvement of health and quality of life through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development." For the purposes of this report "environmental noise" as defined within paragraph 2.5 of the NPSE is considered most relevant as it includes noise from transportation sources. The explanatory note to the NPSE introduces three concepts relating to the adverse impacts of noise. The following three statements have been reproduced from the explanatory note: • "NOEL – No Observed Effect Level: This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise." • "LOAEL – Lowest Observed Adverse Effect Level: This is the level above which adverse effects on health and quality of life can be detected" • "SOAEL – Significant Observed Adverse Effect Level: This is the level above which significant adverse effects on health and quality of life occur." The NPSE acknowledges that the values for NOEL, LOAEL and SOAEL are likely to vary depending on the noise source and environment and at present there are no defined numerical values to allow flexibility within the policy until further evidence and guidance is presented.
Local Policy	
Dartford Local Plan (Adopted 1995) (Ref 8-11)	The following factors will be taken into account in considering development proposals: (a) Proposed Use The nature and characteristics of the proposed use should be appropriate for its location and should not have a detrimental effect on the local area through visual impact, traffic generation, noise, fumes or other factors.
Gravesham Local Plan: Sustainability Appraisal (December 2012) (Ref 8-12)	SA Framework 8: Support sustainability objectives of the emerging Minerals Local Development Framework (for example with regard to habitat protection, transport, noise, water, air)
	5.76 It is important that the Local Plan supports the objectives of the key documents through the careful location of new development, managing demand and the use of planning obligations to secure improvements to public transport. Traffic congestion (and consequent effects on air quality, noise and greenhouse gas emissions) is one of the most important issues facing the Council in the preparation of its Local Plan.

8.6 Design, Mitigation and Enhancement Measures (including monitoring requirements)

8.6.1 At this stage of the Schemes design it would not be feasible to consider the implementation and detailed design of mitigation measures for all of the Route Options considered. As such mitigation and enhancement measures associated with the Scheme are not considered within the scope of this Chapter.

8.6.2 However, following the selection of a favoured Route Option consideration will be given to mitigation measures including, but not limited too; low noise surfacing and acoustic barriers. Where necessary these measures would be assessed and as appropriate incorporated into the Scheme design accounting for a project of this nature. This is in line with the NN NPS (Ref 8-8) which in paragraph 5.191 makes reference to operational noise with respect to human receptors and the consideration of mitigation.

8.7 Magnitude of Impacts & Significance of Effects

8.7.1 Within the scope of this assessment, three Route Options are being considered as defined within Section 2 of this document.

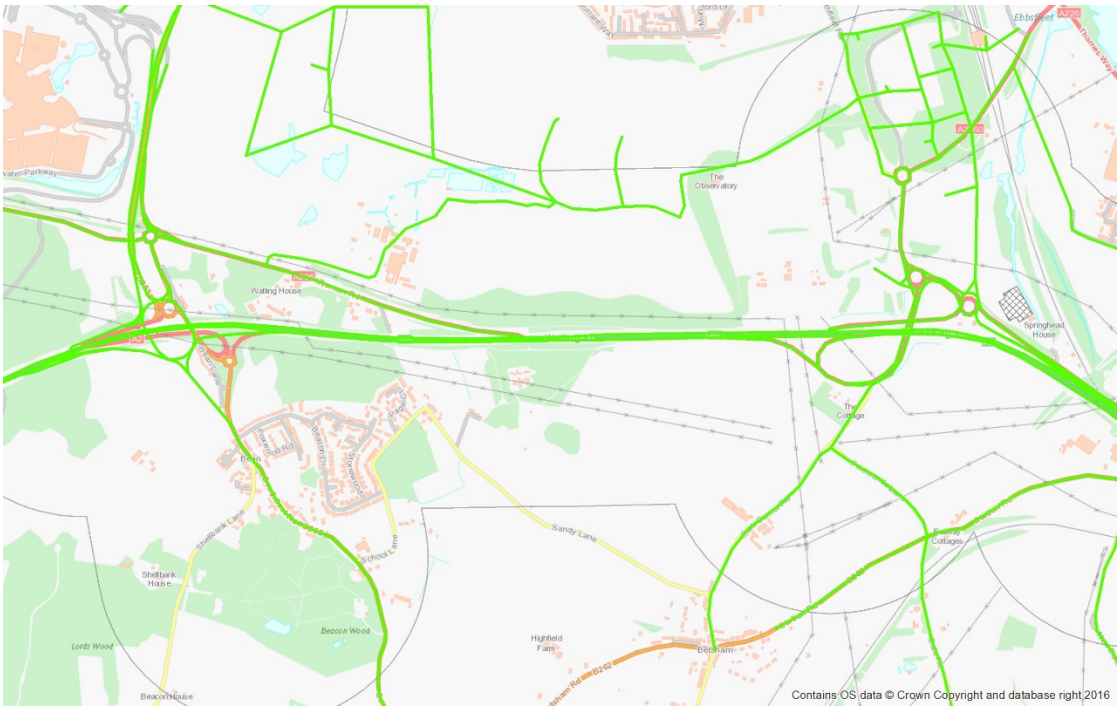
8.7.2 Whilst each of these options consists of a new/different online junction alignment at the Bean junction of the A2 (Bean Junction Options 3, 4b and 5), these are combined with only one junction option at the Ebbsfleet junction (Ebbsfleet Option 1b).

8.7.3 Each of these Route Options are considered individually below by virtue of both short term and long term impacts.

8.7.4 Assessment and consideration of the magnitude and significance of effects in both the short and long terms will be undertaken within the following sections in accordance with the DMRB rating scheme presented and discussed within Section 8.3 of this Chapter.

Route Option B03E01b

8.7.5 Option B03E01b consists of Bean Junction Option 3 combined with Ebbsfleet Junction Option 1b as detailed below:



Insert 8-3 Route Option B03E01b

8.7.6 This Route Option is assessed and considered below.

Short Term Impacts – Route Option B03E01b

8.7.7 To assess short term road traffic noise impacts associated with Option B03E01b a comparison has been made between the Do-minimum and Do-something scenarios in the opening year of 2025. This enables the consideration of abrupt changes in road traffic noise to be considered immediately following the opening of the Scheme.

8.7.8 A summary table of the predicted short term noise changes within the study area are provided in Table 8-5 below.

Table 8-5 Short Term Noise Impacts Option B03E01b

Change in Noise Level		**Number of Dwellings**	**Number of Other Sensitive Receptors**
Increase in noise level, LA10,18-hour	0.1 - 0.9	897	1
	1.0 - 2.9	38	0
	3 - 4.9	7	0
	>5	8	0
No Change	0	484	2
Decrease in noise level, LA10,18-hour	0.1 - 0.9	719	0
	1.0 - 2.9	54	0
	3 - 4.9	16	0
	>5	36	0

8.7.9 The following is concluded with regard to the information presented in Table 8-5 above, following the impact classification as shown in Table 8-2, based on the assumption that all receptors have a high sensitivity in the opening year of the Scheme:

- 484 dwellings and 2 other sensitive receptors are predicted to experience a 0.0dB change in road traffic noise in the short term as a result of Scheme Option 3. This would result in a short term impact classification of **no change**. The other sensitive receptors which fall into this banding are:
    - Heslington Care Home
    - Rosewood Care Home

- 897 dwellings and 1 other sensitive receptor are predicted to experience short term increases in road traffic noise of between 0.1dB to 0.9dB as a result of Scheme Option B31E. This would result in a short term impact classification of **negligible adverse**. The other sensitive receptors which fall into this banding are:
    - Bean Primary School

- 38 dwellings and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels of between 1.0dB to 2.9dB as a result of Scheme Option 3. This would result in a short term impact classification of **minor adverse**.

- 7 dwellings and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme

Option B03E01b. This would result in a short term impact classification of **moderate adverse**.

- 8 receptors are predicted to experience short term increases in road traffic noise levels above 5.0dB as a result of Scheme Option B03E01b, this would be classified as a **major adverse** impact at these receptors.

- 719 dwellings and no other sensitive receptor are predicted to experience short term decreases in road traffic noise levels of between 0.1dB to 0.9dB as a result of Scheme Option B03E01b. This would result in a short term impact classification of **negligible beneficial**.

- 54 dwellings and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 1.0dB to 2.9dB as a result of Scheme Option B03E01b. This would result in a short term impact classification of **minor beneficial**.

- 16 dwellings and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B03E01b. This would result in a short term impact classification of **moderate beneficial**.

- 36 dwelling and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of greater than 5.0dB in the short term as a result of Scheme Option B03E01b. This would result in a short term impact classification of **major beneficial**.

8.7.10 In the Opening Year of the Scheme (2025) sensitive receptors across the Study Area are predicted to experience short term changes in road traffic noise level within the range from 0.0dB to an increase of 0.2dB. These changes fall within the **No Change/Negligible** classification.

8.7.11 The change in predicted road traffic noise levels indicate that there would be 53 receptors which would experience a perceptible increase in short term road traffic noise of greater than 1dB in the opening year with Scheme Option B03E01b. There would 106 residential receptors which would experience a perceptible reduction in short term road traffic noise levels.

Table 8-6 Short Term Noise Impacts on Noise Important Areas Option B03E01b

Noise Important Areas	Short Term Change dB
NIA 5959	+0.3
NIA 6265	-0.4
NIA 5960	-0.2
NIA 925	-0.4
NIA 1220	+/-0
NIA 1219	-0.1
NIA 924	-0.2

8.7.12 The results presented in Table 8-6 for the identified DEFRA NIA within the Study Area conclude that with Route Option B03E01b there are no adverse changes in road traffic noise levels in the short term that exceed 1dB, which suggests that there are no detrimental effects of this Scheme

Option on these Noise Important Areas. This would be concluded to represent a short term impact classification of no greater than **negligible adverse**.

Long Term Impacts – Route Option B03E01b

8.7.13 To assess long term road traffic noise impacts associated with Option B03E01b a comparison has been made between the Do-minimum scenario in the opening year of 2025, and the Do-something scenario in the future assessment year of 2041.

8.7.14 This enables the consideration of longer term changes in road traffic noise to be considered associated with the Scheme.

Table 8-7 Long Term Noise Impacts Route Option B03E01b

Change in Noise Level		**Number of Dwellings**	**Number of Other Sensitive Receptors**
Increase in noise level, LA10,18-hour	0.1 - 2.9	13	0
	3.0 - 4.9	3	0
	5.0- 9.9	0	0
	>10	4	0
No Change	0	0	0
Decrease in noise level, LA10,18-hour	0.1 - 2.9	1923	1
	3.0 - 4.9	260	2
	5.0- 9.9	27	0
	>10	29	0

8.7.15 The following is concluded with regard to the long term assessment of daytime road traffic noise levels associated with Scheme Option B03E01b.

- No dwellings and no other sensitive receptor are predicted to experience a 0.0dB change in road traffic noise as a result of Scheme Option B03E01b.
- 13 dwellings and no other sensitive receptor are predicted to experience long term increases in road traffic noise of between 0.1dB to 2.9dB as a result of Scheme Option B03E01b. This would be concluded to represent a long term impact classification of **negligible adverse**.
- 3 dwellings and no other sensitive receptors are predicted to experience long term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B03E01b. This would be concluded to represent a long term impact classification of **minor adverse**.
- 4 receptors are predicted to experience increases in road traffic noise levels above 10dB in the long term as a result of Scheme Option B03E01b, this can be classified as a **major adverse** impact.
- 1,923 dwellings and 1 other sensitive receptor are predicted to experience long term decreases in road traffic noise levels of between 0.1dB to 2.9dB as a result of Scheme Option B03E01b. This would be concluded to represent a long term impact classification of **negligible beneficial**. The other sensitive receptor which falls into this banding is:
    - Bean Primary School
- 260 dwellings and 2 other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B03E01b. This would be concluded to represent a long term impact classification of **minor beneficial**. The other sensitive receptors which fall into this banding are:

    - Heslington Care Home
    - Rosewood Care Home
- 27 dwelling and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 5.0dB to 9.9dB as a result of Scheme Option B03E01b. This would be concluded to represent a long term impact classification of **moderate beneficial**.
- 29 dwelling and no other sensitive receptors are predicted to experience decreases in road traffic noise levels of greater than 10dB in the long term as a result of Scheme Option B03E01b. This would be concluded to represent a long term impact classification of **major beneficial**.

8.7.16 In the Future Assessment Year of the Scheme (2041) sensitive receptors across the Study Area are predicted to experience long term changes in road traffic noise level within the range from a decrease of -2dB to -3.3dB.

8.7.17 The change in predicted road traffic noise levels indicate that there would be 7 dwellings which would experience a perceptible increase in long term road traffic noise of greater than 3dB in the future assessment year with Scheme Option B03E01b. There would be 316 dwellings which would experience a perceptible reduction in long term road traffic noise levels.

Table 8-8 Long Term Noise Impacts on IA's Option B03E01b

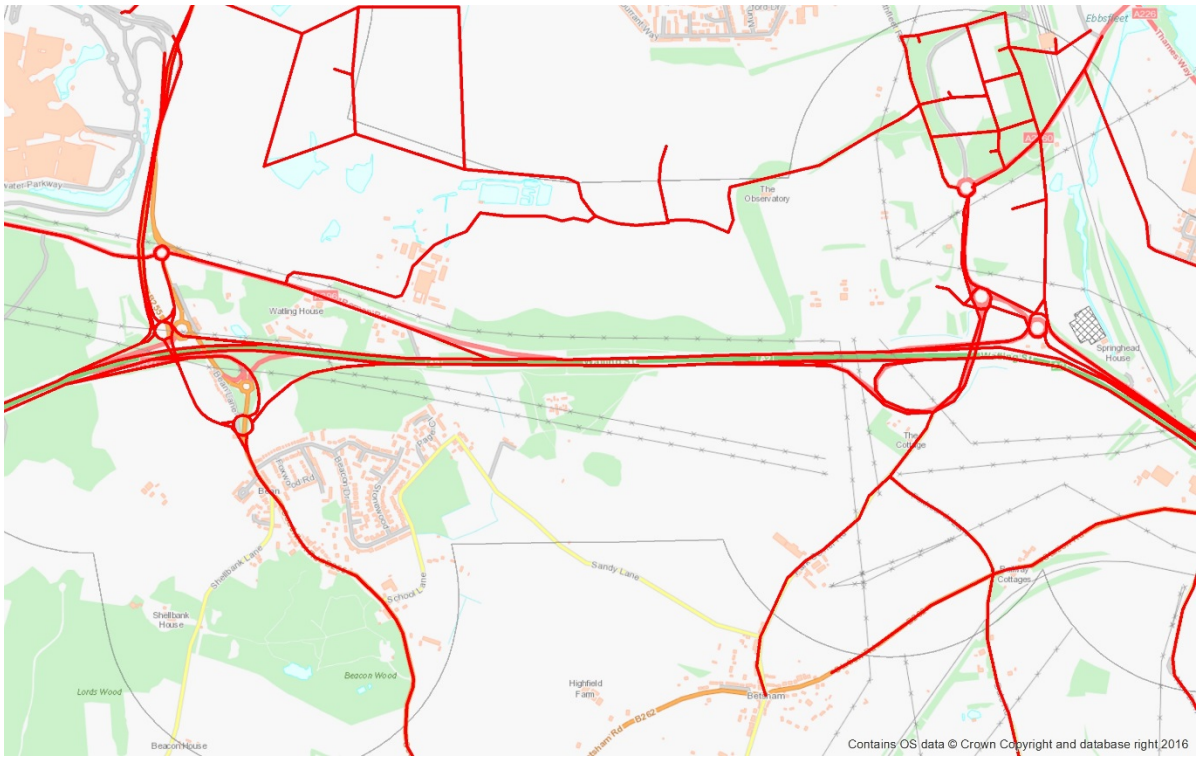
Noise Important Areas	Long Term Change dB
NIA 5959	-1.9
NIA 6265	-2.6
NIA 5960	-2.4
NIA 925	-2.2
NIA 1220	-2.3
NIA 1219	-2.4
NIA 924	-2.0

8.7.18 The results presented in Table 8-8 for the identified DEFRA Noise Important Areas within the Study Area conclude that with Route Option B03E01b there are no adverse changes in road traffic noise levels in the long term that exceed 3dB. The results of the modelling further conclude actual reductions in road traffic noise levels at these Noise Important Areas as a result of Route Option

B03E01b. With a maximum reduction of 2.6 and a minimum reduction of 1.9 these reductions all fall into the **negligible** classification.

Option B04bE01b

8.7.19 Route Option B04bE01b consist of Bean Option 4b combined with Ebbsfleet Option 1b as detailed below:



Insert 8-4 Option B04bE01b

8.7.20 This Route Option will be assessed and considered below.

Short Term Impacts – Option B04bE01b

8.7.21 For the assessment of Option B04bE01b during the short term a comparison has been made between the Do-minimum and Do-something scenarios in the opening year of 2025.

Table 8-9 Short Term Noise Impacts Option B04bE01b

Change in Noise Level		**Number of Dwellings**	**Number of Other Sensitive Receptors**
Increase in noise level, LA10,18-hour	0.1 - 0.9	683	0
	1.0 - 2.9	67	0
	3 - 4.9	9	0
	>5	7	0
No Change	0	403	0
Decrease in noise level, LA10,18-hour	0.1 - 0.9	978	3
	1.0 - 2.9	66	0

Change in Noise Level		Number of Dwellings	Number of Other Sensitive Receptors
	3 - 4.9	20	0
	>5	24	0

8.7.22 The following is concluded with regard to the information presented in Table 8-9 above, following the impact classification as shown in Table 8-2, based on the assumption that all receptors have a high sensitivity in the opening year of the Scheme;

- 403 dwellings and no other sensitive receptors are predicted to experience a 0.0dB change in short term road traffic noise as a result of Scheme Option B04bE01b. This would result in a short term impact classification of **no change**.
- 683 dwellings and no other sensitive receptor are predicted to experience short term increases in road traffic noise of between 0.1dB to 0.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a short term impact classification of **negligible adverse**.
- 67 dwellings and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels of between 1.0dB to 2.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a short term impact classification of **minor adverse**.
- 9 dwellings and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a short term impact classification of **moderate adverse**.
- 7 receptors are predicted to experience short term increases in road traffic noise levels above 5.0dB as a result of Scheme Option B04bE01b, this would be classified as a **major adverse** impact.
- 978 dwellings and 3 other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 0.1dB to 0.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a short term impact classification of **negligible beneficial**. The other sensitive receptors which fall into this banding are:
    - Heslington Care Home
    - Rosewood Care Home
    - Bean Primary school
- 66 dwellings and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 1.0dB to 2.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a short term impact classification of **minor beneficial**.
- 20 dwellings and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a short term impact classification of **moderate beneficial**.
- 26 dwelling and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of greater than 5.0dB in the short term as a result of Scheme Option B04bE01b. This would be concluded to represent a short term impact classification of **major beneficial**.

8.7.23 In the Opening Year of the Scheme (2025) sensitive receptors across the Study Area are predicted to experience short term changes in road traffic noise level within the range from a decrease of 0.4 to 0.6. This falls within the **negligible** classification.

8.7.24 The change in predicted road traffic noise levels indicate that there would be 83 dwellings which would experience a perceptible increase in short term road traffic noise of greater than 1dB in the

opening year with Scheme Option B04bE01b. There would 112 residential receptors which would experience a perceptible reduction in short term road traffic noise levels.

Table 8-10 Short Term Noise Impacts on Noise IA's Option B04bE01b

Noise Important Areas	Short-term Change dB
NIA 5959	-0.5
NIA 6265	+0.6
NIA 5960	+1.1
NIA 925	-0.2
NIA 1220	-0.1
NIA 1219	-0.1
NIA 924	-0.7

8.7.25 The results presented in Table 8-10 for the identified DEFRA Noise Important Areas within the Study Area conclude that with Route Option B04bE01b, 6 of the 7 NIA's considered experience changes in road traffic noise levels in the short term that don't exceed 1dB, which suggests that there are no detrimental effects of this Scheme Option on these Noise Important Areas. This would be concluded to represent a short term impact classification of no greater than **negligible adverse**.

8.7.26 Additionally, with regard to important area NIA 5960 (A2), Scheme Option B04bE01b would result in an increase in road traffic noise of 1.1dB, which could be perceived as an observable increase whilst remaining a **minor adverse** impact.

Long Term Impacts – Option B04bE01b

8.7.27 For the long term assessment of Option B04bE01b a comparison has been made between the Do-minimum scenario in the opening year of 2025, and the Do-something scenario in the future assessment year of 2041.

Table 8-11 Long Term Changes with Option B04bE01b

Change in Noise Level		Number of Dwellings	Number of Other Sensitive Receptors
Increase in noise level, LA10,18-hour	0.1 - 2.9	14	0
	3.0 - 4.9	5	0
	5.0- 9.9	0	0
	>10	2	0
No Change	0	1	0
Decrease in noise level, LA10,18-hour	0.1 - 2.9	1886	1
	3.0 - 4.9	290	2
	5.0- 9.9	50	0
	>10	11	0

8.7.28 The following is concluded with regard to the long term assessment of daytime road traffic noise levels associated with Scheme Option B04bE01b.

- 1 dwelling and no other sensitive receptors are predicted to experience a 0.0dB change in road traffic noise in the long term as a result of Scheme Option B04bE01b. This would result in a long term impact classification of **no change** at this receptor.
- 14 dwellings and no other sensitive receptor are predicted to experience long term increases in road traffic noise of between 0.1dB to 2.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a long term impact classification of **negligible adverse**.
- 5 dwellings and no other sensitive receptors are predicted to experience long term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a long term impact classification of **minor adverse**.
- 2 receptors are predicted to experience long term increases in road traffic noise levels above 10dB as a result of Scheme Option B04bE01b, this can be classified as a **major adverse** impact.
- 1888 dwellings and 1 other sensitive receptor are predicted to experience long term decreases in road traffic noise levels of between 0.1dB to 2.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a long term impact classification of **negligible beneficial**. The other sensitive receptor which falls into this banding is:
    - Bean Primary school
- 290 dwellings and 2 other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a long term impact classification of **minor beneficial**. The other sensitive receptors which fall into this banding are:
    - Heslington Care Home
    - Rosewood Care Home
- 50 dwelling and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 5.0dB to 9.9dB as a result of Scheme Option B04bE01b. This would be concluded to represent a long term impact classification of moderate beneficial.
- 11 dwelling and no other sensitive receptors are predicted to experience decreases in road traffic noise levels of greater than 10dB in the long term as a result of Scheme Option B04bE01b. This would be concluded to represent a long term impact classification of major beneficial.

8.7.29 In the Future Assessment Year of the Scheme (2041) sensitive receptors across the Study Area are predicted to experience long term changes in road traffic noise level within the range from a decrease of 2.6 to 3.5dB.

8.7.30 The change in predicted road traffic noise levels indicate that there would be 7 dwellings which would experience a perceptible increase in long term road traffic noise of greater than 3dB in the future assessment year with Scheme Option B04bE01b. There would 351 dwellings which would experience a perceptible reduction in long term road traffic noise levels.

Table 8-12 Long Term Noise Impacts on IA's Option B04bE01b

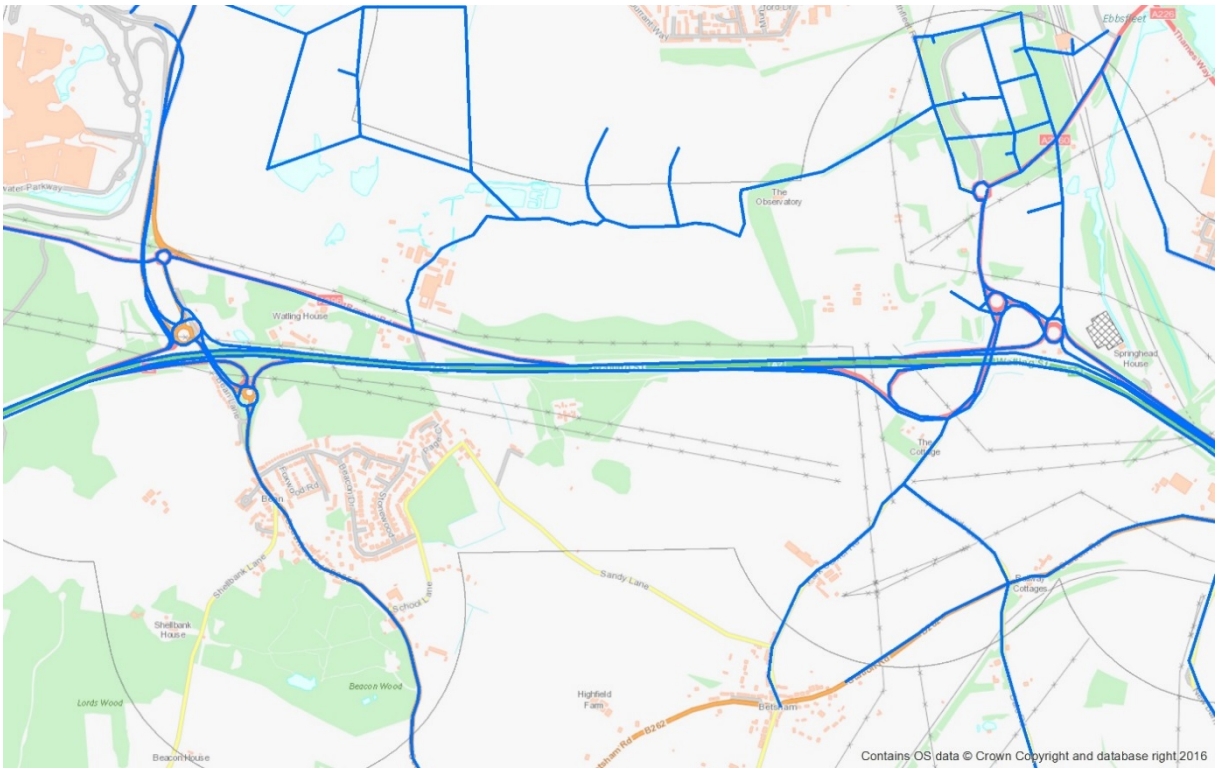
Noise Important Areas	Long Term Change dB
NIA 5959	-2.7
NIA 6265	-1.6
NIA 5960	-1.2
NIA 925	-1.9
NIA 1220	-2.4

Noise Important Areas	Long Term Change dB
NIA 1219	-2.4
NIA 924	-2.6

8.7.31 The results presented in Table 8-12 for the identified DEFRA Noise Important Areas within the Study Area conclude that with Route Option B04bE01b there are no adverse changes in road traffic noise levels in the long term that exceed 0dB, which suggests that there are no detrimental effects of this Scheme Option on these Noise Important Areas. This would be concluded to represent a long term impact classification of **negligible**.

Option B05E01b

8.7.32 Route Option B05E01b consist of Bean Junction Option 5 combined with Ebbsfleet Junction Option 1 as detailed below:



Insert 8-5 Option B05E01b

8.7.33 This Route Option will be assessed and considered below.

Short Term Impacts – Route Option B05E01b

8.7.34 For the assessment of Option B05E01b during the short term a comparison has been made between the Do-minimum and Do-something scenarios in the opening year of 2025.

Table 8-13 Short Term Noise Impacts Option B05E01b

Change in Noise Level		**Number of Dwellings**	**Number of Other Sensitive Receptors**
Increase in noise level, LA10,18-hour	0.1 - 0.9	870	2
	1.0 - 2.9	37	0
	3 - 4.9	14	0
	>5	7	0
No Change	0	608	0
Decrease in noise level,	0.1 - 0.9	601	1

Change in Noise Level		Number of Dwellings	Number of Other Sensitive Receptors
LA10,18-hour	1.0 - 2.9	61	0
	3 - 4.9	24	0
	>5	37	0

8.7.35 The following is concluded with regard to the information presented in Table 8-13 above, following the impact classification as shown in Table 8-2, based on the assumption that all receptors have a high sensitivity in the opening year of the Scheme;

- 608 dwellings and no other sensitive receptors are predicted to experience a short term 0.0dB change in road traffic noise as a result of Scheme Option B05E01b. This would result in a short term impact classification of **no change**.
- 870 dwellings and 2 other sensitive receptors are predicted to experience short term increases in road traffic noise of between 0.1dB to 0.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a short term impact classification of **negligible adverse**. The other sensitive receptors which fall into this banding are:
    - Heslington Care Home
    - Rosewood Care Home
- 37 dwellings and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels of between 1.0dB to 2.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a short term impact classification of **minor adverse**.
- 14 dwellings and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a short term impact classification of **moderate adverse**.
- 7 receptors and no other sensitive receptors are predicted to experience short term increases in road traffic noise levels above 5.0dB as a result of Scheme Option B05E01b, this would be classified as a **major adverse** impact.
- 601 dwellings and 1 other sensitive receptor are predicted to experience short term decreases in road traffic noise levels of between 0.1dB to 0.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a short term impact classification of **negligible beneficial**. The other sensitive receptor which falls into this banding is:
    - Bean Primary school
- 61 dwellings and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 1.0dB to 2.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a short term impact classification of **minor beneficial**.
- 24 dwellings and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a short term impact classification of **moderate beneficial**.
- 37 dwelling and no other sensitive receptors are predicted to experience short term decreases in road traffic noise levels of greater than 5.0dB in the short term as a result of Scheme Option B05E01b. This would be concluded to represent a short term impact classification of **major beneficial**.

8.7.36 In the Opening Year of the Scheme (2025) sensitive receptors across the Study Area are predicted to experience short term changes in road traffic noise level within the range from a decrease of 0.6 to 0.0dB.

8.7.37 The change in predicted road traffic noise levels indicate that there would be 58 dwellings which would experience a perceptible increase in short term road traffic noise of greater than 1dB in the opening year with Scheme Option B05E01b. There would be 122 residential receptors which would experience a perceptible reduction in short term road traffic noise levels with this option.

Table 8-14 Short Term Noise Impacts on IA's Option B05E01b

Noise Important Areas	Short Term Change dB
NIA 5959	+0.1
NIA 6265	+0.6
NIA 5960	+1.2
NIA 925	-0.1
NIA 1220	-0.1
NIA 1219	-0.1
NIA 924	-0.3

8.7.38 The results presented in Table 8-14 for the identified DEFRA Noise Important Areas within the Study Area conclude that with Route Option B05E01b, 6 of the 7 NIA's experience changes in road traffic noise levels in the short term that don't exceed 1dB, which suggests that there are no detrimental effects of this Scheme Option on these Noise Important Areas. This would be concluded to represent a short term impact classification of no greater than **negligible**.

8.7.39 Additionally, with regard to important area NIA 5960 (A2), not included in the paragraph above, Scheme Option B05E01b would result in an increase in road traffic noise of 1.2dB, this could be perceived as a **minor increase**.

Long Term Impacts – Route Option B05E01b

8.7.40 For the long term assessment of Option B05E01b a comparison has been made between the Do-minimum scenario in the opening year of 2025, and the Do-something scenario in the future assessment year of 2041.

Table 8-15 Long Term Noise Impacts on Noise IA's Option B05E01b

Change in Noise Level		Number of Dwellings	Number of Other Sensitive Receptors
Increase in noise level, LA10,18-hour	0.1 - 2.9	26	0
	3.0 - 4.9	3	0
	5.0- 9.9	1	0
	>10	2	0
No Change	0	3	0
Decrease in noise level, LA10,18-hour	0.1 - 2.9	1987	3
	3.0 - 4.9	172	0
	5.0- 9.9	40	0
	>10	25	0

8.7.41 The following is concluded with regard to the long term assessment of daytime road traffic noise levels associated with Scheme Option B05E01b.

- 3 dwelling and no other sensitive receptors are predicted to experience a long term 0.0dB change in road traffic noise as a result of Scheme Option B05E01b. This would result in a long term impact classification of **no change**.
- 26 dwellings and no other sensitive receptor are predicted to experience long term increases in road traffic noise of between 0.1dB to 2.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a long term impact classification of **negligible adverse**.
- 3 dwellings and no other sensitive receptors are predicted to experience long term increases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a long term impact classification of **minor adverse**.
- 1 receptor is predicted to experience a long term increase in road traffic noise levels between 5.0 and 9.9dB as a result of Option B05E01b. This can be classified as a **Moderate adverse** impact at this receptor.
- 2 Receptors are predicted to have a long term increase of greater than 10dB as a result of Scheme Option B05E01b. This is classified as a **major adverse** impact in the long term.
- 1987 dwellings and 3 other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 0.1dB to 2.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a long term impact classification of **negligible beneficial**. The other sensitive receptors which fall into this banding are:
    - Heslington Care Home
    - Rosewood Care Home
    - Bean Primary school
- 172 dwellings and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 3.0dB to 4.9dB as a result of Scheme Option B05E01b. This would be concluded to represent a long term impact classification of **minor beneficial**.
- 40 dwelling and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of between 5.0dB to 9.9dB as a result of Scheme

Option B05E01b. This would be concluded to represent a long term impact classification of **moderate beneficial**.

- 25 dwelling and no other sensitive receptors are predicted to experience long term decreases in road traffic noise levels of greater than 10dB in the long term as a result of Scheme Option B05E01b. This would be concluded to represent a long term impact classification of **major beneficial**.

8.7.42 In the Future Assessment Year of the Scheme (2041) sensitive receptors across the Study Area are predicted to experience long term changes in road traffic noise level within the range from a decrease of -2.7 to -2.9dB.

8.7.43 The change in predicted road traffic noise levels indicate that there would be 6 dwellings which would experience a perceptible increase in long term road traffic noise of greater than 3dB in the future assessment year with Scheme Option B05E01b. There would 224 dwellings which would experience a perceptible reduction in long term road traffic noise levels as a result of this Scheme Option.

Table 8-16 Long Term Noise Impacts on IA's Option B05E01b

Noise Important Areas	Long Term Change dB
NIA 5959	-2.1
NIA 6265	-1.6
NIA 5960	-1.1
NIA 925	-1.9
NIA 1220	-2.4
NIA 1219	-2.4
NIA 924	-2.2

8.7.44 The results presented in Table 8-16 for the identified DEFRA Noise Important Areas within the Study Area conclude that with Route Option B05E01b there are no adverse changes in road traffic noise levels in the long term that exceed 0dB, which suggests that there are no detrimental effects of this Scheme Option on these Noise Important Areas. This would be concluded to represent a long term impact classification of **negligible**.

8.8 Cumulative Effects

8.8.1 The Traffic data used in the assessment is cumulative data so takes into account potential future changes that may influence traffic flows therefore the results provide a most likely scenario. The list of developments included in the traffic model can be found in the Stage 1 Traffic Forecasting Report, Doc Ref: 0003-UA007244-UT22R.

8.9 Limitations of Assessment

8.9.1 The information used to inform this assessment is indicative of any noise impacts which could occur as a result of the presented Scheme Options and should not be used for the assessment of noise insulation qualification under the Noise Insulation Regulations or for the determination of

whether any receptors would experience a Significant Observed Adverse Effect Level (SOAEL) as specified in NPSE. (Ref 10.5). This is largely due to the early stage of the assessment.

8.9.2 The information presented within the scope of this assessment is appropriate for the direct comparison of the specified Route Options only, and should therefore be considered within this context.

8.10 Summary

8.10.1 This section of the Chapter draws together the results of the assessment of the 3 Route Options, namely Route Options B03E01b, B04bE01b and B05E01b.

8.10.2 Within Table 8-17 below the number of dwellings predicted to experience a perceptible short and/or long term increase or decrease in noise as a result of the detailed Route Option is presented within a single reference table. This allows easier comparison of the potential impacts of the 3 Route Options to inform the selection of the preferred Option.

8.10.3 For Route Options B03E01b, B04bE01b and B05E01b there is expected to be general benefits when Web tag health impacts and noise reductions are considered. There are no significant or distinguishable differences in the results of the assessment across the three options.

Table 8-17: Summary of significant effect, mitigation proposed and residual effects on Noise

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Option B03E01b					
Noise and Vibration	**6 Green**	WebTAG value of £107,150 option B03E01b is generally beneficial. In the short term 8 receptors spread across the study area will be subject to major adverse noise increases of over 5dB. 36 receptors are forecast to experience a Major beneficial impact in the form a reduction in excess of 5dB. In the long term 4 of the same receptors are predicted to experience major adverse effects, these increases are focused in the west of the study area. There are 29 properties that are predicted to experience a major beneficial reduction in noise of greater that 10dB. A general benefit when Web tag health impacts and noise reductions are considered.	There are 7 DEFRA designated Noise Important Areas in the study area. None of these are predicted to experience significant effects in either scenario.	It is assumed that all new roads and all roads in the future year will be surfaced with low noise surfacing therefore minimising the type noise. It may also be prudent to implement noise barriers in order to protect certain groups of receptors.	The Traffic data used in the assessment is cumulative data so takes into account potential future changes that may influence traffic flows therefore the results provide a most likely scenario.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Option B04bE01b					
Noise and Vibration	**6 Green**	With a WebTAG value of £31,788 option B04bE01b is generally beneficial. In the short term there are 7 receptors predicted to experience a Major dis-benefit in noise, these receptors are largely focussed in Ebbsfleet with one being located in Bean. In the short term 26 receptors are predicted to benefit from a reduction in noise greater than 5dB, a change classed as Major Beneficial. In the long term 2 dwellings are forecast to be subject to Major Adverse noise increases of over 10dB, these are both in Bean village. In the same scenario 11 dwellings are predicted to benefit from a reduction on noise greater than 10dB.	Of the 7 DEFRA identified Noise Important Areas one is expected to observe a perceptible increase in the short term however in the long term they are all predicted to benefit from a decrease in noise.	It is assumed that all new roads and all roads in the future year will be surfaced with low noise surfacing therefore minimising the tyre noise. It may also be prudent to implement noise barriers in order to protect certain groups of receptors.	The Traffic data used in the assessment is cumulative data so takes into account potential future changes that may influence traffic flows therefore the results provide a most likely scenario.
Option B05E01b					

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Noise and Vibration	**6 Green**	With a WebTAG value of £58,823 option B05E01b is is generally beneficial. In the short term 7 receptors are predicted to suffer from an adverse increase of more than 5dB, this is classed as major Adverse. The dwellings are spread across the study area. There are 37 receptors predicted to benefit from a decrease in excess of 5dB, this is classed as a Major Benefit. In the long term 2 receptors are predicted to suffer increases greater than 10dB, these receptors are located to the north of the Bean junction on the A2. In the same scenario 25 receptors are predicted to experience a major beneficial noise reduction in excess of 10dB.	Similar to Option B04bE01b of the 7 NIA's one is predicted to perceive an increase of over 1dB in the short term. In the long term they are all predicted to benefit from a noise reduction.	It is assumed that all new roads and all roads in the future year will be surfaced with low noise surfacing therefore minimising the tyre noise. It may also be prudent to implement noise barriers in order to protect certain groups of receptors.	The Traffic data used in the assessment is cumulative data so takes into account potential future changes that may influence traffic flows therefore the results provide a most likely scenario.

9 Cultural Heritage

9.1 Introduction & Study Area

9.1.1 This chapter presents the findings of the Cultural Heritage assessment undertaken for the three pairs of Scheme options. It identifies the study area, methodology, baseline conditions, receptors potentially affected (and their value), regulatory / policy framework, design mitigation and enhancement measures (where relevant), monitoring requirements, the magnitude of impacts and significance of effects (including cumulative). Summary findings are presented in Section 9.11 and Table 9-15 summarises the significant effects, mitigation proposed and residual effects outlined in this chapter.

9.1.2 This chapter should be read in conjunction with Figures 9.1-9.4 and Appendix 9-1 and 9-2.

9.1.3 The study area encompasses an area extending 500m from the Scheme options and is shown on Figures 9.1-9.4. The size of the study area was determined through a combination of the requirements of DMRB Vol 11 Section 3 part 2 HA208/07 (Ref 9-1) and taking into account the significance of specific cultural heritage assets identified in earlier scoping reports (Ref 9-2). The study area is designed to help inform the potential for archaeological remains to be present within the Scheme Limit and therefore extends outside of areas of physical impact.

9.2 Methodology

Consultation

9.2.1 Consultation was carried out with statutory bodies as outlined at Appendix 4-1. Consultation with statutory agencies will continue to take place during Stage 2 and 3 of the EAR.

Obtaining Baseline Information

9.2.2 The baseline has been informed by collating data on known designated and non-designated heritage assets (receptors) from the following sources:

- National Heritage List of England (designated heritage assets);
- Kent Historic Environment Record (non-designated heritage assets and historic landscape character)

9.2.3 Professional judgement, based on the existing baseline, has been used to assess the potential for currently unknown archaeological remains to be present. Further archaeological investigations (including archaeological trail trenching) will be carried out as the project progresses.

Identifying Design, Mitigation and Enhancement Measures (and Monitoring)

9.2.4 It may be possible to mitigate the impacts of the Scheme options to the setting of heritage assets through design measures to reduce visual intrusion such as tree planting or the installation of earthwork barriers. Direct physical impacts can be mitigated through realignment of Scheme options or through ‘preservation by record’ (historic building recording or archaeological excavation) prior to construction works commencing. ‘Preservation in-situ’ will be considered if appropriate and if there is an engineering solution.

9.2.5 Depending on which option is selected as the preferred option, it may be necessary to review the requirements for further study at the next project stage in order to inform further mitigation. At this stage it is not possible to rule out the possible need for future intrusive evaluation surveys to further assess the possible impacts of the Scheme. Mitigation may take the form of archaeological

excavation prior to construction, monitoring by an archaeologist during construction may also be appropriate as part of a staged approach to mitigation.

Assessment Methodology

Approach

9.2.6 The approach taken is that of a 'high level' assessment, closely aligned with a 'simple' assessment as set out in DMRB. As this is not a simple assessment document minor deviations from DMRB have been made to fit the format of this document. These deviations have been made through the application of professional judgement.

9.2.7 The following paragraphs outline the criteria used in this assessment to predict the significance of effect of the Scheme options on the baseline. The value (or sensitivity) of heritage assets, magnitude of impacts and predicted significance of effect with respect to the Scheme options have been assessed using the criteria set out in DMRB (reproduced in Table 9-1 to Table 9-8). The criteria for the value of heritage assets and magnitude of impact are each split into three separate categories: archaeological remains, historic buildings and structures and historic landscapes. The scope and level of detail to which the assessment has been undertaken has been guided by the Environmental Constraints Report (Ref 9-2).

Value of Heritage Assets

9.2.8 Table 9-1 presents the criteria used in determining the value of archaeological remains; this excludes standing historic buildings and structures and areas of historic landscape, both of which are assessed against distinct criteria.

Table 9-1 Criteria for determining the value of archaeological remains (Modified from DMRB Vol 3, Section 2)

Value	Typical Example
Very High	World Heritage Sites (including nominated sites) Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives
High	Scheduled monuments (including proposed sites) Undesignated assets of schedulable quality and importance Assets that can contribute significantly to acknowledged national research objectives
Medium	Designated or undesignated assets that contribute to regional research objectives
Low	Designated and undesignated assets of local importance Assets compromised by poor preservation and/or poor survival of contextual associations Assets of limited value, but with potential to contribute to local research objectives
Negligible	Assets with very little or no surviving archaeological interest

Value	Typical Example
Unknown	The importance of the resource has not been ascertained

9.2.9 Table 9-2 presents the criteria used in determining the value of historic buildings and structures.

Table 9-2 Criteria for determining the value of historic building receptors (Modified from DMRB Vol 3, Section 2)

Value	Typical Example
Very High	Structures inscribed as of universal importance as World Heritage Sites Other buildings of recognised international importance
High	Scheduled monuments with standing remains Grade I and Grade II* listed buildings Other listed buildings that can be shown to have exceptional qualities in their fabric or historical associations not adequately reflected in the listing grade Conservation areas containing very important buildings Undesignated structures of clear national importance
Medium	Grade II listed buildings Historic (unlisted) buildings that can be shown to have exceptional qualities in their fabric or historical associations Conservation areas containing buildings that contribute significantly to its historic character Historic townscape or built up areas with important historic integrity in their buildings, or built settings (e.g. including street furniture and other structures)
Low	Locally listed buildings Historic (unlisted) buildings of modest quality in their fabric or historical association Historic townscape or built up areas of limited historic integrity in their buildings or built settings (e.g. including street furniture and other structures)
Negligible	Buildings of no architectural or historical note; buildings of intrusive character
Unknown	Buildings with some hidden (i.e. inaccessible) potential for historic significance

9.2.10 Table 9-3 presents the criteria used in determining the value of historic landscapes.

Table 9-3 Criteria for determining the value of historic landscape receptors (Modified from DMRB Vol 3, Section 2)

Value	Typical Example
Very High	World Heritage Sites inscribed for their historic landscape qualities Historic landscapes of international value, whether designated or not

Value	Typical Example
	Extremely well preserved historic landscapes with exceptional coherence, time-depth, or other critical factor(s)
High	Undesignated landscapes of outstanding interest Undesignated landscapes of high quality and importance, and of demonstrable national value Well preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factor(s)
Medium	Undesignated historic landscapes that would justify special historic landscape designation, landscapes of regional value Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor(s)
Low	Robust undesignated historic landscapes Historic landscapes with importance to local interest groups Historic landscapes whose value is limited by poor preservation and/or poor survival of contextual associations
Negligible	Landscapes with little or no significant historical interest

Magnitude of Impacts

9.2.11 The magnitude of impact on heritage assets considers the anticipated scale / extent of change as a result of the Scheme options, and the nature and duration of such change. The survival and extent of heritage assets is often uncertain and, consequently, the magnitude of change can be difficult to predict. Two types of impact are considered in this assessment.

9.2.12 The first type of impact is direct physical impacts on heritage assets resulting from works associated with the construction of the Scheme options. These direct impacts take the form of disturbance to, or removal of, part or all of known or potential archaeological remains. They may also take the form of changes to the fabric or composition of above ground heritage assets, such as historic buildings, and may include impacts to designated heritage assets such as scheduled monuments, listed buildings, conservation areas and registered parks and gardens.

9.2.13 The second type of impact is direct impacts to the setting of a heritage asset, caused by the physical presence of the Scheme options. Impacts to the setting of heritage assets usually take the form of changes to the views to and from the assets, but may take the form of changes in the way the asset is experienced, such as due to increases in noise or night-time light levels. Types of heritage asset considered with regard to impacts to setting in this chapter include conservation areas and listed buildings.

9.2.14 Table 9-4 presents the criteria used in determining the anticipated magnitude of impact of the Scheme options on archaeological remains.

Table 9-4 Criteria used in determining the magnitude of impact of the Scheme upon archaeological remains (Modified from DMRB Vol 3, Section 2)

Magnitude of Impact	Typical Example
Major	Change to most or all key archaeological materials, such that the resource is totally altered Comprehensive changes to setting

Magnitude of Impact	Typical Example
Moderate	Changes to many key archaeological materials, such that the resource is clearly modified Considerable changes to setting that affect the character of the asset
Minor	Changes to key archaeological materials, such that the asset is slightly altered Slight change to setting
Negligible	Very minor changes to archaeological materials, or setting
No Change	No change

9.2.15 Table 9-5 presents the criteria used in determining the anticipated magnitude of impact of the Scheme options on historic buildings and structures.

Table 9-5 Criteria used in determining the magnitude of impact of the Scheme upon historic buildings (Modified from DMRB Vol 3, Section 2)

Magnitude of Impact	Typical Example
Major	Change to key historic building elements, such that the resource is totally altered Comprehensive changes to the setting
Moderate	Change to many key historic building elements, such that the resource is significantly modified Changes to the setting of an historic building, such that it is significantly modified
Minor	Change to key historic building elements, such that the asset is slightly different Change to setting of an historic building, such that it is noticeably changed
Negligible	Slight changes to historic building elements or setting that hardly affect it
No Change	No change to fabric or setting

9.2.16 Table 9-6 presents the criteria used in determining the anticipated magnitude of impact of the Scheme options on historic landscapes.

Table 9-6 Criteria used in determining the magnitude of impact of the Scheme upon historic landscapes (Modified from DMRB Vol 3, Section 2)

Magnitude of Impact	Typical Example
Major	Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit.
Moderate	Changes to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access; resulting in moderate changes to historic landscape character.

Magnitude of Impact	Typical Example
Minor	Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality; slight changes to use or access: resulting in limited changes to historic landscape character.
Negligible	Very minor changes to key historic landscape elements, parcels or components, virtually unchanged visual effects, very slight changes in noise levels or sound quality; very slight changes to use or access; resulting in a very small change to historic landscape character.
No Change	No change to elements, parcels or components; no visual or audible changes; no changes arising from in amenity or community factors.

Significance of Effect

9.2.17 Table 9-7 illustrates how information on the value of the asset and the magnitude of impact are combined to arrive at an assessment of the significance of effect. The matrix is not intended to 'mechanise' judgement of the significance of effect but to act as a check to ensure that judgements regarding value, magnitude of impact and significance of effect are reasonable and balanced. In order to allow for professional judgement, in some cases the matrix allows a choice of significance of effect when a magnitude of impact and a value are combined. In these cases the individual attributes of a specific asset, along with any relevant site specific factors and consideration of other influencing elements, would be taken into account when considering the most appropriate value to apply. Once the potential mitigation of an impact has been taken into account, the residual significance of effect can be predicted.

Table 9-7 Criteria for determining the significance of effects (Modified from DMRB Vol 3, Section 2)

		Magnitude of Impact				
		No Change	Negligible	Minor	Moderate	Major
Value	Very High	Neutral	Slight	Moderate / Large	Large or Very Large	Very Large
	High	Neutral	Slight	Moderate / Slight	Moderate / Large	Large / Very Large
	Medium	Neutral	Neutral / Slight	Slight	Moderate	Moderate / Large
	Low	Neutral	Neutral / Slight	Neutral / Slight	Slight	Slight / Moderate
	Negligible	Neutral	Neutral	Neutral / Slight	Neutral / Slight	Slight

9.3 Baseline Conditions

9.3.1 Heritage asset numbers are given in bold type and their locations are shown on Figure 9.1. An accompanying gazetteer of non-designated heritage assets is presented in Appendix 9-1.

Designated Assets

9.3.2 There are no World Heritage Sites, registered parks and gardens, registered battlefields or conservation areas within the study area.

9.3.3 The study area does contain four scheduled monuments. Neolithic sites near Ebbsfleet (**SM3**); two monuments which date to the Roman period (**SM2** and **SM4**) and a woodland boundary of Medieval origin (**SM1**).

9.3.4 The study area also contains five Grade II listed buildings. They mostly date from the post-medieval period (AD 1540 to 1901) with a single buildings originating from the medieval period (AD 1066 to 1540) Grade II listed Stone Castle (**LB1**) with one being modern (AD 1901-present) (**LB4**).

Table 9-8 Designated heritage assets within the site and study area[1]

Arcadis No.	HE / HER No.	Name / Description	Designation	Period
SM1	1013378 / TQ 57 SE 38	Woodland boundary in Darenth Wood, comprises irregular sinuous earthworks of a probable 13th century coppice enclosure with a small annexe to the SE of slightly later date and a former annexe to the north that was destroyed by construction of the A296 in 1921.	Scheduled Monument	Medieval
SM2	1005140 / TQ 67 SW 6	Springhead Roman Site. Sanctuary located where Watling Street crosses the head of the Ebbsfleet Valley. First used as religious site in the Iron Age focused on the natural springs that fed into a pool and this was enclosed by a ditch and surrounded by a ceremonial way. It developed into a major religious centre in the 1st and 2nd centuries AD, after which it began to decline. At least 7 'romano-celtic' temples discovered to the south of the pool and there were also houses, shops, workshops and a bathhouse. To the south-east was a walled cemetery containing stone sarcophagi and over 500 burials.	Scheduled Monument	Roman
SM3	1004206 / TQ 67 SW 39	Neolithic sites near Ebbsfleet consisting of Neolithic 'B' pottery and a few flint flakes, first discovered in 1938. This is the type site for Ebbsfleet pottery. Re-excavation in 1960 revealed trackway and timber construction on the site of the previous pottery finds.	Scheduled Monument	Middle Neolithic
SM4	1004226 / TQ 67 SW 89	Roman enclosure SE of Vagniacae. Romano-British walled cemetery SE of Springhead roman site and adjoining Watling Street, contained several stone sarcophagi and leaden coffins, cremations within urns and inhumations	Scheduled Monument	Roman
LB1	1099902 / TQ 57 SE 1031	Stone Castle	II	Medieval - Post Medieval
LB2	1099940 / TQ 57 SE 1034	Lower Bean Farmhouse	II	Post Medieval
LB3	1085808 / TQ 57 SE 1042	Barn to South East of Lower Bean Farmhouse	II	Post Medieval

[1] Historic England/Historic Environment Record reference number

Arcadis No.	HE / HER No.	Name / Description	Designation	Period
LB4	1119762 / TQ 67 SW 1335	Swanscombe cutting footbridge crossing A2 east of A296 junction	II	Modern
LB5	1336457 / TQ 57 SE 1040	Blue House	II	Post Medieval

Non-designated Heritage Assets

9.3.5 The Kent Historic Environment Record lists 592 non-designated heritage assets within the study area. A number of these heritage assets relate to the designated heritage assets listed above and may cover portions of the asset that lie outside the scheduled area or designation of the listed building. The findspots will have been removed from their find location and associated features will have also been largely removed during the excavations that recorded them and subsequent developments that necessitated the excavations.

9.3.6 Due to its size the list of non-designated heritage assets within the site and study area is reproduced in full at Appendix 9-1 and not in the main text.

9.3.7 In the west of the study area a handful of recorded heritage assets date to the Palaeolithic period (**3**, **23** and **24**). In the west there are numerous records of flints and hand axes (**1**, **2**, **5**, **17**, **20** and **21**) along with a tool manufacturing site (**19**) and an elephant butchery site (**27**). Later period prehistoric sites are also represented in the baseline with Mesolithic, Neolithic and Bronze Age sites recorded.

9.3.8 Within Darenth Wood a possible causeway enclosure is recorded south of the A2 (**577**).

9.3.9 Evidence of human activity and settlement within the study area during the Roman period (AD 43 to 410) is represented by the two scheduled monuments listed above (**SM2** and **SM4**) and non-designated heritage assets related to Springfield Roman Site including several significant monuments including temples and cemeteries.

9.3.10 Excavations at Stone Castle Quarry, located 600m north-west of Bean Junction, revealed remains of Iron Age and Roman settlement activity (**60**). Further to the north in Stone Castle village there is recorded a possible farmstead (**236**), field system (**235**) and enclosures (**216**) all of Roman date. Pits and a gully of Roman origin (**432** and **430**) have also been located north of Bean village and to the north of the Bean Junction.

9.3.11 The Roman road of Watling Street is known to lie within the study area and is thought to be located beneath the A296 (**435**).

9.3.12 The earth works in Darenth Wood (**SM1**), approximately 250m west of Bean Junction have been interpreted as being a medieval coppice enclosure bank, part of which may have Roman origins. In addition, several chalk pits (**586**), which may be of medieval date, are recorded within the wood.

9.3.13 The number of modern records is relatively slight for such a developed landscape. A modern brickworks is known to have been operational in the early part of the 20th century located to the east of the B255. The listed footbridge (**LB4**) over the A2 dates to 1964, listed above.

9.3.14 There is potential for currently unknown sub-surface archaeological remains to be present within the Scheme Limit. This potential is generally considered to be moderate to low across the Scheme but would be greater in the vicinity of known archaeological remains where the ground remains

undisturbed by previous development. As the known archaeological resource within the study area dates from the prehistoric to the post-medieval period it is considered that any currently unknown archaeological remains may also date from the prehistoric to the post-medieval periods.

Historic Landscape Character

9.3.15 The historic landscape character of the study area contains twenty-four defined areas, demonstrating thirteen different landscape types. There are five post-medieval agricultural landscapes whilst the remaining areas have been significantly modified in modern times. The high level of later 20th century development, especially the A2 motorway that bisects the study area and extensive areas of quarrying to the north of the road are the dominant landscape features. The historic landscape does not demonstrate a high degree of time depth and the presence of the large areas of 20th century landscape types has reduced any surviving historic coherence.

9.4 Value (Sensitivity) of Resource

9.4.1 The values of the baseline heritage assets identified during this assessment have been assigned using the criteria set out in the methodology tables above. The designated assets are listed in Table 9-9. Appendix 9-2 contains the values of non-designated heritage assets.

Table 9-9 Designated heritage assets within the site and study area

Asset No.	Receptor	Value
SM1	Woodland boundary in Darenth Wood	High
SM2	Springhead Roman Site	High
SM3	Neolithic sites near Ebbsfleet	High
SM4	Roman enclosure SE of Vagniacae.	High
LB1	Stone Castle	Medium
LB2	Lower Bean Farmhouse	Medium
LB3	Barn to South East of Lower Bean Farmhouse	Medium
LB4	Swanscombe cutting footbridge crossing A2 east of A296 junction	Medium
LB5	Blue House	Medium

9.5 Regulatory/Policy Framework

9.5.1 This assessment has been undertaken in accordance with current legislation along with national, regional and local plans and policies. A summary of which is provided below in Table 9-10.

Table 9-10 Regulatory and Planning Policy Framework

Policy / Legislation	Summary of Requirements
Planning (Listed Buildings and Conservation Areas)	This Act applies special protection to buildings and areas that are considered to be of special architectural and / or historic interest.

Policy / Legislation	Summary of Requirements
Act 1990 (Ref 9-3)	
Ancient Monuments and Archaeological Areas Act 1979 (Ref 9-4)	This Act gives statutory protection to any structure, building or area of archaeological remains that is considered to be of particular historic and / or archaeological interest.
National Networks National Policy Statement (NN NPS) (Ref 9-5)	The NN NPS, paragraphs 5.126 and 5.127, contain guidance on the assessment of impacts from national road and rail projects on the historic environment. The applicant is required to describe the significance of any heritage assets affected, including any contribution made by their setting.
National Planning Policy Framework ('NPPF') (Ref 9-6)	Section 12 of the NPPF 'Conserving the Historic Environment', contains policies relating to the treatment of the historic environment in the planning process.
Dartford Borough Council Local Plan 1995 Saved Polices Policy B7 (Ref 9-7)	Policy B7 - Proposals for the demolition of listed buildings will rarely be permitted. The following factors will be taken into account in considering any such proposals: (a) the intrinsic importance of the building itself and its scarcity value within the locality; (b) the contribution the building makes to the local scene; (c) the architectural or historic merit of the building; (d) the condition of the building, the cost of repairs, and the economic value of the building when repaired and available for occupation; and (e) the importance of any alternative use for the site and, in particular, whether the use of the site for some public purpose would make it possible to enhance the environment and especially other listed buildings in the area; or whether, in a run-down area, a limited redevelopment might bring new life and make the other listed buildings more economically viable.
Dartford Borough Council Local Plan 1995 Saved Policies Policy B11 (Ref 9-8)	Policy B11 - Development proposals that would adversely affect scheduled ancient monuments and other nationally important archaeological sites will not be permitted.
Dartford Borough Council Local Plan 1995 Saved Policies Policy B12 (Ref 9-8)	Policy B11 - Other sites of archaeological significance will be protected from development where the archaeological interest is of overriding importance. Where the interest is not overriding, development proposals may be permitted where it can be demonstrated that the site can be preserved either in situ (the preferred option) or by making a detailed record of it for future archaeological reference. Appropriate conditions will be attached to any planning permission.
Gravesham Borough Council Core Strategy 2014 Policy CS19 (Ref 9-9)	Policy CS19 - Development and Design Principles New development will be visually attractive, fit for purpose and locally distinctive. It will conserve and enhance the character of the local built, historic and natural environment, integrate well with the surrounding local area and meet anti-crime standards. The design and construction of new development will incorporate sustainable construction standards and techniques, be adaptable to reflect changing lifestyles, and be resilient to the effects of climate change. This will be achieved through the criteria set out below: • Using the collaborative approach advocated in Building for Life 12 and in line with the guidance set out in Kent Design, the design, layout and form of new development will be derived from a robust analysis of local context and character and will make a positive contribution to the street scene, the quality of the public realm and the character of the area. Account will be taken of the scale, height, building lines, layout, materials and other architectural features of adjoining buildings. Account will also be taken of the wider site context, including strategic views, site topography, the

Policy / Legislation	Summary of Requirements

	significance of heritage assets and features of townscape and landscape value which contribute to local character and sense of place;
	• New development will encourage sustainable living and choice through a mix of compatible uses which are well connected to places that people want to use,
	including the public transport network, local services and community facilities; encourage sustainable travel; enhance Green Grid links and encourage healthier lifestyles;
	• New development will be located, designed and constructed to:
	  • safeguard the amenity, including privacy, daylight and sunlight, of its occupants and those of neighbouring properties and land;
	  • avoid adverse environmental impacts from pollution, including noise, air, Odour and light pollution, and land contamination; and
	  • not pose an unacceptable risk or harm to the water environment, including the quality and/or quantity of ground waters, surface waters, wetlands and coastal water systems;
	• The design and layout of new residential development, including conversions, will accord with the adopted Residential Layout Guidelines;
	• New development will be designed in an inclusive way to be accessible to all members of the community;
	• New development will provide appropriate levels of private and public amenity space;
	• New development will include details of appropriate hard and soft landscaping, public art, street furniture, lighting and signage and will ensure that public realm and open spaces are well planned, appropriately detailed and maintained so they endure;
	• Car parking will be well related to the development it serves;
	• New development will protect and, where opportunities arise, enhance biodiversity and the Borough's Green Infrastructure network. Support will be given to environmental enhancements where opportunities arise;
	• New development will be fit for purpose and adaptable to allow changes to be made to meet the needs of users;
	• The design and layout of new development will take advantage of opportunities to build in resilience to the effects of climate change. This will include protection against flood risk, where relevant, delivering carbon reduction, provision for low carbon and renewable energy, and minimising energy consumption and water use;
	• New development will incorporate appropriate facilities for the storage and recycling of waste; and
	• The layout of new development will create a safe and secure environment and provide surveillance to minimise opportunities for crime and vandalism.

Gravesham Borough Council Core Strategy 2014 Policy CS20(Ref 9-9)	Policy CS20 - Heritage and the Historic Environment The Council will accord a high priority towards the preservation, protection and enhancement of its heritage and historic environment as a non-renewable resource, central to the regeneration of the area and the reinforcement of sense of place. Particular attention in this regard will be focused on those heritage assets most at risk through neglect, decay or other threats. Securing viable, sustainable and appropriate futures for such assets at risk will need to be reconciled with the sensitivity to change that many present. Proposals and initiatives will be supported which preserve and, where appropriate, enhance the significance of the Borough's heritage assets, their setting where it contributes to the significance of the asset and their interpretation and enjoyment, especially where these contribute to the distinct identity of the Borough. These include: • Gravesend Town Centre, its development as a heritage riverside town, and its setting;

Policy / Legislation	Summary of Requirements
	• The Borough's urban and rural conservation areas; and • Surviving built features and archaeology relating to the Borough's maritime, military, industrial and transport history. When considering the impact of a proposed development on a designated heritage asset, the weight that will be given to the asset's conservation value will be commensurate with the importance and significance of the asset. For non-designated assets, decisions will have regard to the scale of any harm or loss and the significance of the heritage asset.
Gravesham Borough Council Local Plan 1994 Saved Policies Policy TC2 (Ref 9-9)	Policy TC2 - The Borough Council will adopt the following approach to applications affecting listed buildings: - (i) Proposals which involve the demolition of listed buildings will not be granted consent unless the applicant is able to demonstrate substantial and overriding reasons why such consent should be forthcoming. In those few cases where the Borough Council is satisfied that there is no alternative but to grant consent for such demolition, all available means will be used to secure early and appropriate redevelopment. (ii) In the case of applications for development involving alterations or extensions to listed buildings or affecting the letting of listed buildings, the primary consideration of the Borough Council will be the maintenance of the integrity of the original listed building. Proposals will also need to be sympathetic to the listed building in terms of massing, scale, appearance and materials. (iii) Applications for the change of use of listed buildings will be considered on their merits, in relation to the land use policies set out in this Written Statement. A major consideration will be whether the character or appearance of the listed buildings will suffer as a result.
Gravesham Borough Council Local Plan 1994 Saved Policies Policy TC2 (Ref 9-9	Policy TC3 - The Borough Council will adopt the following approach to applications for development within or affecting conservation areas: - (i) Where development is acceptable in relation to other policies in this Plan, it will be carefully judged for its impact and will be expected to make a positive contribution to the conservation area. The Borough Council will expect applications to contain sufficient details to enable the impact of the proposal upon the conservation area to be assessed. (ii) The demolition of unlisted buildings will be resisted unless the Borough Council is satisfied that the existing building is harmful to the conservation area and that the proposals for redevelopment or other use of the site will be beneficial. To this end, the Borough Council may, in suitable cases, require an agreement for the replacement of the building or other suitable treatment of the site, prior to the granting of conservation area consent for demolition.
Gravesham Borough Council Local Plan 1994 Saved Policies Policy TC2 (Ref 9-9)	Policy TC7 - Throughout the Borough Plan Review area, development on important archaeological sites will not normally be permitted. On archaeological sites where permanent preservation is not warranted, applications will normally be refused unless arrangements have been made by the developer to ensure that time and resources are available to allow satisfactory archaeological investigation and recording of, by an approved archaeological body to take place in advance of or during development. The specification and programme of work for the archaeological investigation, including its relationship to the programme of development are to be submitted to and approved by the Borough Council. In order to determine a planning application, the Borough Council may require the developer to provide additional information, in the form of an assessment of the archaeological or historic importance of the site in question and the likely impact of development. In certain cases, such an assessment

Policy / Legislation	Summary of Requirements
	may involve an evaluation excavation. Planning permission may be refused without adequate assessment of the archaeological implications.

9.6 Design, Mitigation and Enhancement Measures (including monitoring requirements)

9.6.1 It may be possible to mitigate the impacts of the Scheme options to the setting of heritage assets through design measures to lesson visual intrusion such as tree planting or the installation of earthwork barriers. Direct physical impacts can also be mitigated through realignment of Scheme options resulting in 'preservation in-situ' or through 'preservation by record' (historic building recording or archaeological excavation) prior to construction works commencing.

9.6.2 Options for mitigation which are currently under consideration are as follows:

9.6.3 It may be possible to mitigate the impact on **SM1** through the construction of a revetment wall. In addition archaeological recording via excavation prior to construction works or an archaeological watching brief during construction work would also help to mitigate the impacts on this asset. This would conflict with the generally accepted practice of preservation in situ, however the extent of the preserved remains below the existing roadway is currently unknown.

9.6.4 Impacts on the listed buildings could be mitigated by screening views to and from the listed buildings with fencing or planting. Fencing or planting could also be used to mitigate impacts on the other scheduled monuments within the study area.

9.6.5 Impacts on buried archaeological remain could be mitigated through archaeological recording either by archaeological excavation prior to construction or archaeological watching brief during construction.

9.6.6 Details of appropriate mitigation for direct physical impacts along with the methodology for carrying out this mitigation will be presented in a Written Scheme of Investigation (WSI). The WSI will be referenced in the CEMP and the key points from the WSI included in the CEMP.

9.6.7 Depending on which option is selected as the preferred option, it may be necessary to review the requirements for further study at the next project stage in order to inform further mitigation. At this stage it is not possible to rule out the possible need for future intrusive evaluation surveys to further assess the possible impacts of the Scheme.

9.7 Magnitude of Impacts

Bean Option 3

9.7.1 Bean Option 3 would create a large roundabout over the A2 at the Bean junction utilising the existing Bean Road Over Bridge with a new bridge crossing to the west. Wider banking would be created to the northwest and southwest of the new junction to achieve the required height over the road. This banking would encroach on the Darenth Wood scheduled monument to the north and to the south of the A2. The monument lies adjacent to the existing road and was in fact cut by the existing road (A2) when it was constructed. To the south of the road, Option 3, would place new road construction over the north eastern limit of the monument as it survives, south of the road (A2). This direct physical magnitude of impact to part of the structure of the scheduled monument is considered to be **moderate**. Given the proximity of the Scheme option to the asset there would be an impact on the setting of this designated heritage asset. The heavily wooded nature of the scheduled monument and its existing setting comprising the present road would mean that any

changes to its heritage significance through changes to its setting will be minimal and the magnitude of impact is anticipated to be **minor adverse**.

9.7.2 Bean Option 3 would be located within approximately 500m of two Grade II listed buildings (**LB2 and LB3**) such that the setting of the listed buildings will be affected by the Scheme option. The increased embankment adjacent to the A2 and to the rear of Hope Cottages is likely to be visible from these designated heritage assets due to their proximity and the current intervisibility with the existing road. There will be no physical impacts to the buildings but changes in their setting will impact their heritage significance and the magnitude of impact is **minor adverse**.

9.7.3 Bean Option 3 would have direct physical impact on any currently unknown archaeological remains that may be present within the Scheme footprint including those remains associated with the Roman road (A296), a non-designated heritage asset. The nature and extent of any archaeological remains, if present, are currently unknown. However, the magnitude of impact could feasibly range from **negligible to moderate adverse**.

9.7.4 Bean Option 3 may have a negative impact on the historic landscape character of the study area. Given the current level of development within the locality, the magnitude of impact is anticipated to be negligible adverse. Table 9-11 presents the Predicted Residual Significance of Effects after mitigation.

Bean Option 4b

9.7.5 Bean Option 4b would create a new bridge over the A2 at the Bean junction to the west of the existing Bean Road Over Bridge which would be demolished. Wider banking would be created to the northwest of the new junction to achieve the required height over the road. This banking would encroach on the setting of Darenth Wood scheduled monument to the north of the A2 but would not impact it physically. The monument lies adjacent to the existing road and was in fact cut by the existing road (A2) when it was constructed. Given the proximity of the Scheme option and the asset there would be an impact on the setting of this designated heritage asset. The heavily wooded nature of the scheduled monument and its existing setting comprising the present road would mean that any changes to its heritage significance through changes to its setting would be minimal and the magnitude of impact is anticipated to be **minor adverse**.

9.7.6 Bean Option 4b would be located within approximately 500m of two Grade II listed buildings (**LB2** and **LB3**). The new embankment to the rear of Hope Cottages is likely to be visible from these designated heritage assets due to the proximity of the embankment to the listed buildings. The magnitude of impact to their heritage significance through changes in their setting is anticipated to be **moderate adverse**. The setting of **LB4**, the listed Swanscombe cutting footbridge crossing the A2 east of A296 primarily comprises the existing road. Any impact to its setting would be minimal and in reality its surrounding would remain consistent. As such, the magnitude of impact is anticipated to be **no change**.

9.7.7 Bean Option 4b may have a direct physical impact on any currently unknown archaeological remains that may be present within the Scheme footprint including those associated with the Roman road (A296), a non-designated heritage asset. The nature and extent of any archaeological remains, if present, are currently unknown. However, the proposed road changes

are over a short section and the magnitude of impact is considered to be reduced from option 3 but could feasibly range from **negligible to moderate adverse**.

9.7.8 Bean Option 4b may have an impact on the undesignated historic landscape character of the study area. Given the current level of development within the locality, the magnitude of change is anticipated to be negligible. Table 9-12 presents the Predicted Residual Significance of Effects.

Bean Option 5

9.7.9 Bean Option 5 would create a new bridge over the A2 close to the existing Bean Road Over Bridge whist retaining the latter. The option confines much of the proposal to within the existing road corridor with the notable exception of the new bridge and the relocation of two roundabouts. Hope Cottages Roundabout would be enlarged and signalised with its centre shifting to the southwest. Ightham Roundabout would also be enlarged and signalised. The enlargement would result in the demolition of the row of Ightham Cottages. Ightham Cottages are not heritage assets.

9.7.10 An embankment that is slightly wider than existing would be created to the west of the enlarged Ightham Cottage Roundabout. This banking would encroach on the setting of Darenth Wood scheduled monument to the north of the A2 but would not impact it physically. The monument lies adjacent to the existing road and was in fact cut by the existing road (A2) when it was constructed. Given the proximity of this option and the asset there would be an impact on the setting of this designated heritage asset. The heavily wooded nature of the scheduled monument and its existing setting comprising the present road would mean that any changes to its heritage significance through changes to its setting would be minimal and the magnitude of impact is anticipated to be **minor adverse**.

9.7.11 Bean Option 5 would be located within approximately 500m of two Grade II listed buildings (**LB2 and LB4**). The Scheme option is unlikely to be visible from these designated heritage assets due to topography, vegetation and intervening buildings and there would be no negative impacts to their heritage significance through changes in their setting. As such, the magnitude of impact is anticipated to be no change. The setting of **LB4**, the Swanscombe cutting footbridge crossing the A2 east of A296 primarily comprises the existing road. Any impact to its setting would be minimal and in reality its surrounding would remain consistent. As such, the magnitude of impact is anticipated to be **no change**.

9.7.12 Bean Option 5 would have a direct physical impact on archaeological remains that may be present within the Scheme footprint associated with the Roman road (A296), a non-designated heritage asset. The nature and extent of any archaeological remains, if present, are currently unknown. However, the proposed road changes are over a short section (approximately 2.5mk) and the magnitude of impact is considered to be less than those presented for option 3 but could feasibly range from **negligible to moderate adverse**.

9.7.13 Bean Option 5 may also have a direct physical impact on any currently unknown archaeological remains that may be present within the Scheme footprint. The magnitude of impact is currently **unknown**.

9.7.14 Bean Option 5 may have a negative impact on the historic landscape character of the study area. Given the current level of development within the locality, the magnitude of impact is anticipated to be **negligible**. Table 9-13 presents the Predicted Residual Significance of Effects.

Ebbsfleet Option 1b

9.7.15 Ebbsfleet Option 1b for the Ebbsfleet junction primarily lies within existing road corridors with slight re-alignment. The east and west roundabouts would both be enlarged and signalised with the connecting link road widened to a two lane dual carriageway. The northbound A2260 would also be

widened to three lanes resulting in banking to the east extending beyond the exiting road way. The Scheme option does not extend to the south of the road and therefore does not impact physically on the scheduled monuments of Springhead Roman Site (**SM2**) or the Roman Enclosure SE of Vagniacae (**SM4**). The option would be immediately to the north of Springhead Roman Site scheduled monument and is likely to impact on the setting of this designated heritage asset. The presence of the option would negatively impact on the heritage significance of this asset however the changes are not significant and the magnitude of impact is anticipated to be **minor adverse**.

9.7.16 Ebbsfleet Option 1b would be located within approximately 500m of one Grade II listed building (**LB4**). The Scheme option is unlikely to be visible from this designated heritage asset due to topography and intervening vegetation and there would be no negative impacts to its heritage significance through changes in its setting. The fundamental setting of the footbridge over the A2 would remain unaltered. As such, the magnitude of impact is anticipated to be **no change**.

9.7.17 Ebbsfleet Option 1b would have a direct physical impact on any currently unknown archaeological remains including those associated with the Roman road, a non-designated heritage asset. The nature and extent of any archaeological remains, if present, are currently unknown. However, the proposed road changes are over a short section and the magnitude of impact could feasibly range from **negligible to moderate adverse**.

9.7.18 Ebbsfleet Option 1b may have a negative impact on the historic landscape character of the study area. Given the current level of development within the locality, the magnitude of impact is anticipated to be **negligible**. Table 9-11 presents the Predicted Residual Significance of Effects.

9.8 Significance of Effects (Including Cumulative)

Table 9-11 Predicted Residual Significance of Effects (Bean Option 3)

Receptor	Potential Effect	Sensitivity / Value	Mitigation	Magnitude of impact following mitigation	Significance of Residual Effect*
CONSTRUCTION					
Scheduled Monument: Woodland boundary in Darenth Wood (**SM1**)	Large	High	It may be possible to construct a revetment wall which would limit the bank. Archaeological recording via excavation prior to construction works or archaeological watching brief during construction works.	Moderate	Large Adverse
Grade II listed buildings: Lower Bean Farmhouse (**LB2**) Barn to South East of Lower Bean Farmhouse (**LB3**)	Moderate	Medium	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Minor	Slight Adverse
Buried archaeological remains: Archaeological remains associated with the Possible Roman road (A296) (**435**)	Neutral to Moderate Adverse	Low	Archaeological recording via excavation prior to construction works or archaeological watching brief during construction works	Negligible	Slight
Unknown buried archaeological remains	Neutral to Moderate Adverse	Unknown	Archaeological recording via excavation prior to construction works or archaeological watching brief during construction works	Unknown	Unknown

Receptor	Potential Effect	Sensitivity / Value	Mitigation	Magnitude of impact following mitigation	Significance of Residual Effect*
Historic landscape character	Neutral	Low	None considered necessary	Negligible	Neutral
OPERATION					
Scheduled Monument: Woodland boundary in Darenth Wood (**SM1**)	Moderate Adverse	High	It may be possible to screen views of the Scheme option though fencing or planting	Minor	Slight
Grade II listed buildings: Lower Bean Farmhouse (**LB2**) Barn to South East of Lower Bean Farmhouse (**LB3**)	Moderate	Medium	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Minor	Slight Adverse
Historic landscape character	Neutral	Low	None considered necessary	Negligible	Neutral

* Refer to Table 9-7

Table 9-12 Predicted Residual Significance of Effects (Bean Option 4b)

Receptor	Potential Effect	Sensitivity / Value	Mitigation	Magnitude of impact	Significance of Effect*
CONSTRUCTION					
Scheduled Monument: Woodland boundary in Darenth Wood (**SM1**)	Minor Adverse	High	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Minor	Slight Adverse
Grade II listed buildings: Lower Bean Farmhouse (**LB2**) Barn to South East of Lower Bean	Large	Medium	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Moderate	Moderate Adverse

Receptor	Potential Effect	Sensitivity / Value	Mitigation	Magnitude of impact	Significance of Effect*
Farmhouse (**LB3**)					
Buried archaeological remains: Archaeological remains associated with the Possible Roman Road (A296) (**435**)	Neutral to Moderate Adverse	Low	Archaeological recording via excavation prior to construction works or archaeological watching brief during construction works.	Negligible to Moderate	Slight adverse
Historic landscape character	Neutral to Moderate Adverse	Low	Archaeological recording via excavation prior to construction works or archaeological watching brief during construction works.	Negligible to Moderate	Slight adverse
OPERATION					
Scheduled Monument: Woodland boundary in Darenth Wood (**SM1**)	Slight Adverse	High	It may be possible to screen views of the Scheme option through fencing or planting	Negligible	Slight Adverse
Grade II listed buildings: Lower Bean Farmhouse (**LB2**) Barn to South East of Lower Bean Farmhouse (**LB3**)	Large	Medium	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Moderate	Moderate Adverse
Historic landscape character	Neutral	Low	None considered necessary	Negligible	Neutral

* Refer to Table 9-7

Table 9-13 Predicted Residual Significance of Effects (Bean Option 5)

Receptor	Potential Effect	Sensitivity / Value	Mitigation	Magnitude of impact	Significance of Effect*
CONSTRUCTION					
Scheduled Monument: Woodland boundary in Darenth Wood (**SM1**)	Minor Adverse	High	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Minor	Slight Adverse
Grade II listed buildings: Lower Bean Farmhouse (**LB2**) Barn to South East of Lower Bean Farmhouse (**LB3**)	Neutral	Medium	None considered necessary	No change	Neutral
Buried archaeological remains: Archaeological remains associated with the Possible Roman Road (A296) (**435**)	Slight to Moderate Adverse	Low	Archaeological recording via excavation prior to construction works or archaeological watching brief during construction works.	Minor	Slight Adverse
Historic landscape character	Neutral	Low	None considered necessary	Negligible	Neutral
OPERATION					
Scheduled Monument: Woodland boundary in Darenth Wood (**SM1**)	Minor Adverse	High	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Minor	Slight Adverse
Grade II listed buildings: Lower Bean Farmhouse (**LB2**) Barn to South East of Lower Bean	Neutral	Medium	None considered necessary	No Change	Neutral

Receptor	Potential Effect	Sensitivity / Value	Mitigation	Magnitude of impact	Significance of Effect*
Farmhouse (**LB3**)					
Historic landscape character	Neutral	Low	None considered necessary	Negligible	Neutral

* Refer to Table 9-7

Table 9-14 Predicted Residual Significance of Effects (Ebbsfleet Option 1b)

Receptor	Potential Effect	Sensitivity / Value	Mitigation	Magnitude of impact	Significance of Effect*
CONSTRUCTION					
Scheduled Monument: Springhead Roman Site (**SM2**)	Slight adverse	High	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Minor	Moderate
Grade II listed building; Swanscombe cutting footbridge (**LB4**)	Neutral	Medium	None considered necessary	No change	Neutral
Buried archaeological remains: Archaeological remains associated with the Possible Roman Road	Slight to moderate adverse	Low	Archaeological recording via excavation prior to construction works or archaeological watching brief during construction works.	Minor	Slight Adverse
Historic landscape character	Neutral	Low	None considered necessary	Negligible	Neutral
OPERATION					
Scheduled Monument: Springhead Roman Site (**SM2**)	Slight adverse	High	It may be possible to screen views of the Scheme option through the construction of a fence or planting.	Minor	Moderate
Grade II listed buildings:	Neutral	Medium	None considered necessary	No Change	Neutral

Receptor	Potential Effect	Sensitivity / Value	Mitigation	Magnitude of impact	Significance of Effect*
Historic landscape character	Neutral	Low	None considered necessary	Negligible	Neutral

* Refer to Table 9-7

9.9 Cumulative Effects

9.9.1 Additional planned development in the surrounding area would largely not affect the archaeological resource as much of the development is occurring in previously developed land where survival of archaeological remains is unlikely. Therefore the cumulative effects on the vast majority of the archaeological remains within the study area is considered to be no change. The settings of the designated heritage assets (scheduled monuments and listed buildings) within the study area do not extend into the areas of proposed development to an extent that any impact from the development would be considered adverse to the significance of the asset. Therefore the cumulative effects on these assets is also considered to be no change. Development 5 has the potential to have moderate or slight adverse cumulative impact to the non-designated remains of Springhead Roman Site to the north of the road junctions.

9.10 Limitations of Assessment

9.10.1 This assessment has been compiled using heritage asset data obtained from third party sources and the prediction of effects is based on the accuracy of that data. Whilst the data from these sources is generally valid, there can be instances where asset data is mislabelled, placed in the wrong geographical location or omitted altogether. In the unlikely event that this occurs it could result in an impact being predicted that actually will not occur as the asset is actually outside of the impact area. Conversely impacts could occur in locations where the data does not indicate that there are any assets present. This risk, already slight, will be lessened as the project progresses to ES and further archaeological investigations are carried out.

9.10.2 Due to the nature of archaeological remains, their identification and assessment necessarily requires an element of assumption. In particular, the nature, extent, survival, and even the precise location, of buried archaeological remains are often uncertain, as the majority of such sites have never been subject to archaeological investigation to modern standards. Assessment of the value of such sites (as part of the assessment process) is often, therefore, heavily reliant on informed extrapolation from limited data, comparison with similar assets in similar contexts and, ultimately, on professional judgment.

9.10.3 No field surveys have been undertaken during this assessment to either ground truth the third party data, or gather new data on previously unrecorded heritage assets. Further archaeological investigation, if appropriate, will be carried out to inform the Environmental Statement.

9.11 Summary

9.11.1 This section of the Chapter draws together the results of the assessment of the 3 Route Options, namely Route Options B03E01b, B04bE01b and B05E01b.

9.11.2 Within all three options considered, there is a loss of ancient woodland at Darenth Wood SSSI. Option B03E01b has the most adverse impact due to the permanent effects predicted on the

scheduled monument at Darenth Wood. All three options would incur a permanent impact on several regionally designated and potentially national significant sites.

9.11.3 Results for the three options are summarised in Table 9-15. Based on the current assessment any additional planned development in the surrounding area will not largely affect the archaeological presence in the area.

Table 9-15 Summary of significant effect, mitigation proposed and residual effects on Cultural Heritage. Scoring follows guidance in Table 4-2.

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Option B03E01b					
Historic Environment	**2 Red/ Amber**	Nationally important sites permanently affected with minimal opportunity to reverse impacts. Settings minimally impacted and effects could be reduced over time with planting or fencing.	1 Nationally designated site permanently affected. The scheduled monument at Darenth Wood would be physically impacted. Several regionally designated and potential nationally significant sites permanently affected. Planning (Listed Buildings and Conservation Areas) Act 1990 and Ancient Monuments and Archaeological Areas Act 1979 are of key importance.	Mitigation for direct affected sites would not be sufficient to reduce the impact to nationally designated site.	Additional planned development in the surrounding area would largely not affect the archaeological resource. The setting of the heritage assets within the study area does not extend into the areas of proposed development such that any impact from the development would be considered negligible to the significance of the asset. The proposed Springhead Enterprise Park and CTRL Alignment, along with the Scheme has the potential to have moderate or slight adverse cumulative impact to the non-designated remains of Springhead Roman Town.
Option B04bE01b					
Historic Environment	**3 Amber**	Regionally designated and potential nationally significant sites permanently affected with minimal opportunity to reverse impacts. Settings minimally impacted and	Several regionally designated and potential nationally significant sites permanently affected. These sites relate to the Roman settlement at	Mitigation likely to be required. Conflicts with preservation in situ but extent of survival of remains	Additional planned development in the surrounding area would largely not affect the archaeological resource as much of the development is occurring in previously developed land where survival of archaeological remains is unlikely. Furthermore, the setting of the heritage

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
		effects could be reduced over time with planting or fencing.	Springfield and include a burial ground and a landing stage and other settlement activity such as a kiln, courtyard and well. Planning (Listed Buildings and Conservation Areas) Act 1990 and Ancient Monuments and Archaeological Areas Act 1979 are of key importance.	below existing roadways is unknown.	assets within the study area does not extend into the areas of proposed development such that any impact from the development would be considered negligible to the significance of the asset. The Springhead Enterprise Park and CTRL Alignment along with the scheme has the potential to have moderate or slight adverse cumulative impact to the non-designated remains of Springhead Roman Town.
Option B05E01b					
Historic Environment	**3 Amber**	Regionally designated and potential nationally significant sites permanently affected with minimal opportunity to reverse impacts. Settings minimally impacted and effects could be reduced over time with planting or fencing.	Several regionally designated and potential nationally significant sites permanently affected. These sites relate to the Roman settlement at Springfield and include a burial ground and a landing stage and other settlement activity such as a kiln, courtyard and well. Planning (Listed Buildings and Conservation Areas) Act 1990 and Ancient	Mitigation likely to be required. Conflicts with preservation in situ but extent of survival of remains below existing roadways is unknown.	Additional planned development in the surrounding area would largely not affect the archaeological resource as much of the development is occurring in previously developed land where survival of archaeological remains is unlikely. Furthermore, the setting of the heritage assets within the study area does not extend into the areas of proposed development such that any impact from the development would be considered negligible to the significance of the asset. The proposed Springhead Enterprise Park and CTRL Alignment along with the scheme has the potential to have moderate or slight adverse

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
			Monuments and Archaeological Areas Act 1979 are of key importance.		cumulative impact to the non-designated remains of Springhead Roman Town.

10 Road Drainage and the Water Environment

10.1 Introduction & Study Area

10.1.1 This chapter of the EAR presents the findings of the Road Drainage and the Water Environment assessment undertaken for the three Scheme options, B03E01b, B04bE01b and B05E01b. It identifies the study area, methodology, baseline conditions, identifies receptors potentially affected (and their value), regulatory / policy framework, design mitigation and enhancement measures (where relevant), monitoring requirements, a screening assessment checklist, the magnitude of impacts and significance of effects (including cumulative). The chapter also summarises the underlying geology and assesses contaminated land aspects and how the scheme might impact upon or be impacted by these aspects. Summary findings are presented in Section 10.10.

10.1.2 This chapter should be read in conjunction with Figures 10.1-10.9.

10.1.3 The extent of the study area is described in Chapter 2 and comprises an area of between 0.5km and 4km radius from the project boundary, where the extension depends on the sensitivity attributed to identified receptors and the relevance to the study. The study area includes the:

- A296 from Bluewater to the A2 Junction
- A2 at Darenth Wood to east of the Junction with the B262
- B255 from Bluewater to south of the A2
- A2/B259 Junction area
- Corridor around the A2/B262 Junction.

10.1.4 Likely works that may have significant effects include the construction at the:

- Current and new road alignments
- New junctions
- New gantries
- Realignments of current drainage network.

10.2 Methodology

Obtaining Baseline Information

10.2.1 The following sources of information have been used to provide information on the baseline surface water and groundwater environment:

- Environment Agency (EA) online data sets for flood risk, water quality, groundwater and contaminated land (Ref 10-1)
- MAGIC interactive mapping (www.magic.gov.uk) (Ref 10-10)
- Ordnance Survey (OS) Mapping
- Kent Thameside Delivery Board, Strategic Flood Risk Assessment (SFRA), 2005 (Ref 10-2)
- Kent Thameside Delivery Board, Updating the SFRA, 2009 (Ref 10-3)
- Flood Estimation Handbook Web Service (Centre for Ecology and Hydrology, 2016), accessed online at http://fehweb.ceh.ac.uk/; (Ref 10-4)
- Highways Agency Drainage Data Management System (HADDMS), accessed online; (Ref 10-5)
- BGS Geology of Britain Viewer, accessed online via http://www.bgs.ac.uk/; (Ref 10-6)
- River Basin Management Plan, Thames River Basin District (Environment Agency, 2015 (Ref 10-7));

- Ordnance Survey (OS) Explorer 1:25,000 Maps;
- Kent Thameside Delivery Board, Strategic Flood Risk Assessment (SFRA), 2009 (Ref 10-8);
- Thameside Stage 1 Surface Water Management Plan (JBA for Kent County Council, 2013 (Ref 10-9);
- Available Envirocheck data in the area has been reviewed.

Assessment Methodology

10.2.2 The first stage of the assessment involves the consideration of the facets of the water environment local to the Scheme to be scoped in or excluded from the assessment. This considers the sensitivity of groundwater quality and flow regimes, surface water quality and flood impacts to the proposed development in alignment with Volume 11, Section 3, Part 10 of the DMRB (HD45/09) (Ref 10-11).

Surface Water Quality

10.2.3 GIS software have been used to undertake a desk study to identify water features located within the study area. The EA's River Basin Management Plan (RBMP) for the area has also been consulted, to gather data to characterise these water features in terms of their existing attributes and qualities, to inform the DMRB assessment methodology.

Groundwater Quality

10.2.4 GIS software and EA database information have been used to undertake a desk study to identify groundwater features located within the study area.

Surface Water Quality

10.2.5 HD45/09 outlines methodologies for assessing the potential for routine discharges of highway runoff to result in pollution of receiving surface watercourses. A method for assessing the pollution risk associated with an accidental spillage (acute pollution) is also included.

10.2.6 Given the nature of the proposed works, with the potential for discharge of additional volumes of highway runoff and the construction of new discharge outfalls, consideration of water quality impacts has been scoped into this assessment. It should be noted however that at this PCF stage the assessment is qualitative. A more detailed quantitative assessment, using the Highways Agency Water Risk Assessment Tool (HAWRAT), is proposed at a later stage of the project.

Flood Impacts

10.2.7 HD45/09 highlights the potential for highways schemes to result in flood impacts associated with:

- Construction in the floodplain,
- Restrictions to in-channel flow hydraulics, causing increased water levels, due to construction of temporary or permanent in-channel structures, and
- Local changes to catchment drainage patterns due to the introduction of paved areas that, without attenuation, would result in an increase in the rate at which rainfall runoff reaches receiving water bodies.

10.2.8 It is anticipated that the Scheme options will not result in construction on, or encroachment onto, the floodplain and will not result in changes, including restrictions, to in-channel flow hydraulics. The Scheme options will result in the introduction of additional paved areas, which may result in increased runoff rates, so consideration of flood impacts has been scoped into this assessment. It should be noted however the assessment is qualitative, which is considered appropriate at this

early PCF stage. A more detailed quantitative assessment of flood impacts is proposed at a later stage of the project, when more detailed design information is available.

10.2.9 Following the scoping exercise detailed above, the assessment has consisted of a desk based study to characterise the baseline water environment within the study area. The desk study has been informed by published and internet-based information sources and requests for information/environmental data to key bodies, including the Environment Agency (EA) and the Lead Local Flood Authority (D).

Criteria for Determining Value and Impact

10.2.10 Following characterisation of the water environment baseline, the potential for each of the Scheme options to impact on water environment receptors and their attributes has been assessed using a methodology drawn from Volume 11, Section 3, Part 10 of the DMRB (HD45/09). This method comprises a number of stages, the first involving making a judgement as to the value (or sensitivity) of identified receptors, which is assigned to one of the categories defined in Table 10-1. The indicators used to make a judgement on the importance of a feature under consideration are quality, scale, rarity and substitutability and the examples in Table 10-1 are drawn from HD45/09 of the DMRB and Unit A3 of the Transport Analysis Guidance.

Table 10-1 Criteria for Determining the Value (Sensitivity) of the Groundwater and Surface Water Resource (Modified from DMRB HD45/09)

Sensitivity	Criteria	Typical Examples	
Very High	Attribute has a very high quality, importance and rarity on a regional or national scale	Surface water:	European Union (EU) designated salmonid/cyprinid fishery.
			Watercourse achieving Water Framework Directive (WFD) class 'High'. Site protected under EU or United Kingdom (UK) wildlife legislation (Special Area of Conservation, Special Protection Area, Site of Special Scientific Interest, Ramsar site). Designated washland or a large and active floodplain where there is high potential for flooding of a large number (> 100) of residential properties and infrastructure.
		Groundwater:	Principal aquifer providing a regionally important resource or supporting site protected under EC or UK habitat legislation. Source Protection Zone 1. Supports potable water supply abstraction of more than 500m^3/day.
		Geology and Soils	Very rare and/or of very high national and regional geological/geomorphological importance with no potential for replacement. Human Health – Future users of residential properties with private gardens.
High	Attribute has a high quality, importance	Surface water:	Watercourse achieving WFD class 'Good'.
			Major cyprinid fishery.
			Species protected under EU or UK wildlife legislation.

Sensitivity	Criteria	Typical Examples	
	and rarity on a local scale		Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
		Groundwater:	Aquifer providing locally important resource or supporting river ecosystem (Secondary A). Supports industrial/agricultural abstraction of > 500m^3/day or supports a private water supply of potable water to a small community. Source Protection Zone 2.
		Geology and Soils	Medium national and/or high regional geological/geomorphological importance with limited potential for replacement. Human Health* – Future users of allotments / construction workers / nearby residents.
Medium	Attribute has a medium quality, importance and rarity on a local scale	Surface water:	Watercourse achieving WFD Class 'Moderate'. Water feature that supports an abstraction for agricultural or industrial use of between 50 and 499m^3/day. Floodplain or defence protecting 10 or fewer industrial properties from flooding.
		Groundwater:	Aquifer providing water for agricultural or industrial use with limited connection to surface water (Secondary B). Source Protection Zone 3.
		Geology and Soils	Low regional and/or high local geological/geomorphological importance with some potential for replacement. Human Health* – Future users of residential properties without private gardens.
Low	Attribute has a low quality, importance and rarity on a local scale	Surface water:	Watercourse that is not a fishery, achieving WFD Class 'Poor'. Supports an abstraction for agricultural or industrial use of < 50m^3/day. Floodplain within limited constraints and a low probability of flooding of residential and industrial properties.
		Groundwater:	Non-productive aquifer.
		Geology and Soils	Local geological/geomorphological importance with potential for replacement. Human Health* – Future users of the completed highway and associated public open space.

10.2.11 The magnitude of change (or impact) on the baseline condition is then assigned considering the scale/extent of change and the nature and duration of the impact. Definitions of magnitude are

provided in Table 10-2, which have been drawn from HD45/09 of the DMRB and Unit A3 of the Transport Analysis Guidance.

Table 10-2 Criteria for Determining the Magnitude of Impact on the Surface Water, Groundwater Resource and Geology and Soils (Modified from DMRB HD45/09)

Magnitude of Impact	**Criteria**	**Typical Example**	
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface water:	Loss or extensive change to a fishery.
			Loss or extensive change to a Nature Conservation Site. Change in the WFD class of a river reach or pollution of a potable source of abstraction. Increase in peak flood level (1% annual probability) > 100 mm, or increasing the risk of flooding to >100 residential properties.
		Groundwater:	Loss of, or extensive change to an aquifer used for potable supply, potential high risk of pollution of groundwater. Loss of, or extensive change to groundwater supported designated wetlands.
		Soils and Geology	The Scheme is very damaging to the geological environment/soils resource of the study area; may result in loss of or damage to areas designated as being of regional or national geodiversity value; and the effects cannot be mitigated. Significant harm to human health is likely to arise from an identified hazard at the site without appropriate remedial action.
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute	Surface water:	Partial loss in productivity of a fishery due to a polluting discharge. Increase in peak flood level (1% annual probability) > 50 mm, or increased flood risk to < 100 residential properties.
		Groundwater:	Partial loss or change to an aquifer, potential medium risk of groundwater pollution. Partial loss of the integrity of groundwater supported designated wetlands.
		Soils and Geology	The Scheme may result in the loss of or damage to areas designated as being of national and/or regional geodiversity value within the study area. Some mitigation may be possible but would not prevent damage to the geological environment, as some features of interest would be lost or partly destroyed. It is possible that without appropriate remedial action, significant harm to human health could arise to a designated receptor but it is relatively unlikely that any such harm would be severe and if any harm were to occur, it is likely that such harm would be relatively mild.

Magnitude of Impact	Criteria	Typical Example	
Minor adverse	Results in some measurable change in attribute quality or vulnerability	Surface water:	Discharges to a watercourse that result in no significant loss of quality, fishery or biodiversity value. Increase in peak flood level (1% annual probability) < 50 mm or increasing the risk of flooding to < 10 industrial properties.
		Groundwater:	No significant change to an aquifer, potential low risk of pollution to groundwater Minor effects on groundwater supported wetlands.
		Soils and Geology	The Scheme would not affect areas with regional or national geodiversity value but may result in the loss of or damage to areas of local geodiversity value. The effects cannot be completely mitigated but opportunities exist for local enhancement of geodiversity value. It is possible that harm could arise to a designated receptor (human health) from an identified hazard but it is likely that at worst this harm if realised would normally be mild.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	The Development is unlikely to affect the integrity of the water environment. The Scheme would result in very minor loss of geodiversity value of local areas of geological interest/soils resource such that mitigation is not considered practical. There is a low possibility that harm could arise to a human health receptor. In the event of such harm being realised, it is likely to be mild or minor.	
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Flood risk:	Reduction in peak flood level (1% annual probability) > 10 mm. The Scheme may result in the exposure of geological formations that may become of significant local interest.
Moderate Beneficial	Results in moderate improvement of attribute quality	Flood risk:	Reduction in peak flood level (1% annual probability) > 50 mm. There is benefit to the geodiversity value of the geological/soils resource of the area as a result of the Scheme. The Scheme may result in the exposure of geological formations that may become of significant regional interest. The scheme may resolve moderate impact arising from existing land or water contamination.
Major Beneficial	Results in major improvement of attribute quality	Surface water:	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Reduction in peak flood level (1% annual probability) > 100 mm.

Magnitude of Impact	Criteria	Typical Example	
		Groundwater:	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring.
		Soils and Geology	The Scheme is very beneficial to the geodiversity value of the geological/soils resource of the area. The Scheme may result in the exposure of geological formations that may become of significant regional and or national interest.

10.2.12 The overall significance of effects is then derived by combining the value (sensitivity) of the receptor with the magnitude of the impact (change), as illustrated in Table 10-3.

Table 10-3 Criteria for Determining the Significance of Effects (Modified from DMRB HD45/09)

		MAGNITUDE OF IMPACT			
		Negligible	**Minor**	**Moderate**	**Major**
SENSITIVITY OF ATTRIBUTE	**Very High**	Neutral	Moderate	Large	Very Large
	High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Moderate

10.2.13 Based on professional judgement, a “significant” effect is considered to be one of Moderate significance or above.

Consultation

10.2.14 Consultation has been undertaken with Kent County Council and the Environment Agency. River Basin Management Plans and Strategic Flood Risk Assessments, published for the area, have also been utilised. Appendix 4-1 summarises these consultations. Consultation with statutory agencies will continue to take place during Stage 2 and 3 of the EAR.

10.3 Baseline Conditions

10.3.1 The following section summarises the baseline information obtained from desk based research of available data. Figures 10.1 to 10.11 also summarise the baseline information.

Geology and Groundwater

10.3.2 Table 10-4 below and Figures 10.1 to 10.8 summarise the geology and hydrogeology in the study area.

Table 10-4 Baseline Information Summary – Geology and Hydrogeology

Geology	**Superficial Deposits** – Most options cross local areas of head deposits around Bean junction and Ebbsfleet. The options also pass over local areas of river terrace deposits (sand and gravel). The majority of the option areas have no superficial deposits present.

Source – British Geological Survey map viewer	**Solid Geology** – At Bean junction most options would lie on or close to the Seaford Chalk Formation. To the south of the junction the dominant geology then becomes Thanet sand, with small pockets of Lambeth Group sand and clay and the London Clay Formation to the east of the junction. At Ebbsfleet the south east and east area of the junction is dominated by the Seaford chalk formation. Towards the western side of Ebbsfleet the geology is dominated by the Thanet sand formation.
Hydrogeology OS Maps / EA database – "What's in my backyard	**Aquifer Designations – *Superficial:*** The river terrace deposits are designated a secondary A aquifer. The head deposits are designated a Secondary aquifer – undifferentiated. ***Bedrock****:* The Lambeth Group sand and clay and Thanet Sand are designated as Secondary A aquifers. The Seaford Chalk Formation is shown as a principal aquifer of high to intermediate vulnerability.
	Source Protection Zones (SPZ) There are several SPZ 1's within the study area, including: • Two to the north of the A2 near Bean junction; • One to the south west of Bean junction; • Two to the south east of Bean junction; • One 250m south of the Ebbsfleet junction; • One to the north east of Ebbsfleet junction; • One to the south of the Ebbsfleet junction, which is related to a large public drinking water supply borehole. The remaining study area lies within a SPZ 2 or 3.
	Flow Direction Groundwater flow is considered to flow generally to the north and towards the Thames. Near the Ebbsfleet junction groundwater is likely to flows towards the River Ebbsfleet.
	Groundwater Abstractions Groundwater abstractions: • Two to the north of the A2 near Bean junction, • Another to the south west of the Bean Junction (450 m SW). • Two abstractions to the south east of Bean junction. • One large public water abstraction to the south of the Ebbsfleet junction. • Another two close to the Ebbsfleet junction (100 m E) • Another to the north east of the Ebbsfleet junction (250 m NE). All of the above are in the study area. None are located within the Scheme Limit.
	Groundwater Flood Risk Groundwater flood risk may become high when the water table rises in areas such as the Darent catchment and former chalk quarries. The EA groundwater emergence map, showing areas vulnerable to groundwater emergence (flooding), shows no potential flooding within the project extent (Kent County

	Council, February 2013. Flood Response Plan, Issue 1). However, the method of analysis is not stated so the potential for groundwater flooding should be reassessed at the next stage of route selection, particularly if deep excavation is proposed.
	Discharges to Groundwater: • Discharge consent immediately south of Ebbsfleet junction; • Discharge consent at B262/A2 junction; • Discharge consent at Eastern Quarry • A2 drainage soakaways, infiltration ponds and ditches (see later section)
	Groundwater Quality Based on information from the Environment Agency online mapping, the groundwater in the Chalk aquifer below the site is described as overall being of poor quality. The chemical quality is also classed as poor (deteriorating). Overall the aquifer is defined as being at risk and is a protected area.
Geodiversity heritage sites, SSSI and RIGs **Source –** Magic website	The nearest and largest Site of Special Scientific Interest (SSSI) is Darenth Wood (Chapter 9) which is unrelated to geological heritage and is an ecological SSSI. A smaller (6 ha) SSSI (Baker's Hole) is located within 0.5 km of the scheme area, to the north-east. It comprises an Earth Heritage site (geology). Key Pleistocene site exposing a complex sequence of periglacial and temperate climate deposits, These are associated with the Ebbsfleet Valley and they have yielded mammals, molluscs, and two different Palaeolithic industries. The interdigitation of solifluction (slope) deposits and temperate freshwater sediments implies that more than one glacial period is represented (Ref 10-23). Swanscombe Skull SSSI is located around 1 km to the north of the scheme area. It is a site of cultural interest as well as geological. Barnfield Pit, Swanscombe is the only site in the UK to yield unquestionable Lower Palaeolithic human remains and arguably the most important site in the British Pleistocene. In addition to its paleoanthropological interest the site is of great importance for stratigraphy, palaeontology and Palaeolithic archaeology. The site is of considerable importance, quite apart from the world-famous human skull. The recorded faunas include 26 mammalian taxa (e.g. man, macaque, lion, straight-tusked elephant, two extinct rhinos, horse, several deer, aurochs and small mammals) and many birds. The site also has a fossil soil and a horizon of fossil footprints, (Ref 10.24) The SSSI designations do not mention surface water or groundwater features and OS mapping does not indicate such features in the vicinity of the SSSIs.

Contaminated Land (Geology and Soils)

10.3.3 Table 10-5 below and Figure 10.9 summarise the historical and existing potentially contaminative uses in the study area.

Table 10-5 Baseline Information Summary – Contaminated Land

Waste Activities EA database – "What's in my backyard	One registered historical landfill (Northfleet Landfill) to the north east of the Ebbsfleet junction (~800m).

	There are several other historical landfills within 1km of the scheme, although none directly within any of the scheme development areas. These landfills are highlighted below: • Southfleet Pit (~700m N) (dates unknown) • Bamber Pit (~1km N) (last waste received 16 April 1993) • South of Springhead (1km E) (dates unknown) • Alkerden Lane (~900m N) (dates unknown) • Darenth Wood (~1km W) (dates unknown) The waste types deposited at the above landfills are reported to include inert and commercial wastes.
Recorded pollution incidents	No recorded pollution incidents on the A2 itself. Two significant pollution incidents around 200 m N and S of the A2 near Bean junction. The incident to the north occurred on the 4th of March 2002 and comprised a spill of oils and fuel to water and land. The significant incident to the south occurred on the 15th March 2004 and comprised pollution from inert materials and wastes to land. No pollution to controlled waters occurred in this location. The one major incident is around 100 m south of Ebbsfleet junction and occurred on the 27th of October 2004. This incident comprises a spill of oils and fuels which had significant impacts to land and major impacts to nearby controlled waters.
Other potentially Contaminative Land Uses (Present)	• To the north of the A2 near Ebbsfleet junction there is an electrical production and distribution centre (50 m N); • Further quarries to the north east of the Ebbsfleet junction (On Site and present up to 1 km away from the road); • Another electricity production and distribution centre to the south east of the Ebbsfleet junction (10 m NE); • Car breaker's yard to the east of the Bean junction (within the Bean triangle) (50 m S).
Other potentially contaminative land uses (Historical)	• A historical factory/works to the north east of the Ebbsfleet junction (420 m NE); • A historical sewage works to the north east of the Ebbsfleet junction (450 m NE); • Closed fuel station 'Watling road services' close to Bean junction (50 m S); • Closed fuel station 'Springhead services' at Ebbsfleet junction (50 m NE); • By Bean junction there is a historical clay, brick and tile manufacturer between the two roundabout options (10 m E); • To the north of the A2 within the study area there are two large historical chalk quarries (25 m N).

Surface Water

10.3.4 Table 10-6 below and Figure 10.10 summarise the surface water features of interest.

Table 10-6 Baseline Information Summary – Surface Water

Major surface water features	River Ebbsfleet is the only designated Main River within the site boundary. The River Ebbsfleet is described in the Thames River Basin Management Plan (RBMP) as being a heavily modified waterbody that has a 'Moderate' ecological status and a 'Not Requiring Assessment' chemical status, based on the WFD classifications. The Ebbsfleet also contains a section of reed bed that has been designated with UK Biodiversity Action Plan (BAP) protection. River Darent is located approximately 1.9km west of the site boundary. The River Darent is a partly groundwater fed river with 'Poor ecological status and 'Good' chemical status. River Thames, located approximately 1.2km north of the site boundary (WFD waterbody 'Thames Middle'). The River Thames is a heavily modified waterbody that has a 'Moderate' ecological status and a 'Good' chemical status. The Dry Valley at Bluewater is listed within the EA's 2009 RBMP for the area and is described as a heavily modified water body with 'Good' ecological potential and a 'Not Requiring Assessment' chemical status.
Other minor surface water features	There are also a number of lakes in the vicinity of the site. Eastern Quarry contains a number of lakes and is located north of the A2 and the Blue Lake, is located approximately 350 m northeast of the site. These waterbodies were formed from historical quarrying activities. Blue Water Retail Park, located approximately 500 m north of the site, also contains a series of ponds. These lakes and ponds are not described in the RBMP nor classified under the WFD. There are also a number of attenuation/infiltration ponds that form part of the surface water drainage systems that serve the existing highways within the study area. The site and study area also contains a number of un-named surface water drains and ditches that are likely to receive local drainage and form tributaries to the main watercourses listed above.
Surface Water abstractions	Information on licensed abstractions from surface waters from the EA shows that there are no abstractions within and up to 0.5 km from the study area. There are a number of abstraction points on the River Darenth and the River Thames, but given their distance from site these are unlikely to pose a constraint on development.
Flood Risk	The EA flood map for planning, which illustrates flood risk from main rivers and the sea, indicates that the majority of the Scheme and wider study area is located in Flood Zone 1, having an annual chance of less than 1 in 1000 (0.1%) of flooding from these sources. There is a narrow area of Flood Zone 3 (greater than 1 in 100 year (1%) annual chance of flooding) along

	the upstream reach of the River Ebbsfleet, which intersects with the Scheme approximately 500m east of the A2 Ebbsfleet Junction. No parts of the Scheme or wider study area are within the medium (Flood Zone 2) or high (Flood Zone 3) flood risk zones associated with the River Thames. However, flooding within the River Thames may interact with the River Ebbsfleet, via backwater effects for example, and this may contribute to the predicted flood likelihood and extent for the River Ebbsfleet and the Ebbsfleet junction area of the Scheme. The EA flood map also indicates that much of the flood risk areas described above benefit from protection by flood defences, however the standard of these defences has not been confirmed. The EA risk of flooding from surface water map shows that land within the Scheme limits generally has a very low risk of surface water flooding, which denotes areas with an annual chance of flooding of less than 1 in 1000 (0.1%). However, there are some areas of low, medium and high risk; the distribution of these areas is synonymous to the existence of current surface water features and areas of low-lying topography. Areas of high risk, including the highway corridor, are located around the River Ebbsfleet crossing of the A2, toward the eastern boundary of the Scheme. The EA risk of flooding from reservoirs map shows that there is no risk to the Scheme of flooding from reservoir failure and release. Neither Kent County Council (KCC) nor the EA hold any records of flooding in the study area. However, the HADMMS database records thirteen incidents of highway flooding within the Scheme limits, seven in the proximity of the Bean Junction and six at Ebbsfleet Junction. The majority of these incidents were related to blocked gullies or filter drains becoming over grown. No information about the storm return period or duration is recorded so it is not possible to confirm if the storms that resulted in these floods were greater than the allowable design return period, or if the current drainage is inadequate.

Drainage

10.3.5 Table 10-7 and Figure 10.11 summarise the drainage system currently in place in the study area.

Table 10-7 Baseline Information Summary – Highway Drainage

Outfalls to Surface Water	The A2 drainage in the vicinity of the Ebbsfleet Junction discharges to the River Ebbsfleet. A settlement tank is located at the outfall, but it is unknown if there are any online flow attenuation facilities. Further downstream along the River Ebbsfleet, there are more outfalls from the road drainage and there is an attenuation pond north of the Ebbsfleet Junction. The Channel Tunnel Rail Link (CTRL) also has an outfall to the River Ebbsfleet. The CTRL outfall is at the same location as an A2 drainage outfall.

	There are some large waterbodies to the north of the A2/A296; however as there is no drainage information in these areas it is considered unknown whether these would be used for highway drainage outfalls.
Outfalls to Ground	There are no outfalls or infiltration structures to ground around the Ebbsfleet junction. Drainage at Bean junction comprises infiltration to ground; approximately 17 soakaways, one infiltration pond, an infiltration ditch and associated fuel interceptors. The infiltration ditch is located on the A296 slip road entering the A2 from the west. There are two ponds located close to the Bean junction. The attenuation pond (WB3 on Figure 10.11) west of the junction discharges to a series of borehole soakaways. The other pond (WB5) is both an attenuation and infiltration pond (infiltration to ground).

10.4 Value (Sensitivity) of Resource

10.4.1 Based on the baseline information detailed above, the following potential resources / receptors have been identified within the study area that could be impacted by development of the scheme. Each receptor has been assigned a value in accordance with guidance outlined above. The resource / receptors and value are detailed in Table 10-8 below.

Table 10-8 Receptor Value Summary – Surface Water, Groundwater and Contaminated land (Created from DMRB guidance HD45.09)

Receptor	Value
River Ebbsfleet	Water Quality – **Medium**, having overall WFD ecological status of Moderate. Flow Conveyance & Storage – **Medium**, within the study area having only very limited areas of floodplain. Water Supply & Wastewater Dilution – **Medium**, no licensed abstractions supported within the study area but receives consented discharges. **Overall value: Medium**
River Thames	Water Quality – **High**, having WFD ecological status of Moderate and chemical status of Good. Flow Conveyance & Storage – **Medium**, no residential properties or industrial premises within the study area at risk of direct flooding, but may cause backwater effects on the River Ebbsfleet. Water Supply & Wastewater Dilution – **Medium**, no licensed abstractions supported within the study area but receives consented discharges and abstractions in the wider vicinity. **Overall value: High**
River Darent	Water Quality – **Medium**, having WFD ecological status of Poor but chemical status of Good.

Receptor	Value
	Flow Conveyance & Storage – **Low**, having no residential properties or industrial properties at risk of flooding within the study area. Water Supply & Wastewater Dilution – **Medium**, no licensed abstractions or discharges within the study area, but receives some abstractions in the wider vicinity. **Overall value: Medium**
Dry Valley at Bluewater	Water Quality – **High**, having overall WFD ecological status of Good and a chemical status that 'does not require assessment' as there are no identified priority substances or specific pollutants that are discharged in significant quantities to this waterbody. Flow Conveyance & Storage – **Low**, limited flow and storage capacity and low flood risk. Water Supply & Wastewater Dilution – **Low**, no abstractions or discharges. **Overall value: Medium**
Lakes and ponds	Water Quality – **Medium**, no WFD status classification but significant features at the local scale. Flow Conveyance & Storage – **Medium**, low flood risk and limited connectivity to wider catchment. Water Supply & Wastewater Dilution – **Low**, no licensed abstractions or consented discharges. **Overall value: Medium**
Unnamed streams/drains	Water Quality – **Low**, No assigned WFD status, but assumed to have low ecological value. Flow Conveyance & Storage – **Low**, drain small, local catchments. Water Supply & Wastewater Dilution – **Low**, no licensed abstractions or consented discharges. **Overall value: Low**
Principal Aquifer (Chalk)	Water Supply – **Very High**, Water Quality issues, regional supply. Conveyance of Flow – **Very High**, Groundwater Level reduction (Particularly if fracture flow dominant, has very high transmissivity allowing rapid water rise or fall). **Overall value: Very High**
Secondary Aquifer (Thanet and Lambeth)	Water Supply – **Medium to High**, Water Quality issues. Conveyance of Flow; **Medium to High**, Groundwater level reduction. Removal of waste products – **Medium to High.** **Overall value: Medium to High**

Receptor	Value
Licensed wells – Public Supply Wells	Water Supply – **High**, Water Quality (Loss of well: regional supply). Value to Economy – **High**, Loss of well. Water Quality – **High**, Loss of well. Conveyance of Flow - **High**, Loss of well. **Overall value: High**
Licensed wells – others	Water Supply – **Medium to High**, Water Quality (Loss of well: local supply). Value to Economy – **Medium to High**, Loss of well. Water Quality – **Medium to High**, Loss of well. Conveyance of Flow – **Medium to High**, Loss of well. **Overall value: Medium to High**
SPZ 1	Water supply – **Very High**, Water Quality issues.
SPZ 2	Water supply – **High**, Water Quality issues.
River Darent (groundwater supported water course)	Water Quality – **High,** Reduction of base flow. Conveyance of Flow - **High,** Reduction of base flow. Biodiversity - **High,** Reduction of base flow. Recreation - **High,** Reduction of base flow. Value to economy - **High,** Reduction of base flow. **Overall value: High**
Properties that could be affected by groundwater flooding	Conveyance of Flow (underlying groundwater) – **High**, Groundwater flooding.
Human Health	Construction Workers / Residents – **Medium to High**, Inhalation or contact with contaminants. End users (Road Users) – **Low**, Inhalation or contact with contaminants.
Geological receptors (Bakers Hole SSSI and Swanscombe Nest SSSI)	Flooding of SSSI – **High**, Damage to the SSSI. Direct damage to SSSI - **High**, Damage to the SSSI. **Overall value: High**

10.5 Regulatory/Policy Framework

10.5.1 This assessment has been undertaken in accordance with current legislation along with national, regional and local plans and policies. A summary of which is provided below in Table 10-9.

Table 10-9 Regulatory and Planning Policy Framework

Policy / Legislation	Summary of Requirements
The National Planning Policy Framework (NPPF) and planning practice guidance (Ref 10-13)	The National Planning Policy Framework (NPPF) and planning practice guidance set out the Government's planning policies for England, including development in flood risk areas. The NPPF states that developers and Local Authorities should try to locate development in areas of lowest flood risk. Development of roads fall under the NPPF category of 'essential infrastructure' and development of this nature is deemed suitable in Flood Zones 1 and 2 (defined by the Environment Agency and referring to the probability of sea and river flooding only, ignoring the presence of existing defences) and also suitable in Flood Zone 3 subject to satisfaction of the Exception Test. In accordance with NPPF it must be demonstrated that the Scheme provides wider sustainability benefits to the community that outweigh flood risk, will be safe from flooding for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. The NPPF also obliges developers to "prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location". Whilst containing only limited guidance on land affected by contamination the document does state that: "To prevent unacceptable risks from pollution and land instability, planning policies and decisions should ensure that new development is appropriate for its location. The effects (including cumulative effects) of pollution on health, the natural environment or general amenity, and the potential sensitivity of the area or proposed development to adverse effects from pollution, should be taken into account. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner".
The Water Environment (Water Framework Directive) (England and Wales) Regulations, (Ref 10-14)	The Water Framework Directive (WFD), enacted in England via The Water Environment (Water Framework Directive) (England and Wales) Regulations, establishes a legal framework to promote the sustainable use of Europe's waters and restore clean water. There is an aim to achieve 'good status' for all surface waters. The Environment Agency is responsible for classifying water bodies in England, setting future water quality targets and implementing measures to achieve good status, where required. The WFD provides for a range of measures to protect surface and groundwater quality and has led to the setting up of various protected areas for groundwater such as drinking water protected areas, source protection zones and safeguard zones.
The Water Resources Act 1991 (Ref 10-15)	The Water Resources Act 1991 as amended sets out the regulatory regime under which water abstraction and impounding is licensed by the EA.
The Water Drainage Act 1991 (Ref 10-16)	Provides for the EA to prevent the obstruction of any watercourse or any main river through the construction of any flow control structures, culverts or any other structure in a watercourse or main river. Where culverting or other works have a potential to affect the flow regime of ordinary watercourses, consent is required from the LLFA under the Flood and Water Management Act 2010.
Environmental Protection Act (1990) (Ref 10-17)	Government policy in relation to land contamination is outlined in Department of Environment Food and Rural Affairs (Defra) (2012) Statutory Guidance on Contaminated Land. The policy aims to both prevent new contamination and to address the inherited legacy of contaminated land.

Policy / Legislation	Summary of Requirements
	The identification of contaminated land, as defined in Part 2A of the Environmental Protection Act 1990, comprises a risk-based approach. For harm to the non-aquatic environment or pollution of controlled waters to occur, there must be a relevant 'pollutant linkage'. This linkage is based on the following being present: • A source of contamination (hazard); • A pathway for the contaminant to move from source to receptor; and A receptor (target), which is affected to an unacceptable degree by the contaminant. This includes humans, ecosystems, controlled waters, physical systems and built structures, which could be affected by the hazard.
National Networks National Policy Statement (2014) (Ref 10-18)	This policy document sets out the need for, and Government's policies to deliver, development of nationally significant infrastructure projects (NSIPs) on the national road and rail networks in England. Geological conservation is detailed within the Biodiversity and Ecological Conservation chapter and relates to the sites that are designated for their geology and /or their geomorphological importance.
North Kent Rivers Catchment Flood Management Plan (Ref 10-19)	The North Kent Rivers Catchment Flood Management Plan includes the catchment of both the River Darent and the River Ebbsfleet and is designed to guide and inform planning and decision making by key stakeholders to promote more sustainable approaches to manage flood risk.
Dartford Borough Council Core Strategy (Ref 10-20)	Dartford Borough Council Core Strategy sets out the long-term spatial strategy for the Borough to 2026. The Strategy aims to ensure sustainability in the future and guides the planning process to minimise any potential environmental, economic or social issues. The plan has identified the need for infrastructure improvements in the region, including along the A2, as well as noting the Ebbsfleet to Stone area as a priority development area. The strategy includes a hydrological focus in aiming to ensure the retention and enhancement of the River Ebbsfleet and other watercourses within the area, which includes the provision of flood risk mitigation measures, as well as ensuring the effective management of surface waters in the area.
Thames River Basin Management Plan (Ref 10-7)	The Thames River Basin Management Plan has been prepared to set out the environmental objectives of surface water and groundwater bodies following the long-term objectives of the WFD. The Thames RBMP provides specific and localised guidance on the achievement of 'Good' status for water bodies as well as promoting sustainable water management.

10.6 Design, Mitigation and Enhancement Measures

10.6.1 At Stage 1, the design, mitigation and enhancement measures described in this section are largely generic and relevent to each of the three options described in Section 2. Scheme specific design measures are discussed in outline. Detailed mitigation measures would be described at Stage 3 following selection of the prefered option and further design information.

Generic Mitigation Measures

10.6.2 All design, construction and operation work would be carried out in accordance with a number of generic mitigation measures and follow best practice, guidelines, including DMRB that would prevent damage, or loss to the water environment and prevent harm to human health. It is anticipated that the following generic mitigation measures would be applied throughout the design,

construction and operation phases of the Scheme (any Scheme specific measures have been annotated accordingly below):

Design

10.6.3 At Ebbsfleet Junction, no drainage outfalls to ground (i.e. no infiltration features or soakaways) are proposed in order to minimise the risk of causing groundwater flooding and inundation of the drainage system due to the shallow groundwater table (Scheme specific mitigation measure).

10.6.4 At Bean Junction, re-use of existing highway drainage soakaway of infiltration features are proposed, where possible as this is an area where the water table is deep. Replacement of structures will be required where the development causes removal of an outfall structure (to be detailed at Stage 3) (Scheme specific mitigation measure).

10.6.5 Adverse impacts on human health would be avoided where possible. Detailed design of the selected option would aim to prevent a pollutant linkage between a contamination source and contact with humans.

10.6.6 Highways England has a proprietary approach to drainage design as detailed in DMRB Volume 4, Section 2, Part 9 (HA 119/06) (Ref 10-21) which would be used to inform the Drainage Strategy for the Scheme. In accordance with HA 119/06 and the National Networks National Policy Statement the Drainage Strategy would incorporate appropriate forms of Sustainable Drainage System (SuDS) within the drainage design (where appropriate).

10.6.7 When considering road runoff, discharges from roads must not lead to deterioration in the WFD classification status of the receiving surface or groundwater as determined in the relevant River Basin Management Plan (Ref 10-7). A quantitative appraisal of Spillage Risk will be carried out during later PCF stages using the Water Risk Assessment Tool (“HAWRAT”). This assessment will be undertaken for all new outfalls and any existing outfalls that are affected by the Scheme. This assessment will confirm the environmental risk as a result of the Scheme which will then be dealt with through the design to ensure that water quality will not deteriorate compared to the existing situation.

10.6.8 There will be an increase in impermeable area cover associated with all of the Scheme option pairs, so there will be changes to existing patterns, rates and volumes of surface water runoff. The drainage design will be such that operation of the drainage system will result in minimum adverse impacts to the receiving water environment, whether through pollution or increased flood risk. This will be achieved by the design including for the provision of attenuation and treatment/spillage control devices.

Construction

10.6.9 To ensure the quality of the water environment does not deteriorate during construction, a CEMP will document all construction phase mitigation measures. These will include a pollution control plan, standard best practices, relevant CIRIA pollution prevention guidance and a site waste management plan.

10.6.10 Pursuant to the CEMP, method statements and management plans will be prepared by the successful Contractor(s) detailing their approach to construction. Best practice pollution prevention and control measures will be adopted to ensure that water resources are not adversely affected by storm water runoff or accidental spillages from construction sites. The CEMP will also include an

emergency preparedness and response plan. This will provide a full list of protocols and communication channels with the EA in the event of a pollution incident.

10.6.11 The Contractor will comply with BS 6031 'Code of Practice for earthworks' (Ref 10-22) regarding the general control of site drainage including, for example, all washings, abstractions and surface water runoff, unless otherwise agreed by the employer's representative.

10.6.12 If any water abstraction is required as part of the construction process, the EA will be contacted and the appropriate licenses will be obtained. Any abstraction practices will be in accordance with the guidelines and requirements of these licences.

10.6.13 Consultation with the EA or Lead Local Flood Authority is required where any of the Scheme lies within 9 m of a designated main river or ordinary watercourse respectively. Such watercourses are ordinarily subject to byelaw control and consent would also be required under the Water Resources Act 1991 for works on, over or within the river channel, including temporary works required for construction purposes and the construction of surface water outfalls.

10.6.14 The risk of disturbing contamination within and outside the immediate road construction site will depend on a number of factors including the actual presence and type of contamination, site-specific ground conditions such as permeability and the depth of excavations/cuttings below the water table. This will be investigated at a later stage of the Scheme design. Specific assessment of potentially contaminated ground would include assessment of the two former petrol stations (former Watling Road Services and Springhead Services) as necessary.

10.6.15 During stripping excavation / construction works, a watching brief would be adopted with site workers remaining vigilant so any visual or olfactory signs of contamination are noted and that any contaminated soil is kept separate from other materials. Any suspected contaminated material would be analysed to determine if it is suitable for re-use on site or requires disposal off-site to an appropriate soil recycling or disposal facility.

10.6.16 Suitable Personal Protective Equipment (PPE) including Respiratory Protective Equipment (RPE) (if necessary) would be available to all site workers. Appropriate site hygiene protocols would be adopted during the construction phase.

Operation

10.6.17 The road surface will restrict the exposure to the geology and soils beneath the road and therefore potential pollutant linkages (e.g. dermal contact from contaminated soils) would be broken should contaminated soils be present. The impacts to future site users such as maintenance workers will also be mitigated by the remedial measures that are implemented during the construction phase. Any residual risks to Maintenance Workers will be further reduced by the use of appropriate PPE during works and compliance with Health and Safety legislation and CDM Regulations.

10.6.18 There is a risk to shallow soils and the water environment from road spray and pollution incidents associated with the road usage (e.g. fuel / oil spillages). These risks will be mitigated within the design of the drainage system that is installed during the construction of the road.

10.6.19 The highway drainage attenuation and treatment/spillage control devices will require appropriate operational and maintenance procedures for continued avoidance of pollution of the receiving controlled waters.

10.6.20 The highway drainage in the Ebbsfleet junction will be designed to take account of potentially shallow groundwater levels. Consideration will include the potential to ingress into surface water drainage and potential for local groundwater flooding during prolonged wet weather periods. Assessment will include site investigation and water level monitoring. Drainage will be designed to

separate collection and conveyance of surface water from any potential ingress of groundwater, as necessary, in later design stages.

Enhancement Measures

10.6.21 The current drainage network has not been designed with an allowance for climate change. The risk of surface water flooding from the Scheme itself will therefore be alleviated by the provision of a drainage design that accommodates a 1 in 5 year storm event, inclusive of an appropraite allowance for climate change, , in accordance with the guidance in Section 6.2 of HD 33/06, Volume 4, Section 2 (Ref 10-21). The climate change allowance would be determined with reference to the most recent Environment Agency guidance, published in February 2016.

Monitoring Requirements

10.6.22 During the construction phase of the Scheme a surface water and groundwater monitoring plan would be implemented, in terms of both water quality and quantity, if required. This will also include groundwater level monitoring where relevant, including at Ebbsfleet junction.

10.6.23 During the earthworks, a watching brief would be adopted with site workers remaining vigilant to any visual or olfactory signs of contamination and any contaminated soil will be kept separate from other materials. Any suspected contaminated material would be analysed to determine if it is suitable for re-use on site or requires disposal off-site to an appropriate disposal facility.

10.7 Magnitude of Impacts & Significance of Effects

10.7.1 The magnitude of impacts and significance of effects on the water environment are assessed below. The magnitude and characterisation of impacts is based on the baseline data described in Section 10.3 and assumes all necessary mitigation, outlined in Section 10.6, is carried out.

10.7.2 Impacts and their significance relating to Ebbsfleet Option 1b are common to each of the three Scheme options and is discussed first within Table 10-10 below. Impacts specific to each option (i.e those relating to Bean Option 3, Option 4b and Option 5) are discussed seperately as each option involves different areas of development.

Ebbsfleet Option 1b

Table 10-10 Significance ratings for Ebbsfleet Option 1b

Aspect of concern	**Magnitude and characterisation of impact**	**Post Mitigation Residual Significance**
SPZ 1	<u>Construction</u> Any below ground works may increase the potential for any contamination to migrate to the groundwater below the works. Also below ground works have the potential to create suspended solids. Ebbsfleet Junction, has no proposed below ground works so there is minimal risk of impacts occurring here. <u>Operation</u> No operational impacts identified (assuming mitigation from appropriate fuel interceptors and generic mitigation measures).	Moderate adverse Neutral
SPZ 2	<u>Construction</u>	

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
	Any below ground works may allow contamination to migrate to the groundwater below. There are no proposed soakaways or infiltration ditches planned at the Ebbsfleet Junction, so low risk of impacts occurring. Operation No operational impacts identified (assuming mitigation from appropriate fuel interceptors).	Slight / Moderate adverse Neutral
Contamination of water supply from historical fuel station (Springhead services)	Construction Any below ground works may disturb contamination which may allow some migration to the aquifer below. Operation No operational impacts identified (assuming generic mitigation measures described above).	Large adverse* Neutral
Contamination from electrical substation and historical quarrying	Construction Any below ground works may disturb contamination which may allow some migration to the aquifer below. Operation No operational impacts identified (assuming generic mitigation measures described above).	Slight / Moderate adverse Neutral
Contamination of water supply from recorded pollution incidents	Construction Any below ground works may disturb contamination which may allow some migration to the aquifer below. Operation No operational impacts identified (assuming mitigation from appropriate fuel interceptors and generic mitigation measures described above).	Neutral Neutral
Drainage Capacity	Construction Not applicable. Operation There is a shallow water table at Ebbsfleet Junction (2-5 m bgl) and as a result this could allow some groundwater ingress into the drainage system resulting in flooding of the road and surrounding area. Mitigation comprising suitable drainage that would minimise ingress of groundwater into the surface water drainage system is assumed. It should be noted the current drainage design does not have an allowance for climate change	Neutral Slight adverse
Infrastructure	Construction Any below ground works could create a barrier effect to groundwater flow as well as creating a potential local rise in groundwater flooding/rise causing the road to be flooded. None are proposed at	Slight/Moderate adverse

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
	this stage but should structures be proposed then mitigation would include a groundwater level assessment and design to minimise barrier effects, where necessary. Operation Without mitigation prolonged periods of increased rainfall could result in groundwater flooding, particularly due to the likely shallow water table (as low as 2 m bgl). Mitigation would be provided, as necessary and would include further assessment of groundwater levels and assessment of the need for shallow groundwater drainage. Groundwater drainage is not currently present at the junction and the proposed junction layout will remain at grade. The risk or otherwise of increased groundwater levels e.g. from climate change effects will be considered and appropriate mitigation made in later design stages.	Neutral
Bakers Hole SSSI and Swanscombe Skull SSSI	Construction No construction impacts are anticipated as the SSSI sites are not close enough to the Scheme area to be impacted. Operation Operational impacts are unlikely as flooding of the SSSIs from surface water or groundwater due to the Scheme is unlikely.	Neutral Neutral
Construction /Maintenance Workers	Construction Any residual contamination from potential land uses such as the fuel stations, electrical substations and historical factories in the scheme area could impact workers. However, the described generic mitigation measures, including use of appropriate PPE, are likely to reduce the risk. Operation Maintenance workers may still be exposed to residual contamination from the land uses outlined above when performing upgrades to maintain the road. However, if appropriate PPE is worn and best practice health and safety measures are followed then the risk will be lowered.	Slight/Moderate adverse Slight/Moderate adverse
Road Users	Construction No construction impacts anticipated. Operation No operational impacts anticipated.	Neutral Neutral
Surface Water Features	Construction When construction works take place in proximity to surface water features there is potential for direct pollution, silting and erosion. There are also indirect pollution pathways to surface water, due to the receipt of contaminated surface water runoff. Sources of pollutants could include storage and management of fuels and oils,	Slight adverse

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
	use of cement-based products and the potential release of sediment. Additional hazards arising from construction activities include accidental release of floatable material, such as plastic and plastic film, and loss of material during storm events and mobilisation of contamination and migration into controlled waters. In addition, there is also a higher risk of entraining fine sediment in runoff, which could increase siltation in the receiving watercourse. However, adherence to the measures and working methods set out in the CEMP would prevent pollution of the surface water environment or allow containment and rapid clean-up of any accidental spills or incidents. Operation During the operational phase, there is potential for mobilisation of contamination into controlled waters from vehicles using the Scheme. Road drainage could be contaminated by spills and leaks of oil and fuel, and by other materials deposited onto the drained surfaces, and contaminated runoff could be released into the surface water environment, or indirectly to groundwater, via this route. There is also a risk that polluting materials may be spilt onto the road surface as a result of a road accident. These pollutants have the potential to enter surface water. However, as a result of the Scheme, mitigation measures will lead to appropriate drainage control/interpretation prior to discharge which is anticipated to lead to a reduction of pollution entering the water courses.	Neutral
Infrastructure (Surface Water Flooding)	Construction The risk of surface water flooding occurring during construction is most likely to arise from heavy rainfall when runoff may pond, potentially resulting in flooding of working areas and excavations. During the initial earthworks phase, topsoil and subsoil will be exposed and water-logging and ponding may occur more frequently. Additionally, there is a higher risk of entrained sediment in runoff, leading to blockage or reduced conveyance capacity in local drains/ditches and components of the existing highway drainage system. However, with appropriate construction site drainage in place surface water would be managed on site to reduce the likelihood of surface water ponding and flooding. Operation New impermeable areas will be created, which without appropriate measures, would induce higher rates and volumes of rainfall runoff, with the potential for increased surface water flood risk. Drainage of cuttings may increase receiving stream flows and any requirement for new watercourse crossings or alterations to existing crossings has the potential to impact on the flow conveyance and capacity of surface water receptors and flood risk from these sources. However, the scheme drainage design incorporates SuDS measures to deliver attenuation of surface water runoff rates, such that greenfield rates are not exceeded. Drainage from cuttings would also be made in accordance with relevant consent parameters and any new or altered existing watercourse crossings would be designed and	Slight adverse Neutral

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
	constructed in line with current best practice guidelines to prevent impacts on flow conveyance. As a result of these design measures there would be no increase in flood risk from any source as a result of the operation of the Scheme.	

* Two closed fuel stations (both within 500 m) pose a risk to construction workers and also groundwater as there may be residual contamination still present.

Bean Option 3

10.7.3 Table 10-11 identifies the controlled water and geology and soils receptors where construction or operational impacts could arise from Bean Option 3.

Table 10-11 Significance ratings for Bean Option 3

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
SPZ 1	Construction Any below ground works may allow potential contamination to migrate to the aquifer below the works. An infiltration ditch which already exists along the slip road from the A296 joining onto the A2 eastbound partly lies over a SPZ 1 and this presents a potentially risk of impact to groundwater quality during construction. The presence of an infiltration ditch overlying a PSZ1 is an historical legacy and does not meet current best practice (DMRB). However surveys, drainage assessments and liaison with regulatory authorities would be conducted at later design stages in order to improve the drainage and mitigate, where necessary, potential impacts such as to the SPZ1. During construction mitigation would be included as part of CEMP. There are also planned deep cuttings in this area increasing the risk of contaminant migration to the water table. Mitigation to prevent pollutants entering the aquifer would be included as part of the CEMP. Operation No additional operational impacts identified (including for the infiltration ditch compared to the existing situation) assuming mitigation from appropriate fuel interceptors and generic mitigation measures. Additional mitigation to be agreed in consultation with regulators.	Moderate to Large Adverse* Neutral
SPZ 2	Construction Any below ground works may allow contamination to migrate to the aquifer below the works. Construction of the proposed new soakaways around the Bean junction above the SPZ 2 increase the risk of impact to water quality further although the deep water table	Slight / Moderate Adverse

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
	(30 - 50 m bgl) is noted. Mitigation to prevent pollutants entering the aquifer would be included as part of the CEMP. Operation No operational impacts identified (assuming mitigation from appropriate fuel interceptors and generic mitigation measures).	 Neutral
Contamination of water supply from historical quarrying	Construction Any below ground works may disturb contamination which may allow some migration to the aquifer below. Mitigation measures would be described in the CEMP. Operation No operational impacts identified (assuming generic mitigation measures described above).	 Slight / Moderate Adverse Neutral
Contamination of water supply from historical fuel station (Watling road services)	Construction Any below ground works may disturb contamination which may allow some migration to the aquifer below. Mitigation measures would be described in the CEMP. Operation No operational impacts identified (assuming generic mitigation measures described above).	 Moderate to Large Adverse* Neutral
Drainage Capacity	Construction Not applicable Operation No operational impacts anticipated due to the deep water table around the Bean junction (30 - 50 m bgl).	 Neutral Neutral
Infrastructure	Construction No construction impacts causing barrier effects to groundwater flow are anticipated due to the deep water table around the Bean junction. Operation No operational impacts anticipated due to the deep water table around the Bean junction.	 Neutral Neutral
Construction /Maintenance Workers	Construction Any residual contamination from potential land uses such as the fuel stations, electrical substations and historical factories in the scheme area could impact workers. However, the described generic mitigation measures, including use of appropriate PPE, are likely to reduce the risk. Operation	 Slight/Moderate Adverse

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
	Maintenance workers may still be exposed to residual contamination from the land uses outlined above when performing upgrades to maintain the road. However, if appropriate PPE is worn and best practice health and safety measures are followed then the risk will be lowered.	Slight/Moderate Adverse
Road Users	Construction No construction impacts identified. Operation No operational impacts identified (assuming generic mitigation measures described above).	Neutral Neutral
Surface Water Features	Construction Potential for minor and localised residual pollution risks associated with accidental spills and silt releases, however implementation of the CEMP would facilitate rapid containment and clean up. Operation Road drainage design would facilitate appropriate collection and treatment of highway drainage prior to discharge to the surface water environment and would include means of spillage containment. Also, as a result of the Scheme, congestion and the number of accidents, with pollution risks, are anticipated to be reduced.	Slight Adverse Neutral
Infrastructure (Surface Water Flooding)	Construction Appropriate construction site drainage would be put in place to manage surface water runoff on site to reduce the likelihood of surface water ponding and flooding, however some residual risk would remain during more significant rainfall events. Operation New impermeable areas will be created, which without appropriate measures, would induce higher rates and volumes of rainfall runoff, with the potential for increased surface water flood risk. Drainage of cuttings may increase receiving stream flows and any requirement for new watercourse crossings or alterations to existing crossings has the potential to impact on the flow conveyance and capacity of surface water receptors and flood risk from these sources. However, the scheme drainage design incorporates SuDS measures to deliver attenuation of surface water runoff rates, such that greenfield rates are not exceeded. The drainage system would also be designed to accommodate an appropriate allowance for climate change, providing the Scheme with increased flood resilience over its lifetime. Drainage from cuttings would also be made in accordance with relevant consent parameters and any new or altered existing watercourse crossings would be designed and constructed in line with current best practice guidelines to prevent impacts on flow conveyance and flood risk.	Slight Adverse Neutral

* Potentially, moderate to large impacts to groundwater quality could occur due to proposed continued use of a drainage water infiltration ditch which partly lies on a SPZ1 at Bean junction. However, pollution control measures would be added if not already in place. Additional mitigation may be required and future consultation with the regulator and additional surveys would be used to inform the design of appropriate mitigation measures, which would serve to reduce this level of significance from large adverse as the design develops. In this location the groundwater level is deep (30 - 50 m bgl) so this would be a partial mitigating factor. Two closed fuel stations (both within 500 m) pose a risk to construction workers and also groundwater as there may be residual contamination still present.

Bean Option 4b

10.7.4 Table 10-12 identifies the controlled water and geology and soils receptors where construction or operational impacts could arise from Bean Option 4b.

Table 10-12 Significance ratings for Bean Option 4b

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
SPZ 1	Construction Any below ground works may allow some contamination to migrate to the aquifer below the works. An infiltration ditch, which already exists along the slip road from the A296 onto the A2 eastbound, partly lies over a SPZ 1 and presents a significant potential risk of impact to water quality during construction. Unlike option 3 this option will not involve cuttings in the area but the overall risk remains the same. Pollution control measures would be added for construction and operation. During construction mitigation would be included as part of CEMP. Operation No additional operational impacts identified (including for the infiltration ditch compared to the existing situation) assuming mitigation from appropriate fuel interceptors and generic mitigation measures. Additional mitigation to be agreed in consultation with regulators.	Moderate to Large Adverse* Neutral
SPZ 2	Construction Any below ground works may allow contamination to migrate to the aquifer below the works. Construction of the proposed new (replacement) soakaways around the Bean junction above the SPZ 2 increase the risk of impact to water quality further although the deep water table (30 - 50 m bgl) is noted. Operation No operational impacts identified (assuming mitigation from appropriate fuel interceptors and generic mitigation measures). Mitigation to prevent pollutants entering the aquifer would be included as part of the CEMP.	Slight / Moderate Adverse Neutral
Contamination of water supply from	Construction	Slight / Moderate Adverse

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
historical quarrying	Any below ground works may disturb contamination which may allow some migration to the aquifer below. Mitigation measures would be described in the CEMP. Operation No operational impacts identified.	Neutral
Contamination of water supply from historical fuel station (Watling road services)	Construction Any below ground works may disturb contamination which may allow some migration to the aquifer below. Mitigation measures would be described in the CEMP. Operation No operational impacts identified (assuming generic mitigation measures described above).	Large Adverse* Neutral
Drainage Capacity	Construction Not applicable Operation No operational impacts anticipated due to the deep water table around the Bean junction (30 - 50 m bgl).	Neutral Neutral
Infrastructure	Construction No construction impacts causing barrier effects to groundwater flow are anticipated due to the deep water table around the Bean junction. Operation No operational impacts anticipated due to the deep water table around the Bean junction.	Neutral Neutral
Construction /Maintenance Workers	Construction Any residual contamination from potential land uses such as the fuel stations, electrical substations and historical factories in the scheme area could impact workers. However, the described generic mitigation measures, including use of appropriate PPE, are likely to reduce the risk. Mitigation measures would be described in the CEMP. Operation Maintenance workers may still be exposed to residual contamination from the land uses outlined above when performing upgrades to maintain the road. However, if appropriate PPE is worn and best practice health and safety measures are followed then the risk will be lowered.	Slight/Moderate Adverse Slight/Moderate Adverse
Road Users	Construction No construction impacts identified. Operation	Neutral

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
	No operational impacts identified (assuming generic mitigation measures described above).	Neutral
Surface Water Features	Construction Potential for minor and localised residual pollution risks associated with accidental spills and silt releases, however implementation of the CEMP would facilitate rapid containment and clean up. Operation Road drainage design would facilitate appropriate collection and treatment of highway drainage prior to discharge to the surface water environment and would include means of spillage containment. Also, as a result of the Scheme, congestion and the number of accidents, with associated pollution risks, are anticipated to be reduced. .	Slight adverse Neutral
Infrastructure (Surface Water Flooding)	Construction Appropriate construction site drainage would be put in place to manage surface water runoff on site to reduce the likelihood of surface water ponding and flooding, however some residual risk would remain during more significant rainfall events. Operation New impermeable areas will be created, which without appropriate measures, would induce higher rates and volumes of rainfall runoff, with the potential for increased surface water flood risk. Drainage of cuttings may increase receiving stream flows and any requirement for new watercourse crossings or alterations to existing crossings has the potential to impact on the flow conveyance and capacity of surface water receptors and flood risk from these sources. However, the scheme drainage design incorporates SuDS measures to deliver attenuation of surface water runoff rates, such that greenfield rates are not exceeded. The drainage system would also be designed to accommodate an appropriate allowance for climate change, providing the Scheme with increased flood resilience over its lifetime. Drainage from cuttings would also be made in accordance with relevant consent parameters and any new or altered existing watercourse crossings would be designed and constructed in line with current best practice guidelines to prevent impacts on flow conveyance and flood risk.	Slight adverse Neutral

* Potentially, moderate to large impacts to groundwater quality could occur due to proposed continued use of a drainage water infiltration ditch which partly lies on a SPZ1 at Bean junction. However, pollution control measures would be added if not already in place. Additional mitigation may be required and future consultation with the regulator and additional surveys would be used to inform the design of appropriate mitigation measures, which would serve to reduce this level of significance from large adverse as the design develops. In this location the groundwater level is deep (30 - 50 m bgl) so this would be a partial mitigating factor. Two closed fuel stations (both within 500 m) pose a risk to construction workers and also groundwater as there may be residual contamination still present.

Bean Option 5

10.7.5 Table 10-13 identifies the controlled water and geology and soils receptors where construction or operational impacts could arise from Bean Option 5.

Table 10-13 Significance ratings for Bean Option 5

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
SPZ 1	Construction Any below ground works may allow some contamination to migrate to the aquifer below the works. An infiltration ditch, which already exists along the slip road from the A296 onto the A2 eastbound, lies over a SPZ 1 and presents a significant potential risk of impact to water quality during construction. Unlike option 3 this option will not involve cuttings in the area but the overall risk remains the same. During construction mitigation would be included as part of CEMP. Operation No additional operational impacts identified (including for the infiltration ditch compared to the existing situation) assuming mitigation from appropriate fuel interceptors and generic mitigation measures. Additional mitigation to be agreed in consultation with regulators.	Moderate to Large Adverse* Neutral
SPZ 2	Construction Any below ground works may allow contamination to migrate to the aquifer below the works. Construction of the proposed new soakaways around the Bean junction above the SPZ 2 increase the risk of impact to water quality further although the deep water table (30 - 50 m bgl) is noted. Mitigation measures would be described in the CEMP. Operation No operational impacts identified (assuming mitigation from appropriate fuel interceptors and generic mitigation measures).	Slight / Moderate Adverse Neutral
Contamination of water supply from historical quarrying	Construction Any below ground works may disturb contamination which may allow some migration to the aquifer below. Mitigation measures would be described in the CEMP. Operation No operational impacts identified.	Slight / Moderate Adverse Neutral
Contamination of water supply from historical fuel station (Watling road services)	Construction Any below ground works may disturb contamination which may allow some migration to the aquifer below. Mitigation measures would be described in the CEMP. Operation No operational impacts identified (assuming generic mitigation measures described above).	Moderate to Large Adverse* Neutral

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
Drainage Capacity	Construction Not applicable Operation No operational impacts anticipated due to the deep water table around the Bean junction (30 - 50 m bgl).	Neutral Neutral
Infrastructure	Construction No construction impacts causing barrier effects to groundwater flow are anticipated due to the deep water table around the Bean junction. Operation No operational impacts anticipated due to the deep water table around the Bean junction.	Neutral Neutral
Construction /Maintenance Workers	Construction Any residual contamination from potential land uses such as the fuel stations, electrical substations and historical factories in the scheme area could impact workers. However, the described generic mitigation measures, including use of appropriate PPE, are likely to reduce the risk. Mitigation measures would be described in the CEMP. Operation Maintenance workers may still be exposed to residual contamination from the land uses outlined above when performing upgrades to maintain the road. However, if appropriate PPE is worn and best practice health and safety measures are followed then the risk will be lowered.	Slight/Moderate Adverse Slight/Moderate Adverse
Road Users	Construction No construction impacts identified. Operation No operational impacts identified (assuming generic mitigation measures described above).	Neutral Neutral
Surface Water Features	Construction Potential for minor and localised residual pollution risks associated with accidental spills and silt releases, however implementation of the CEMP would facilitate rapid containment and clean up. Operation Road drainage design would facilitate appropriate collection and treatment of highway drainage prior to discharge to the surface water environment and would include means of spillage containment. Also, as a result of the Scheme, congestion and the number of accidents, with associated pollution risks, are anticipated to be reduced.	Slight adverse Neutral
Infrastructure (Surface	Construction	Slight adverse

Aspect of concern	Magnitude and characterisation of impact	Post Mitigation Residual Significance
Water Flooding)	Appropriate construction site drainage would be put in place to manage surface water runoff on site to reduce the likelihood of surface water ponding and flooding, however some residual risk would remain during more significant rainfall events. Operation New impermeable areas will be created, which without appropriate measures, would induce higher rates and volumes of rainfall runoff, with the potential for increased surface water flood risk. Drainage of cuttings may increase receiving stream flows and any requirement for new watercourse crossings or alterations to existing crossings has the potential to impact on the flow conveyance and capacity of surface water receptors and flood risk from these sources. However, the scheme drainage design incorporates SuDS measures to deliver attenuation of surface water runoff rates, such that greenfield rates are not exceeded. The drainage system would also be designed to accommodate an appropriate allowance for climate change, providing the Scheme with increased flood resilience over its lifetime. Drainage from cuttings would also be made in accordance with relevant consent parameters and any new or altered existing watercourse crossings would be designed and constructed in line with current best practice guidelines to prevent impacts on flow conveyance and flood risk.	Neutral

* Potentially, moderate to large impacts to groundwater quality could occur due to proposed continued use of a drainage water infiltration ditch which partly lies on a SPZ1 at Bean junction. However, pollution control measures would be added if not already in place. Additional mitigation may be required and future consultation with the regulator and additional surveys would be used to inform the design of appropriate mitigation measures, which would serve to reduce this level of significance from large adverse as the design develops. In this location the groundwater level is deep (30 - 50 m bgl) so this would be a partial mitigating factor. Two closed fuel stations (both within 500 m) pose a risk to construction workers and also groundwater as there may be residual contamination still present.

10.8 Cumulative Effects

10.8.1 Table 10-14 below lists the nearby (within 1km) developments to the scheme and outlines the potential cumulative impacts to water and the environment.

Table 10-14 Cumulative effects of nearby developments to the scheme

Planning Application Reference	Application Description	Potential cumulative effects
DA/12/01451/EQVAR	**Eastern Quarry Watling Street Swanscombe Kent** A mixed use development of up to 6250 dwellings & up to 231,000 square metres of additional built floor space (in total)	Further contamination of the water supply could occur as a result of this large development close to the scheme. This development is planned above the same SPZ 1 the infiltration ditch and deep cuttings are for the A2 at Bean junction. This development is located wholly or partially in the catchment of the River Ebbsfleet and as a result there is

Planning Application Reference	Application Description	Potential cumulative effects
		potential for impacts cumulatively with all three of the A2 Scheme options on water quality attributes and the hydrology/flooding regime of the River Ebbsfleet catchment. However, each development will be subject to compliance with relevant planning policies, for example the NPPF with regard to development and flood risk, and regulatory regimes preventing pollution and safeguarding water quality. To satisfy these policy and regulatory requirements, the Eastern Quarry development would be designed to ensure flood risk resilience and appropriate management of surface water drainage, including climate change allowance. Cumulatively therefore, the developments would be expected to have neutral (operation) to slight adverse (construction) effects on surface waterbodies and it is concluded that cumulative impacts would not be significant.
15/00887/CPO	**Eastern Quarry Wastewater Treatment Works** Application for construction of a waste water treatment works and ancillary infrastructure to serve the development at Eastern Quarry KCC/EDC	As with development of housing there could be contamination of the water supply as a result of construction. The construction of the treatment works has the potential to cause contamination of groundwater in the SPZ1 due to accidental spillages and creation of pollutant pathways e.g. from foundations or excavations. It is assumed that the development will be subject to standard groundwater protection planning conditions and best practice construction methods.
12/01464/OUT	**The West Village (and Adjacent Land) Bluewater Shopping Centre Greenhithe** Outline application for redevelopment of the West Village through part demolition, alteration and refurbishment of existing buildings/structures and erection of new buildings/structures to provide retail and related uses	Further contamination of the water supply could occur as a result of this development close to the scheme. Any below ground structures here also may increase the risk of groundwater flooding on the A2 by creating barriers to flow and increasing the potential for water level rise.
12/01404/FUL	**Land at St Clements Way** Erection of 187 dwellings extending to between 2 and 3 storeys in height, including 132 houses and 55 flats, together with the provision of associated public realm and landscaping, parking and infrastructure works	Further contamination of the water supply could occur as a result of this development close to the scheme. Any below ground structures here also may increase the risk of groundwater flooding on the A2 by creating barriers to flow and increasing the potential for water level rise.
20150155	**Land at Ebbsfleet Bounded by A2** The development of land at Ebbsfleet for mixed use up to 789,550m^2 gross floor space comprising employment, residential, hotel and leisure	Further contamination of the water supply could occur as a result of this development close to the scheme. Any below ground structures here also may increase the risk of groundwater flooding on the A2 by creating barriers to flow and increasing the potential for water level rise,

Planning Application Reference	Application Description	Potential cumulative effects
	uses, supporting retail and community facilities and provision of car parking, open space, roads and infrastructure.	particularly as development will take place in area with very shallow water table. This development is located wholly or partially in the catchment of the River Ebbsfleet and as a result there is potential for impacts cumulatively with all three of the A2 Scheme option pairs, on water quality attributes and the hydrology/flooding regime of the River Ebbsfleet. However, as described for the **Eastern Quarry Watling Street** development above, cumulatively the developments would be expected to have neutral (operation) to slight adverse (construction) effects on surface waterbodies and it is concluded that cumulative impacts would not be significant.
05/00308/OUT	**Northfleet West Sub Station Southfleet Road Swanscombe Kent** Redevelopment of site comprising a mixed use of up to 950 dwellings & non-residential floor space for: shopping, food & drink, hotel use; community, health, education & cultural uses; assembly & leisure facilities & associated works to provide the development	Further contamination of the water supply could occur as a result of this development close to the scheme. Any below ground structures here also may increase the risk of groundwater flooding on the A2 by creating barriers to flow and increasing the potential for water level rise. No details are available bit it is assumed that the regulator would apply conditions to mitigate against causing groundwater flooding as necessary.

10.9 Limitations of Assessment

10.9.1 The assessment is qualitative in nature, as considered appropriate to this PCF stage. Further, quantitative assessments will be undertaken at later stages in the Project, guided by the outcome of detailed consultation with relevant statutory consultees.

10.9.2 The available existing drainage information for the A296 part of the Scheme is limited and surveys and further assessment will be needed in order to inform future, detailed liaison with the Environment Agency and detailed design in order to protect the nearby SPZ1. The aim of the drainage design, for all of the Scheme, will be to improve, where necessary, the existing drainage to meet or exceed current best practice. Future, detailed assessment of the current drainage arrangement will be required at later design stages. The current assessment assumes some mitigation in terms of addition of pollution control only (where possibly not already in place). However as a result of future work, further mitigation is expected to be detailed and risks would be expected to be further reduced.

10.9.3 The state of remediation of the two nearby former fuel stations (Watling Road Services and Springhead Services) is not known at this stage and would be part of detailed assessment in order

to assess risks and mitigation at a later design stage. As a result of future work, further mitigation is expected to be detailed and risks would be expected to be further reduced

10.10 Summary

10.10.1 This section of the Chapter draws together the results of the assessment of the 3 Route Options, namely Route Options B03E01b, B04bE01b and B05E01b. A summary of the mitigation measures proposed and the resulting residual effects of the three Scheme options is provided in Table 10-15 below.

10.10.2 It is anticipated that Scheme design, incorporating sustainable drainage methods to attenuate and treat routine highway runoff, and to contain any runoff during an accidental spillage event, would ensure no detriment to surface water flood risk or the water quality of receiving waterbodies during the operational phase of the Scheme. Over its operational lifetime the Scheme would also design in a degree of flood resilience by incorporating an appropriate allowance for climate change within the highway drainage system, in line with recent Environment Agency climate change guidelines.

10.10.3 During the construction phase implementation of a CEMP would significantly reduce the risk of surface water pollution and construction site runoff would be managed to ensure no detriment to off site flood risk. A minor residual risk of on site surface water ponding during intense or long duration rainfall events would remain, as would the temporary risk of localised pollution incidents, however with the means for rapid containment and clean up.

10.10.4 It is therefore concluded that there will be no significant effects to the surface water quality or flood risk attributes of surface waterbodies as a result of the proposed Scheme options. Effects are considered to range from neutral to slight adverse, with slight adverse effects linked to the temporary construction phase of the Scheme. No additional mitigation measures are therefore considered necessary, however this would be confirmed during later stages, during detailed consultations with regulatory bodies. It is therefore considered that residual effects of from all three Scheme options will be insignificant. These impacts have therefore been omitted from table 10-15 below.

10.10.5 Potentially, moderate to large impacts to groundwater quality could occur due to proposed continued use of a drainage water infiltration ditch which partly lies on a SPZ1 at Bean junction. However, pollution control measures would be added if not already in place. Additional mitigation may be required and future consultation with the regulator and additional surveys would be used to inform the design of appropriate mitigation measures, which would serve to reduce this level of significance from large adverse as the design develops. In this location the groundwater level is deep (30 - 50 m bgl) so this would be a partial mitigating factor. Two closed fuel stations (both within 500 m) pose a risk to construction workers and also groundwater as there may be residual contamination still present.

10.10.6 These large adverse impacts are present for each of the three options B03E01b, B04bE01b and B05E01b and therefore do not have a bearing on the determining the most preferred option, which is the purpose of this report.

Table 10-15 Summary of significant effect, mitigation proposed and residual effects on Road Drainage and the Water Environment

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
B03E01b					
Water Supply / Quality	**3** **Amber**	**Ebbsfleet Option 1b** Development associated with the option will take place within SPZ 1's as well as being above principal and secondary A aquifers. No proposed cuttings or pilings minimise the risk of impact to the groundwater below but there may be local ground works (gantries etc.) that could change this. No proposed soakaways or infiltration ditches proposed either. Caution should still be taken however as the water table in the Ebbsfleet junction area is very shallow. **Bean Option 3** Development associated with the option will take place above a SPZ 1. Proposed cuttings by the SPZ 1 as well as an existing infiltration ditch currently present the greatest risk but the large depth (30 – 50 mbgl) to the	A source protection zone 1 is a highly sensitive resource. (SPZs are not statutory. However, SPZ1 has been noted in statutory guidance as the minimum area under the former Groundwater Directive that is identified for the protection of drinking water. SPZs are also recognised within the Environmental Permitting Regulations (EPR) as a zone where certain activities cannot take place. DMRB also states that no drainage outfall to ground shall be permitted in a SPZ1).	The principal aquifer is an irreplaceable resource. Mitigation would involve addition of pollution controls (if not already in place), reducing discharge volumes and/or other mitigation to be agreed with the Environment Agency at a later design stage once further surveys and assessments have been undertaken.	Could be cumulative impact (combination of diffuse and point source contamination e.g. from mostly accidental spillages but only if no mitigation) from development at 'Land at Ebbsfleet Bounded by A2' and 'Northfleet West Sub Station Southfleet Road Swanscombe Kent' which are both close to the Ebbsfleet junction. Could be cumulative impact (reduced water quality) from development at Eastern Quarry Watling Street Swanscombe Kent and Eastern Quarry Wastewater Treatment Works both close to the Bean junction. Further contamination of water supply as well as increased risk of groundwater flooding as discussed in section 10.8 could occur although mitigation is likely to have been applied at the outside of Scheme developments (but details are unknown at this stage).

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
		water table will reduce the risk to a degree.			
Human Health	**4 Amber / Green**	Some contaminative land uses identified nearby the option may have implications for construction workers on site. Workers may come into exposure with contaminants if contamination present in near surface soils.	Construction and Design Regulations (2015) and Safety at Work Act 1974	Appropriate PPE and adopting a watching brief reporting any indications of contamination will mitigate risks.	No cumulative impact
B04bE01b					
Water Supply / Quality	**3 Amber**	**Ebbsfleet Option 1b** Development associated with the option will take place within SPZ 1's as well as being above principal and secondary A aquifers. No proposed cuttings or pilings minimise the risk of impact to the groundwater below but there may be local ground works (gantries etc.) that could change this. No proposed soakaways or infiltration ditches proposed either. Caution should still be taken however as the water table in the Ebbsfleet junction area is very shallow.	A source protection zone 1 is a highly sensitive resource. SPZs are not statutory. However, SPZ1 has been noted in statutory guidance as the minimum area under the former Groundwater Directive that is identified for the protection of drinking water. SPZs are also recognised within the Environmental Permitting Regulations (EPR) as a	The principal aquifer is an irreplaceable resource. Mitigation would involve addition of pollution controls (if not already in place), reducing discharge volumes and/or other mitigation to be agreed with the Environment Agency at a later design stage once further surveys and assessments have been undertaken.	Could be cumulative impact (combination of diffuse and point source contamination e.g. from mostly accidental spillages but only if no mitigation) from development at 'Land at Ebbsfleet Bounded by A2' and 'Northfleet West Sub Station Southfleet Road Swanscombe Kent' which are both close to the Ebbsfleet junction. Could be cumulative impact from development at Eastern Quarry Watling Street Swanscombe Kent and Eastern Quarry Wastewater Treatment Works both close to the Bean junction. Further contamination of water supply as well as increased risk of groundwater flooding as discussed in section 10.8 could occur although mitigation is likely to have been applied at the

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
		Bean Option 4b Although development associated with the option will take place above a SPZ 2, infiltration ditch would still be present above the SPZ 1. This presents the greatest risk. Deep water table will reduce risk to a degree.	zone where certain activities cannot take place. DMRB also states that no drainage outfall to ground shall be permitted in a SPZ1)		outside of Scheme developments (but details are unknown at this stage).
Human Health	**4 Amber / Green**	Some contaminative land uses identified nearby the option may have implications for construction workers on site. Workers may come into exposure with contaminants if contamination present in near surface soils.	Construction and Design Regulations (2015) and Safety at Work Act 1974	Appropriate PPE and adopting a watching brief reporting any indications of contamination will mitigate risks.	The construction may result in releasing more contaminants in turn increasing the risk to construction workers.
B05E01b					
Water Supply / Quality	**3 Amber**	**Ebbsfleet Option 1b** Development associated with the option will take place within SPZ 1's as well as being above principal and secondary A aquifers. No proposed cuttings or pilings minimise the risk of impact to the groundwater below but there may be local ground works (gantries etc.) that could change this. No proposed soakaways or	A source protection zone 1 is a highly sensitive resource. SPZs are not statutory. However, SPZ1 has been noted in statutory guidance as the minimum area under the former Groundwater Directive that	The principal aquifer is an irreplaceable resource. Mitigation would involve addition of pollution controls (if not already in place), reducing discharge volumes and/or other mitigation to be agreed with the Environment Agency at a later design stage once further surveys	Could be cumulative impact (combination of diffuse and point source contamination e.g. from mostly accidental spillages but only if no mitigation) from development at 'Land at Ebbsfleet Bounded by A2' and 'Northfleet West Sub Station Southfleet Road Swanscombe Kent' which are both close to the Ebbsfleet junction. Could be cumulative impact from development at Eastern Quarry Watling Street Swanscombe Kent

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
		infiltration ditches proposed either. Caution should still be taken however as the water table in the Ebbsfleet junction area is very shallow. **Bean Option 5** Development associated with the option will take place within two source protection zones (SPZ) 1. No proposed cuttings or pilings minimise the risk of impact to the groundwater below but there may be local ground works (gantries etc.) that could change this. No proposed soakaways or infiltration ditches proposed either. Caution should still be taken however.	is identified for the protection of drinking water. SPZs are also recognised within the Environmental Permitting Regulations (EPR) as a zone where certain activities cannot take place. DMRB also states that no drainage outfall to ground shall be permitted in a SPZ1)	and assessments have been undertaken.	and Eastern Quarry Wastewater Treatment Works both close to the Bean junction. Further contamination of water supply as well as increased risk of groundwater flooding as discussed in section 10.8 could occur although mitigation is likely to have been applied at the outside of Scheme developments (but details are unknown at this stage).
Human Health	**4 Amber / Green**	Some contaminative land uses identified nearby the option may have implications for construction workers on site. Workers may come into exposure with contaminants if contamination present in near surface soils.	Construction and Design Regulations (2015) and Safety at Work Act 1974	Appropriate PPE and adopting a watching brief reporting any indications of contamination will mitigate risks.	No cumulative impact.

Note: Scheme options have been assessed as having an overall score of Green, having no significant effects on the water quality or flow conveyance/flood risk attributes of the surface water environment within the study area.

11 People and Communities

11.1 Introduction & Study Area

11.1.1 This chapter of the EAR presents the assessment of significance on People and Communities for the three Scheme Options.

11.1.2 This chapter defines the study area, methodology, baseline conditions, identifies receptors potentially affected (and their value), discusses the regulatory and policy framework, moving on to discuss design mitigation and enhancement measures (where relevant), monitoring requirements and the magnitude of impact and the significance of effects (including cumulative).

11.1.3 This chapter should be read in conjunction with Figures 11.1, 11.2 and 11.3. Summary findings care presented in Section 11.10.

11.1.4 The study area is defined by the extent of land that the Scheme construction and associated works would directly change, together with locations where access arrangements (for example to private properties or community facilities) may be affected. These fall within approximately 2km of the Scheme, which constitutes the broad Study Area limit for the People and Communities chapter at this stage.

11.1.5 The settlements of Greenhithe and Dartford are served by the Bean junction of the A2. Further to the east, Swanscombe, Gravesend and Dartford are served by the Ebbsfleet junction of the A2.

11.1.6 These settlements are home to community facilities and employment centres to which local people may travel. A brief description of each of the settlements is provided as follows:

- Swanscombe – is located immediately to the north of the Ebbsfleet junction. Swanscombe had a population of 7,561 (Office for National Statistics (ONS), 2011) (Ref 11-1) and is found within the local authority of Dartford.
- Gravesend – is located to the east of the Ebbsfleet junction. With a population of 55,467 (ONS, 2011), Gravesend is found within the Borough of Gravesham. Gravesend owes much of its growth and development to its strategic position on the south bank of the Thames estuary, leading it to be known as a Thames Gateway commuter town. Today, it still retains strong links to the River Thames and has experienced rejuvenation since the High Speed 1 train service began using Gravesend railway station in 2009.
- Dartford – the principal town in the Borough of Dartford is located 1.5km to the north of the Bean junction. The town has a resident population of 97,365 (ONS, 2011). Dartford initially became established as a river crossing-point with the arrival of the Romans in 43 AD, a focal point between two routes: that from the west to east being part of the main route connecting London with the Continent; and the southerly route following the Darenth valley.
- Greenhithe – located 1.5km north of the Bean junction. With a population of 6,567 (ONS, 2011), Greenhithe is found within Dartford Borough Council. Greenhithe owes much of its development to its strategically advantageous position on the southern estuary of the River Thames. The economy of the local area is directly and indirectly supported by the Bluewater shopping centre, which is found 3km to the west.

11.2 Methodology

11.2.1 The People and Communities assessment follows the approach set out in DMRB, Volume 11 'Environmental Assessment', Section 3, Part 6 'Land Use' Chapter 1 – 11, Section 3 Part 8 'Pedestrians, Cyclists and Equestrians and Community Effects', and Section 3 Part 9 'Vehicle Travellers' (Ref 11-2). In accordance with the DMRB IAN 125/15 (DMRB, IAN 125/15), the People

and Communities assessment scope incorporates topics previously reported under 'Community and Private Assets' and 'All Travellers' headings.

11.2.2 Consideration is given to all environmental effects that may arise from the implementation of a project, including positive (or beneficial) and negative (or adverse) effects, and permanent and temporary effects arising from direct, indirect, cumulative, short, medium and long-term impacts.

11.2.3 DMRB Volume 11, Section 3, Part 6 provides a methodology for the assessment of Scheme impacts as they relate to private assets. In line with this guidance, the assessment would consider the effects of the Scheme on:

- Demolition of property and associated land-take;
- Effects on agricultural land and farm businesses;
- Effects on development land; and
- Loss of land used by the community.
- The Scheme is not considered to have any effect on proposals for the restoration of un-navigable, dis-used or abandoned waterways or the development of new waterways and as such, this topic has been scoped out of the assessment.

11.2.4 DMRB guidance provides a list of key facilities that should be taken into consideration when assessing the impact of a scheme on the journeys people make in their locality, including:

- Healthcare facilities such as hospitals and doctor's surgeries;
- Schools;
- Shops and Post Offices;
- Places of worship; and
- Leisure facilities and areas of public open space.

11.2.5 The guidance provides a methodology for the assessment of impact on the local community, including potential changes in journey lengths and access to community facilities.

Identifying Design, Mitigation and Enhancement Measures

11.2.6 With reference to relevant policies, regulations and guidelines, design, mitigation and enhancement measures, in addition to construction phase monitoring requirements, measures have been identified which seek to avoid or reduce any significant impacts of the Scheme on people and communities. These measures are detailed in Section 11.7.

Approach

11.2.7 DMRB Volume 11, Section 3, Part 8 provides a methodology for the assessment of impacts on the local community, including potential changes in journey lengths and access to community facilities.

11.2.8 Key environmental receptors with regard People and Communities relate to commercial and residential properties and community facilities. Adopting the recommendations made in DMRB 'Community Effects' guidance on 'Pedestrians, Equestrians, Cyclists and Community Effects' and that on 'Land Use', together with professional judgement, the significance of receptors would be as described in Table 11-1.

Table 11-1 Value of Community and Private Assets Receptors (Modified from DMRB Vol 3, Section 8)

Value	Description of Receptor
High	• Residential or commercial buildings. • Buildings and land designated for use by the community e.g. schools, community halls, playing fields.

Value	Description of Receptor
	• Community land that attracts users nationally e.g. national parks. • Religious sites and cemeteries. • Land identified for residential development in local development plans • Most versatile agricultural land – i.e. land classified as grades 1, 2 or 3a.
Medium	• Residential or commercial land e.g. gardens. • Land used by the community on a regional scale, e.g. country parks, forests and other land managed in such a way as to attract visitors from a regional catchment. • Locally used community land, e.g. local parks and children's play areas. • Recreational routes, e.g. Public Rights of Way. • Lower quality agricultural land - grades 3b, 4 and 5.
Low	• Derelict or unoccupied buildings and land

11.2.9 The definitions of magnitude of impact and significance of effect have been adapted using professional judgement from those presented in the DMRB. Summary tables for the assessment of magnitude of impacts on community and private assets are provided in Table 11-2 and Table 11-3 setting how the significance of effect is assessed.

Table 11-2 Community and Private Assets Assessment Impact Definitions (Modified from DMRB Vol 3, Section 8)

Score	Definition
Major Adverse	Loss of resource or severe damage to resource. For example: • The demolition of buildings or significant loss of land (>50% of total footprint) • Complete severance of access • Significant employment losses
Moderate Adverse	Where the extent of effects may be moderate. For example: • Moderate loss of land (between 15% to 50% of total footprint) • Major severance of access • A moderate loss of employment
Minor Adverse	• Minor loss of land (<15% of total footprint) • Some partial or temporary severance of access • A minor negative change in employment levels
Negligible Adverse	• Very minor detrimental alteration to the characteristics of one or more receptor(s)
No change	• No observable impact in either direction, positive or negative
Negligible Beneficial	• Very minor benefit, or positive addition to the characteristics of one or more receptor(s)
Minor Beneficial	• Some measurable positive change in employment levels, GVA output, visitor numbers, but which are considered to be within the normal seasonal variability
Moderate Beneficial	• Where there may be moderate beneficial effects (for example employment creation as a result of scheme construction, improved access to local services and facilities)

Score	Definition
Major Beneficial	• Large scale or major improvement of resource; extensive enhancement (for example significant employment creation)

Table 11-3 Assessment of Significance of Effect (Modified from DMRB Vol 3, Section 8)

		Magnitude			
		Negligible	**Minor Adverse/ Beneficial**	**Moderate Adverse/ Beneficial**	**Major Adverse / Beneficial**
Sensitivity	**High**	Minor	Moderate/ minor	Major/ moderate	Major
	Medium	Minor	Minor	Moderate	Major/ moderate
	Low	Negligible	Minor/ negligible	Moderate/ minor	Moderate

11.2.10 The assessment of development land makes use of an alternative approach, based upon the availability of land for the proposed use and impact on amenity as a result of the Scheme. The assessment would identify where the impact might be:

- **Beneficial –** where the availability of land for the proposed use is not affected and where there may be improvements to viability as a result of improved linkages or access, and where there are no amenity issues that may affect the use of the land;
- **Adverse –** where part or all of the site may no longer be available, or where they may be a reduction in amenity at the site that may affect the use of land (either on a temporary or permanent basis); and
- **Neutral –** where there would be no obvious impact on either the viability or amenity of the site.

11.2.11 The assessment of impacts on work detailed elsewhere in this EAR (notably impact relating to air quality, noise and traffic), refers to assessment criteria used within these chapters.

11.2.12 DMRB Volume 11, Section 3, Part 9 provides a methodology for the assessment of impacts on vehicle travellers, which includes the 'view from the road' and 'driver stress'.

11.2.13 The view from the road is defined as the extent to which travellers on that road are exposed to different types of scenery through which a route passes. This considers the nature of the view (including the type and quality of scenery/landscape and features of interest or prominence), and the extent to which travellers may be able to view the scene (whether there is no view, a restricted view, an intermittent view, or an open view).

11.2.14 Driver stress is defined as the adverse mental and physiological effects experienced by a driver traversing a road network. There are three main components that contribute to the levels of stress experienced by vehicle travellers, comprising frustration (caused by a driver's inability to drive at a speed consistent with his or her own wishes in relation to the general standard of the road), fear of potential accidents (mainly caused by the presence of other vehicles, inadequate sight distances and the likelihood of pedestrians, particularly children, stepping into the road), and uncertainty relating to the route being followed (caused primarily by signing that is inadequate for the individual's purposes). No reliable correlations have been established between physical factors and

driver stress, however DMRB Volume 11, Section 3, Part 9, gives guidance on the category of stress (low, moderate or high) resulting from peak hour traffic flows and average traffic speeds.

11.2.15 At this stage only general observations have been made in relation to vehicle travellers; peak hour traffic flows and average traffic speeds will be considered in detail at a later project stage (Stage 3).

11.3 Baseline Conditions

11.3.1 The baseline section has been divided into a number of sub-topics, namely community facilities, private assets (residential and commercial assets), recreation, development land and agricultural land.

Community Facilities

11.3.2 The location of the settlements of Swanscombe, Gravesend, Dartford and Greenhithe are shown on Figure 11.1.

11.3.3 Community facilities (e.g. education and healthcare) located within 500m of each of the three Options (representing approximately a ten-minute walking distance) have been identified and are shown on Figure 11.2. Community facilities are of **High** sensitivity.

Private Assets

11.3.4 Private assets relate to residential, commercial and industrial uses. Residential properties, of **High** sensitivity, which may be affected by the Scheme are described in more detail in the following paragraphs and Table 11-4 for each of the proposed Options.

Table 11-4 Location of residential properties to scheme options

Residential Properties	**Location in relation to Scheme Options**
1-16 Hope Cottages, Bean Lane	A row of semi-detached properties located along Bean Lane immediately to the south of the Bean junction.
1-11 Ightham Cottages	A row of terraced and semi-detached properties located along Bean Lane immediately to the north of the Bean junction.
Bean House, Bean Lane	A detached property located on Bean Lane, approximately 0.3km to the south of the Bean junction.
Thrift Cottage, Watling Street; Thrift Cottage, Watling Street; The Bungalow, Rear of Watling House; Watling House, Watling Street; Oakwood, Watling Street;	These residential properties are found within the Bean Triangle, which is bounded by the Roman Road to the north, the A2 to the south and the Bean junction to the west.

Residential Properties	Location in relation to Scheme Options
Merry Chest Cottage; and Woodbine Cottage.	
The Cottage, Park Corner Road	A detached property located on Park Corner Road, approximately 0.1km to the south of the Ebbsfleet junction.

11.3.5 There are a number of commercial assets, which are of **High** sensitivity, located in close proximity to each of the Options. These are as follows (Please see Figure 11.4 and 11.5):

11.3.6 Found 0.6km to the north west of the Bean junction is the 155,700m^2 Bluewater Shopping Centre (Ref 11-3). Opened in 1999, the site offers a wide variety of commercial and leisure facilities and attracts millions of visitors every year from a wide area of south-east England.

11.3.7 Commercial enterprises located 0.1km to the south of Ebbsfleet junction include Springhead Nurseries.

11.3.8 Spirits Rest Horse Sanctuary is found immediately to the north of the Bean junction. Spirits Rest Horse Sanctuary is a small independent, privately run Horse and Pony Sanctuary, which is currently a permanent home to six rescued ponies. At this stage the full nature and extent of sanctuary usage, as a facility, has not been established. This will be established in stage 3.

Access and Recreation

11.3.9 A Non-Motorised User (NMU) route links the A296 with Bean, and a number of PRoW, footways and cycleways, pass in close proximity to both the Bean and Ebbsfleet Junctions. These receptors are of **Medium** sensitivity. The following are found at or near the Bean and Ebbsfleet Junctions (Please see Figure 11.6):

- PRoW DR18 runs north-south approximately 325 metres to the west of the southern section of Bean Junction;
- PRoW DR27 runs in an east-westerly direction approximately 320 metres to the south of the A2, towards the west of the southern section of the Bean Junction;
- PRoW DR26 links with PRoW DR27 and also runs in an east-westerly direction, to the south of the A2;
- PRoW DR312 runs north south immediately to the north of the A2, approximately 120 metres to the west of the northern section of Bean Junction;
- PRoW DR19 runs in a south-westerly / north-easterly direction towards the east of the Bean Junction. The footpath begins approximately 170 metres to the south of the junction on Bean lane, until it runs parallel directly adjacent to the A2, for approximately 240 metres;
- PRoW DR128 runs in a north south direction from the A2, approximately 310 metres to the west of Ebbsfleet Junction;
- PRoW DR20 runs in a south north direction from the A2, approximately 310 metres to the west of Ebbsfleet Junction, finishing at the A2;
- PRoW NU14 runs in a north south direction approximately 340 metres to the east of Ebbsfleet Junction;
- PRoW DR129 runs in a south-westerly /north-easterly direction towards the east of Ebbsfleet Junction. The footpath begins approximately 420 metres to the south of the junction, finishing at the A2.
- Swanscombe Footbridge, across the A2, and linked footways, located north of Stonewood;

- National Cycle Routes 1 and 177, which run broadly parallel to the A2, and cycleway adjacent to the B255.

11.3.10 None of the Options are in close proximity to any recreation areas.

Development Land

11.3.11 The local authority for the area is Dartford Borough Council. Checks have been undertaken with Dartford Council to identify proposed developments in the vicinity of the Scheme Options. These developments include land identified for residential development in the Local Development Plan, which is of **High** sensitivity. Please see Figure 11.7.

11.3.12 Found immediately to the north of the Bean Junction, is a Priority Area which has been allocated in Dartford's Local Development Plan. Significant progress has already been made in bringing the sites forward, with Bluewater Shopping centre, homes constructed at Waterstone Park and construction currently underway at the Ebbsfleet Garden City.

11.3.13 The Scheme at Ebbsfleet Garden City is found 0.2km to the north of the Ebbsfleet Junction, and comprises a mixed-use development comprising 15,000 homes. The Ebbsfleet, Eastern Quarry and Northfleet West Substation sites jointly comprise the Ebbsfleet Valley Strategic Site, which is allocated within the Local Development Plan. The site spans circa 270 hectares.

11.3.14 Found 1.8Km to the north of the Bean Junction, the Thames Waterfront Priority area is found, which has been allocated as a Priority Area within the Local Development Plan. This site presents an opportunity to create mixed use development, bringing life and activity back to the river. This would be a mixed-use development, incorporating residential, employment and leisure uses.

Agricultural Land

11.3.15 The Scheme is located in an area of lowland England, in which the prevailing climate generally does not limit the agricultural use of the land. The surface geology of the area around Bean junction is underlain by sand and gravel and the bedrock of the area is Lewes Nodular Chalk Found formation, which is made up of Seaford Chalk Formation and Newhaven Chalk Formation.

11.3.16 The surface geology of the area around the Ebbsfleet junction is underlain by sand and gravel and the bedrock of the area is Thanet formation, which is made up of sand.

11.3.17 Agricultural land is classified into five grades and is graded according to the degree to which its physical characteristics impose long-term limitations on agricultural use. The limitations affect the range of crops which can be grown, the level of yield and consistency of yield, and production costs. The ability to grow a wide range of crops (including grass), whether actual or potential, is given considerable weight but does not outweigh the ability to produce consistently high yields of a somewhat narrower range of crops. The grading of agricultural land is on the basis of physical quality, which take into account climate, relief and soil.

11.3.18 The Scheme Options fall within areas of agricultural land classified as Grade 2 in the Agricultural Land Classification Guide (ALC) (Ref 11-4). Grade 2 agricultural land is deemed 'Very Good' agricultural land, which can support a wide range of agricultural and horticultural crops, and is of **High** sensitivity.

Employment

11.3.19 The businesses and agricultural land described above currently provide employment.

Vehicle Travellers

11.3.20 Views from the A2 are generally restricted as a result of the road being intermittently situated in cutting and extensive local vegetation, however more open views are available from the A2 Bean

and Ebbsfleet junctions where the road is on embankment or bridge structures. The local scenery is made up a mix of urban and rural influences, including elements that make a positive contribution to the view (such as farmland and woodland) and those that are detracting (including high voltage power transmission infrastructure). There are a number of planned developments in the area, which would increase urban influences on views in future. The A2 Bean and Ebbsfleet Junctions carry high volumes of traffic, becoming more congested during morning and afternoon peak hours and resulting in high levels of driver stress - particularly during the peak times.

11.4 Regulatory/Policy Framework

11.4.1 This assessment has been undertaken in accordance with current legislation along with national, regional and local plans and policies. A summary of which is provided in Table 11-5 below.

Table 11-5 Regional and Planning Policy Framework

Policy / Legislation	Summary of Requirements
National Planning Policy Framework (NPPF) (Ref 11-5)	The NPPF sets out 12 core planning principles that should underpin decision taking. Those that apply to this Scheme include to 'proactively drive and support to deliver the homes, business and industrial unit, infrastructure and thriving local places that the country needs'. The National Planning Policy Framework must be taken into account in the preparation of local and neighbourhood plans, and is a material consideration in planning decisions. Paragraph 29 of the NPPF states that 'Transport policies have an important role to play in facilitating sustainable development but also contributing to wider sustainability and health issues'. Planning policies and decisions should provide 'solutions which support reduction in greenhouse gas emissions and reduce congestion' (Paragraph 30) and 'improvements can be undertaken within the transport network that cost effectively limit the significant impacts of the development' (Paragraph 32).
Planning Practice Guidance (2014) (Ref 11-6)	The recently released Planning Practice Guidance provides guidance to support the NPPF. The Guidance states that when deciding whether to grant permission for a project, which is likely to have a significant effect on the environment, does so in the full knowledge of the likely significant effects, and takes this into account in the decision making process.
National Network National Policy Statement (NN NPS) (2014) (Ref 11-7)	The Government's vision and strategic objectives for national networks includes, 'supporting a prosperous and competitive economy and improving overall quality of life, as part of a wider transport system', specifically: • Networks with the capacity and connectivity and resilience to support national and local economic activity and facilitate growth and create jobs; • Networks which support and improve journey quality and reliability and safety; • Networks which support the delivery of environmental goals and the move to a low carbon economy; and • Networks which join up our communities and link effectively to each other.
Creating Growth, Cutting Carbon – Making Sustainable Local Transport Happen (2011) (Ref 11-8)	The launch of this White Paper, represents a significant step forward towards meeting two key government objectives: to help create growth in the economy, and to tackle climate change by cutting carbon emissions. Vision is for a transport system that is an engine for economic growth, but one that is also greener and safer and improves quality of life in our communities

Policy / Legislation	Summary of Requirements
South East Plan (2009) (Ref 11-9)	The Regional Spatial Strategy (RSS) for the South East of England, known as the South East Plan, sets out the long term spatial planning framework for the region over the years 2006 – 2026. The Plan provided the policy context within the Local Development Frameworks, produced by district and unitary authorities, for Local Transport Plans to be prepared. It includes policies for: • The scale and distribution of new housing; • Priorities for new infrastructure and economic development; • Protecting countryside, biodiversity, and the built historic environment; and • Tackling climate change and safeguarding natural resources. However, following the election of the Coalition Government in May 2010, the Secretary for Communities and Local Government wrote to all English local authorities advising that Regional Spatial Strategies were to be abolished. Notwithstanding this, Kent County Council considered that many of the principles remain valid. These include the need to prioritise infrastructure investment in the County's Growth Area and Growth points in order to further enhance their accessibility advantages and to generate increased local employment opportunities for their respective sub-regions. This remains a core theme throughout Kent's Local Transport Plan.
South East England Health Strategy (2008) (Ref 11-10)	The South East England Health Strategy aims to ensure that South East England becomes the healthiest region to live in the UK by: • Improving the health and wellbeing of the whole population; • Addressing the underlying causes of ill health in a sustainable way; and • Reducing the inequalities in health that exist between different geographical area and population groups across the region.
Bold Steps for Kent (2010) (Ref 11-11)	Bold Steps for Kent is the County Council's Medium Term Plan to 2014 / 2015. It sets out how Kent County Council will deliver reforms necessary to manage a significant reduction in public spending over the next four years, whilst delivering a radical devolution of public services to the local level. In approaching these challenges, the Plan identifies high levels aims: • To help the Kent economy grow, by building strong relationships with key business sectors in the Kent economy and delivering new housing and infrastructure, whilst ensuring that the challenge of climate change is met; • To put the citizen in control, so they are empowered to take responsibility for their own community and service needs, thereby reducing the role of the state; and • To tackle disadvantage by fostering aspiration rather than dependency.
Vision for Kent (2010) (Ref 11-12)	The Vision for Kent was launched by the County's Local Strategic Partnership, Kent Partnership, in April 2002. A new Vision for Kent for 2011 – 2021, identifies three countryside ambitions that all partner have agreed to prioritise to improve the life in Kent over the next ten years, which mirror the high levels aims contained within Bold Steps for Kent. These ambitions include: • Grow the Economy; • Tackle Disadvantage; and

Policy / Legislation	Summary of Requirements
	• Put the Citizen in Control.
Delivering a Sustainable Transport System: London to Dover / Channel Tunnel (2010) (Ref 11-13)	The Delivering a Sustainable Transport System (DaSTS): London to Dover / Channel Tunnel study was commissioned by Kent County Council on behalf of the former South East England Partnership Board (SEEPB) in 2009. The study identified that the efficient operation of the road and rail routes between London and the Kent ports is critical to both economic growth at a national level and the realisation of the regional growth aspirations set out in the South East Plan. It also highlights the detrimental impacts that Kent's gateway function has on local residents, which are likely to be exacerbated by the forecast growth in international traffic unless robust measures are put in place to mitigate against them. The DaSTS study presents two priority challenges within the study area, which are to: • Safeguard the sustainable, efficient and expeditious movement of international freight and passenger traffic via strategic road and rail networks through International Gateways; and • Deliver 140,000 new homes and 123,000 new jobs by 2026, including Growth Area at Thames Gateway, Kent and Ashford and at growth points at Dover and Maidstone.
Unlocking Kent's Potential: Kent County Council's Framework for Regeneration (2009) (Ref 11-14)	Unlocking Kent's Potential is Kent County Council's 25 year Masterplan for the regeneration of the County. It recognises that regeneration must encompass more than simply economic growth if it is to achieve lasting success; placing equal weight on improving education and skills, fostering a cultural renaissance, and providing an efficient transport system. In doing so, it identified 5 key challenges: • Building a new relationship with business; • Unlocking talent to support the Kent economy; • Embracing a growing and changing population; • Building homes and communities, not estates; and • Delivering growth without transport gridlock.
Growth without Gridlock: a Transport Delivery Plan for Kent (2010) (Ref 11-15)	Kent has South East England's greatest potential to deliver economic growth worth billions of pounds to the UK economy and to stimulate private-sector-led recovery. This document pulls together the big strategic transport solutions, highlighting schemes that can be delivered by creative and innovative means.
Living Later Life to the Full: a policy framework for later life (2009) (Ref 11-16)	Living Later Life to the Full is Kent County Council's response to the challenges and opportunities posed by an ageing population. It takes the themes identified in the Vision for Kent and scrutinises them from the perspective of older people. It aims to increase older people's involvement in community life to encourage greater social interaction both within and between the generations. Following extensive consultation, a number of themes and priorities have been formulated, which include: • Ensure communities are designed to be 'age proof', strong, safe and sustainable; • Improve transport and accessibility; • Enable people to lead healthier lives and have better access to healthcare; and • Support people's citizenship, learning and participation in community life.

Policy / Legislation	Summary of Requirements
Local Transport Plan for Kent (2011 – 2016) (Ref 11-17)	The Local Transport Plan for Kent sets out Kent County Council's Strategy and Implementation Plans for local transport investment for the period 2011 – 2016. The plan explains how Kent County Council will prioritise the following measures under five themes: • Growth without gridlock; • A safer and healthier County; • Support independence; • Tackling a changing climate; and • Enjoying life in Kent. The purpose of the Local Transport Plan is to improve the quality of life for Kent's residents and visitors by tackling problems relates to local transport and the local transport network.
Localism Act 2001 (Ref 11-18)	The Localism Act (2011) states that local authorities must maintain a list of land in its area that is land of community value. Supported by free advice and grants, provided by local authorities and partners, a growing number of people have demonstrated how much they value their local assets. Football grounds, pubs, post offices, swimming pools, libraries, arts centres, theatres, a control tower and Turkish baths have all been listed by local authorities. As part of the Localism Act, under the Community Right to Buy (2012), people can nominate land and buildings to be recognised by their local authority as 'Assets of Community Value'. If listed for sale, a pause in the sale process can be triggered, giving the local community a chance to bid to buy them.
Local Development Frameworks	Under the Planning and Compulsory Purchase Act 2004, each of Kent's 12 district planning authorities must produce a Local Development Framework (LDF) to replace their existing Local Plan. The LDF will provide the strategic context within which development can take place over the next 10 – 15 years. The LDF is essentially a portfolio of planning documents produced by District Councils. The most important of these is the Core Strategy which sits at the heart of the LDF and provides the spatial vision and strategic policies for all other Development Plan Documents. It is vital that transport and spatial planning are closely integrated, particularly in Growth Area such as Ashford and Thames Gateway Kent, in order to encourage more sustainable transport choices. The Government's *Guidance on Local Transport Plans* (July 2009) makes clear that LTPs should reflect and support LDFs and that, in two tier-areas, county councils should work closely with districts to ensure alignment between these documents.
Ashford Borough Council's LDF Core Strategy (2008) (Ref 11-19)	The Core Strategy identifies seven major sites for mixed-use development in Ashford which will supplement the ongoing regeneration of the town centre. Modelling by Kent County Council has led to the identification of a number of major transport infrastructure schemes to accommodate this level of growth.
Canterbury City Council LDF Core Strategy (2010) (Ref 11-20)	Canterbury City Council's Core Strategy seeks to increase the prosperity of the District through the diversification of the local economy such as fostering economic growth within the knowledge-based economy. The strategy highlights that one of the main issues facing the District is traffic congestion and the delivery of new key infrastructure to help relieve this.

Policy / Legislation	Summary of Requirements
Dartford Borough Council Core Strategy (2011) (Ref 11-21)	Dartford Borough Council's long-term spatial strategy for the Borough to 2026 acts as an implementation tool for those elements of the Sustainable Community Strategy which can be delivered through spatial planning. The strategy outlines how the area contains some important strategic routes, with the A2 acting as a key route between the Channel Ports, London and the rest of the UK. The Dartford Crossing on the M25 provides the only vehicular crossing of the River Thames, east of London. As such, these roads carry high volumes of strategic and commuting traffic, whilst also serving as part of the road network for local journeys in and around the Borough. The strategy states that the capacity of the road network is under pressure. Traffic modelling has identified a significant number of points on the network where current of projected capacity is at a point at which congestion and unacceptable delays will arise in the absence of mitigation measures. The strategy identified a number of issues which will need to be addressed, including: • Congestion hot sports, which are likely to deteriorate further with new development, without mitigating action; • The trunk road network serves local needs and projected growth from local development, as well as national and international traffic; • Improvements in connectivity, such as fast trains links with Central London, can result in increased pressure for community; and • Poor air quality adjacent to roads with high traffic flows.
Gravesham Local Plan Core Strategy (2014) (Ref 11-22)	The development strategy for the Borough in this Core Strategy has been informed by the community itself. It is consistent with sustainable development principles and national policy and its location within the Thames Gateway. The Core Strategy has the following aims: • Transform and revitalise previously developed land; • Strengthen the vitality and vibrancy of Gravesend as the Borough's principal town centre; • Create modern, integrates, accessible and sustainable communities which meet the full range of people's needs and aspirations • Preserving the openness and maintaining the national and local planning purposes of the Green Belt, to protect it from inappropriate development.
Maidstone Borough Council Core Strategy (2011) (Ref 11-23)	The Council's vision for the borough sets out its Sustainable Community Strategy and Strategic plan. This Core Strategy has the following aims: • To create a vibrant, prosperous and sustainable community; • Sustainable growth and regeneration; • A sustainable and integrated transport strategy; • The character and identify of rural settlements will be maintained; • Employment skills will be expanded; • Better balance between the housing market; and • Development will be of high quality sustainable design and construction.

Policy / Legislation	Summary of Requirements
Sevenoaks Core Strategy (2011) (Ref 11-24)	A series of spatial strategic objectives have been developed for Sevenoaks as part of its Core Strategy, these include: • Focus the majority of new housing, employment and retail development in the towns of Sevenoaks and Swanley; • Safeguard the countryside around the District's towns and villages; • Meet housing and employment requirements within the existing urban area of Sevenoaks; • To increase the average density of housing development in areas of Sevenoaks with good access to the town centre; • To sustain the role of Sevenoaks town centre; • To retain the number of job opportunities on regenerated and redeveloped employment sites; • To regenerate and transform Swanley town centre; • To regenerate existing employment areas within Swanley; • To improve Swanley's open space provision; and • To retain the role of Edenbridge as a rural service centre;
Shepway LDF Core Strategy (Ref 11-25)	The over-arching strategic needs of the LDF Core Strategy explain the focal issues to be prioritised in the long-term sustainable development of the district. These include: • To improve employment, educational attainment, and economic performance; • To enhance the management and maintenance of the rich natural and historic assets of Shepway; and • Improve the quality of life and sense of place, vibrancy and social mix in neighbourhoods;
Tonbridge and Malling Core Strategy (2007) (Ref 11-26)	The vision of the Tonbridge and Malling Core Strategy will be delivered through the following broad aims and more detailed objectives: • To ensure that new development is achieved in accordance with the principles of sustainability; • To establish a spatial context to guide new development and co-ordinate the transport and community infrastructure needed to serve that development; and • To ensure that new development and other actions result in a high quality environment.

11.5 Design, Mitigation and Enhancement Measures

11.5.1 This section sets out potential design, mitigation and enhancement measures that may be of relevance to each of the three Options. Mitigation measures are required in order to prevent, reduce or offset any significant adverse effects on the environment. A number of these measures

are already embedded within the current Scheme design. Mitigation measures proposed for both construction and operation phases of the Scheme are described in detail below.

Construction

11.5.2 Further information relating to mitigation would be set out in a CEMP, which would document all construction phase mitigation measures.

11.5.3 Appropriate induction would be given to ensure contractors act considerately in relation to local residents, particularly for any works that may be programmed to take place at night. It is proposed that all main contractor would be required to sign up and adhere to the Considerate Constructors Scheme, which seeks to promote good practice on construction sites and would reduce negative externalities to the surrounding environment.

11.5.4 NMU routes, PRoW, footways and cycle routes pass in close proximity to both the Bean and Ebbsfleet Junctions and would be affected by the works during construction. In order to minimise disruption during construction, temporary diversions would be put in place together with new gates and signs. This would be carried out in consultation with the local highways authority and other interested stakeholders.

11.5.5 The Scheme would be developed to minimise temporary land-take, where possible. The right to compensation and methods and / procedures for assessing appropriate levels of such, would be identified in relation to the National Compensation Code. Where necessary, continued consultation would be necessary with landowners, occupiers and agents, as the Scheme developers manage and reduce impact on day-to-day activities as far as practicably possible.

11.5.6 Local residents and businesses in close proximity to the Scheme during construction may experience reductions in amenity from changes in air quality, visual amenity and noise and vibration. Detailed information relating to mitigation for these potential environmental effects can be found in Chapters 7, 6 and 8 of this EAR.

11.5.7 Pursuant to the CEMP, method statements and management plans would be prepared by the successful contractor(s), detailing their approach to construction. These would include appropriate controls of site activities, such as preventing surface water run-off during construction.

11.5.8 Construction works would involve the temporary loss of agricultural land for the purpose of:

- Working Space;
- Laydown area for materials;
- Haul rods and temporary carriageway diversions; and
- Contractor's site compound.

11.5.9 Construction mitigation that may be necessary to farm holdings, include:

- The reinstatement of land following construction in order to reduce the quantity of permanent land-take required;
- The construction programme to take into account potential crop loss through accommodating harvesting periods where possible;
- Maintenance of farm access points where possible and reinstating these as soon as possible, and
- Minimising impacts of, for example dust and noise on crops and livestock.

11.5.10 In relation to soil handling, the process for this would be set out in the CEMP and would follow the relevant guidance, such as that from the Department for Environment, Food & Rural Affairs Good Practice Guide for Handling Soils (2000) (Ref 11-27) and Department for Environment, Food &

Rural Affairs Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (2009) (Ref 11-28).

Operation

11.5.11 The Scheme would be developed to minimise permanent land-take, where possible. The right to compensation and methods and / procedures for assessing appropriate levels of such, would be identified in relation to the National Compensation Code. Where necessary, continued consultation would be necessary with landowners, occupiers and agents, as the Scheme developers manage and reduce impact on day-to-day activities as far as practicably possible.

11.5.12 An NMU route and PRoW (DR19) would be permanently affected by the Scheme. The NMU will be re-aligned as part of the Scheme, to avoid severance. Minor realignments may also be required for other cycleways and footways, to avoid severance. It is recommended that the opportunity to re-align PRoW DR19 should be considered as part of the design process for the preferred option. These measures would be carried out in consultation with the local highways authority and other interested stakeholders.

11.5.13 Local residents and businesses in close proximity to the Scheme may experience changes in amenity from changes in air quality, visual amenity and noise and vibration. Detailed information relating to mitigation for these potential environmental effects can be found in Chapters 7, 6 and 8 of this EAR.

11.5.14 The design of the project inherently addresses the need to reduce driver stress and frustration associated with congestion and poor journey time reliability. The Project would be designed to current standards in order to contribute to an enhanced road user experience.

11.6 Monitoring Requirements

11.6.1 No specific monitoring requirements are proposed.

11.7 Magnitude of Impacts and Significance of Effects

11.7.1 This section describes the magnitude of impacts of the Scheme as they relate to People and Communities, during construction and operation. At this stage, given inherent uncertainties in relation to the characteristics of each option, a precautionary approach to assessment has been taken, particularly in relation to the potential for indirect effects to occur. The approach taken is to assess following the mitigation that it is reasonable to include at this stage; if there is not reasonable certainty that mitigation can be delivered it is not taken into account.

Land-Take

11.7.2 At this stage, the requirements for temporary land-take, during construction, have not been established and the corresponding impacts have not been assessed. The assessment of magnitude of impacts and significance of effects resulting from permanent land-take for each Scheme Option is summarised in Table 11-6 below. The assessment has been undertaken in

accordance with the methodology set out in Section 11.3, with criteria set out in Table 11-2 and Table 11-3.

Table 11-6 Land-Take Impacts

Option	Receptor Description; Sensitivity	Description of Impact	Magnitude of Impact; Significance of Effect
Option B03E01b	**Community Facilities / Land; High sensitivity assets**	There would be no direct impact on community facilities as a result of this Option.	**Negligible Adverse; Minor Adverse.**
	Private Assets; High sensitivity	14, 15 and 16 Hope Cottages, Bean Lane would be demolished and land-take would be required in relation to 17, 18 and 19 Hope Cottages, for this Option.	**Major Adverse; Major Adverse.**
	Development Land: High sensitivity	There would be no direct impacts on development land as a result of land-take.	**Negligible Adverse; Minor Adverse.**
	Agricultural Land; Grade 2 land of High sensitivity	A total of 1ha of Grade 2 agricultural land is required for this Option.	**Minor Adverse; Minor Adverse.**
Option B04bE01b	**Community Facilities / Land: High sensitivity assets, PRoW of medium sensitivity**	There would be no direct impact on community assets as a result of this Option. A PRoW would be permanently lost as part of this Option.	**Major Adverse; Moderate Adverse.**
	Private Assets; High sensitivity	There would be no direct impacts on residential properties. Buildings and land at the Spirits Rest Horse Sanctuary would be required for this Option.	**Major Adverse; Major Adverse.**
	Development Land; High sensitivity	There would be no direct impacts on development land as a result of land-take.	**Negligible Adverse; Minor Adverse.**
	Agricultural Land; Grade 2 land of High sensitivity	A total of 1.9ha of agricultural land, made up of Grade 2 land, would be required for this Option.	**Minor Adverse; Minor Adverse.**
Option B05E01b	**Community Facilities / Land; High sensitivity assets**	There would no direct effect on community facilities as a result of this Option.	**Negligible Adverse; Minor Adverse.**
	Private Assets; High sensitivity	1 – 11 Ightham Cottages would be demolished as part of this Option. Buildings	**Major Adverse; Major Adverse.**

Option	Receptor Description; Sensitivity	Description of Impact	Magnitude of Impact; Significance of Effect
		and land at the Spirits Rest Horse Sanctuary would be required for this Option.	
	Development Land; High sensitivity	There would be no direct effect on development land as a result of land-take.	**Negligible Adverse; Minor Adverse.**
	Agricultural Land; Grade 2 land of High Sensitivity where present in Study Area	The Option passes through land which is predominantly in urban use or land which is primarily in non-agricultural use.	**Negligible Adverse; Minor Adverse.**

Severance

11.7.3 The assessment has been undertaken in accordance with the methodology set out in Section 11.3, with criteria set out in Table 11-2 and Table 11-3. At this stage, the need for temporary severance, during construction, has not been established and the corresponding impacts have not been assessed. This will be established at a later stage.

11.7.4 For all Options, there would be no direct impact on access to community facilities.

11.7.5 The NMU route linking the A296 with Bean will be realigned in the case of all options, avoiding severance. Minor realignments may also be required for other cycleways and footways, avoiding severance.

11.7.6 PRoW DR19 would be permanently severed as part of Option B04bE01b resulting in a **Major Adverse** magnitude of impact and Moderate Adverse significance of effect.

11.7.7 Other PRoW pass in close proximity to each of the Options but would not be directly affected by the proposed works, resulting in a **No Change** magnitude of impact and **Neutral** significance of effect in the case of Options B03E01b and B05E01b.

Employment

11.7.8 The assessment has been undertaken in accordance with the methodology set out in Section 11.3, with criteria set out in Table 11-2 and Table 11-3. Changes in employment levels have been considered as part of this assessment. Options B03E01b and B04bE01b have the potential to affect employment associated with good quality agricultural land. Options B04bE01b and B05E01b have the potential to affect employment associated with the Spirits Rest Horse Sanctuary. This is expected to result in a **Minor Adverse** magnitude of impact and **Minor Adverse** significance of effect in the case of all Options.

Amenity

11.7.9 Local residents and businesses along the route corridors (all options) are likely to experience changes in amenity as a result of possible changes in noise, air quality and visual amenity during Scheme construction and operation. More detailed information on each of these topics can be found in Chapters 8, 7, and 6.

Vehicle Travellers

11.7.10 At this stage only general observations have been made in relation to vehicle travellers. The Scheme options would not significantly alter the view from the road described in the Baseline Conditions (Section 11.4), above. As a result, the operational magnitude of impact on the view from the road is likely to be **No Change**, resulting in a **Neutral** significance of effect. Whilst the construction phase may result in a temporary increase in driver stress, all options are expected to reduce driver stress during operation, principally through reduced driver frustration and fear of accidents. A more detailed analysis of peak hour traffic flows and average traffic speeds will be undertaken at a later project stage (Stage 3).

11.8 Cumulative Effects

11.8.1 No potentially significant cumulative effects have been identified at this stage, cumulative effects would continue to be reviewed.

11.9 Limitations of Assessment

11.9.1 Baseline conditions have been established using desk-based data that is currently available. At this stage, given inherent uncertainties in relation to the characteristics of each option, a precautionary approach to assessment has been taken, particularly in relation to the potential for indirect effects to occur.

11.10 Summary

11.10.1 This chapter has considered the potential impact of the construction and operation of the three Scheme Options on People and Communities. This section of the Chapter draws together the results of the assessment of the 3 Route Options, namely Route Options B03E01b, B04bE01b and B05E01b.

11.10.2 A summary of findings is provided in Table 11-7 below.

11.10.3 Option B03E01b would result in demolition of residential properties at Hope Cottages and agricultural land would be required for the Scheme. For Option B04bE01b, buildings and land at the Spirits Rest Horse Sanctuary would be required, there would be agricultural land-take, and a Public Right of Way would be permanently severed. In the case of Option B05E01b, residential properties at Ightham Cottages would be demolished and buildings and land at the Spirit's Rest Horse Sanctuary would be required. Vehicle travellers are anticipated to experience positive effects, overall, in the case of all three Scheme Options. There are expected to be Major Adverse permanent effects resulting from all three options, with Options B03E01b and B05E01b having the lowest option assessment scores - primarily as a result of demolition of residential properties.

Table 11-7 Summary of significant effects, mitigation proposed and residual effects on People and Communities

		Criteria			
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Option B03E01b					
People and Communities	**1** **Red**	Permanent effects – Major Adverse, overall: 14, 15 and 16 Hope Cottages would be demolished and a total of 1ha of Grade 2 agricultural land would be required for the Scheme. Overall, vehicle travellers are expected to experience positive effects.	The Government's vision and strategic objectives for national networks, set out in National Networks National Policy Statement (2014), include supporting economic activity, improving journey quality, linking communities and delivering environmental goals.	Compensation arrangements in accordance with the National Compensation Code.	No significant cumulative effects have been identified at this stage.
Option B04bE01b					
People and Communities	**2** **Red/Amber**	Permanent effects - Major Adverse, overall: Buildings and land at the Spirits Rest Horse Sanctuary would be required, a Public Right of Way would be permanently severed and 1.9ha of Grade 2 agricultural land would be required for the Scheme. Overall, vehicle travellers are	The Government's vision and strategic objectives for national networks, set out in National Networks National Policy Statement (2014), include supporting economic activity, improving journey quality, linking communities and delivering environmental goals.	Compensation arrangements in accordance with the National Compensation Code.	No significant cumulative effects have been identified at this stage.

		expected to experience positive effects.			
Option B05E01b					
People and Communities	**1** **Red**	Permanent effects - Major Adverse, overall: 1 – 11 Ightham Cottages would be demolished and buildings and land at the Spirit's Rest Horse Sanctuary would be required. Overall, vehicle travellers are expected to experience positive effects.	The Government's vision and strategic objectives for national networks, set out in National Networks National Policy Statement (2014), include supporting economic activity, improving journey quality, linking communities and delivering environmental goals.	Compensation arrangements in accordance with the National Compensation Code.	No significant cumulative effects have been identified at this stage.

12 Summary

12.1.1 Table 12-1 below draws together the results of the assessment of the 3 Route Options (Bean and Ebbsfleet Junction Options combined as outlined in section 3.1.6), namely Route Options B03E01b, B04bE01b and B05E01b for all the environmental topics included in this EAR.

12.1.2 The purpose of this EAR is to present to the public, the statutory environmental bodies and other stakeholders, the environmental assessment findings for the three Scheme options. This information will then be used to inform the decision making process to determine the preferred scheme options to be taken forward for further assessment.

12.1.3 To summarise the comparison of options in relation to environment, Option B05E01b is the overall preferred option with the fewest significant effects.

12.1.4 In contrast Option B03E01b has the greatest potential adverse effects across the environmental topics when taken as a whole entity.

12.1.5 Further assessment work will be undertaken in Stage 2 for Air Quality and Noise and Stage 3 for the other environmental topics, in order to advance the assessment as the options are reduced. Further scheme specific mitigation, required to minimise the impact on the environment, will also be determined and refined as the design progresses throughout Stage 2 and 3.

Table 12-1 Overall Summary table: Overall Option Scores for each topic

Option B03E01b					
Criteria	**Score (from** Table 4-2**)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Ecology and Nature Conservation	2 **Red** / **Amber**	Permanent and irreversible loss of ancient woodland at Darenth Wood SSSI; Significant loss to high value hazel dormouse habitat. Localised loss or disturbance to other receptors, including possible loss of bat roosts and a main badger sett.	Darenth Wood SSSI is a nationally important designated site. Hazel dormouse and its habitat and bats and their roosts are protected under European legislation. Badgers are protected under the Protection of Badgers Act 1992.	Ancient woodland is an irreplaceable resource. Significant compensatory planting likely to be required. Hazel dormouse mitigation to include EPSL license, habitat manipulation and/or translocation of individuals and compensatory habitat planting and landscape planting reinstated. Bats, if found, would require mitigation and could include construction of artificial roosts. The loss of a badger sett would require an artificial sett to be constructed.	Increased recreational activity at Darenth Wood SSSI associated with new residential developments compounded by habitat loss from Scheme.
Landscape and Townscape	**2 Red / Amber**	Residual significant large adverse effects on Darenth Wood Country Park and landscape character area Darenth Wood and Bean Woods. Residual significance large adverse effect on Bean Village, residents of North Bean, and Bean Farm.	Country Park Designation under the Countryside Act 1968	Develop a sensitively routed and well-designed Scheme in line with DMRB Good Roads Guide to ensure good fit with the scale and character of the landscape and townscape resources; Develop landscape strategy for external hard and soft landscaped areas for highway corridors (to include use of native	Vegetation screening along the A2 and junctions would be largely unaffected by the development with roadside planting retained to shield the development from the A2 Junction and other roads. Poor lighting design for the junction improvements, Land at

		Residual significant large adverse effects on residents of Hope and Ightham Cottages and Bean House.		species of local provenance where possible) and for screening purposes including vegetation buffer and other visual barriers; Develop integrated strategy for landscape, habitat creation/enhancement and access improvement works; Develop lighting design strategy to minimize light pollution. Divert rights of way where appropriate	Ebbsfleet and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.
Air Quality	4 **Amber / Green**	The Scheme is not predicted to cause any exceedances of the AQS objectives for NO_2 and PM_{10}. Additionally, there are no receptors in exceedance which increase in concentration as a result of the Scheme. All 'with Scheme' concentrations at receptors are well below the annual mean AQS objectives for NO_2 and PM_{10}. 13 receptors would have an increase in concentrations with the Scheme, and 15 receptors would have a decrease with the Scheme. No significant impacts at ecological receptors.	Compliance reported to EU by Defra. Government AQS objectives	Operational Phase: At this stage mitigation is unlikely as no significant impacts are predicted. The assessment would be further refined at future stages to incorporate updated traffic data etc.	Adjacent developments have been taken into account in the traffic data.
Noise and Vibration	6 **Green**	WebTAG value of £107,150 option B03E01b is generally beneficial.	There are 7 DEFRA designated Noise Important Areas in the study area. None of these	It is assumed that all new roads and all roads in the future year will be surfaced with low noise surfacing therefore minimising the type noise. It may also be	The Traffic data used in the assessment is cumulative data so takes into account potential future changes that may influence traffic

		In the short term 8 receptors spread across the study area will be subject to major adverse noise increases of over 5dB. 36 receptors are forecast to experience a Major beneficial impact in the form a reduction in excess of 5dB. In the long term 4 of the same receptors are predicted to experience major adverse effects, these increases are focused in the west of the study area. There are 29 properties that are predicted to experience a major beneficial reduction in noise of greater that 10dB. A general benefit when Web tag health impacts and noise reductions are considered.	are predicted to experience significant effects in either scenario.	prudent to implement noise barriers in order to protect certain groups of receptors.	flows therefore the results provide a most likely scenario.
Historic Environment	**2 Red/ Amber**	Nationally important sites permanently affected with minimal opportunity to reverse impacts. Settings minimally impacted and effects could be reduced over time with planting or fencing.	1 Nationally designated site permanently affected. The scheduled monument at Darenth Wood would be physically impacted. Several regionally designated and potential nationally significant sites permanently affected. Planning (Listed Buildings and Conservation Areas) Act 1990 and Ancient Monuments and Archaeological Areas Act	Mitigation for direct affected sites would not be sufficient to reduce the impact to nationally designated site. Therefore this is an unmitigated effect.	Additional planned development in the surrounding area would largely not affect the archaeological resource. The setting of the heritage assets within the study area does not extend into the areas of proposed development such that any impact from the development would be considered negligible to the significance of the asset. The proposed Springhead Enterprise Park And CTRL Alignment, along with the Scheme has the potential

			1979 are of key importance.		to have moderate or slight adverse cumulative impact to the non-designated remains of Springhead Roman Town.
Road Drainage and the Water Environment – Water Supply / Quality	**3 Amber**	**Ebbsfleet Option 1b** Development associated with the option will take place within SPZ 1's as well as being above principal and secondary A aquifers. No proposed cuttings or pilings minimise the risk of impact to the groundwater below but there may be local ground works (gantries etc.) that could change this. No proposed soakaways or infiltration ditches proposed either. Caution should still be taken however as the water table in the Ebbsfleet junction area is very shallow. **Bean Option 3** Development associated with the option will take place above a SPZ 1. Proposed cuttings by the SPZ 1 as well as an existing infiltration ditch currently present the greatest risk but the large depth (30 – 50 mbgl) to the water table will reduce the risk to a degree.	A source protection zone 1 is a highly sensitive resource. (SPZs are not statutory. However, SPZ1 has been noted in statutory guidance as the minimum area under the former Groundwater Directive that is identified for the protection of drinking water. SPZs are also recognised within the Environmental Permitting Regulations (EPR) as a zone where certain activities cannot take place. DMRB also states that no drainage outfall to ground shall be permitted in a SPZ1).	The principal aquifer is an irreplaceable resource. Mitigation would involve addition of pollution controls (if not already in place), reducing discharge volumes and/or other mitigation to be agreed with the Environment Agency at a later design stage once further surveys and assessments have been undertaken.	Could be cumulative impact (combination of diffuse and point source contamination e.g. from mostly accidental spillages but only if no mitigation) from development at 'Land at Ebbsfleet Bounded by A2' and 'Northfleet West Sub Station Southfleet Road Swanscombe Kent' which are both close to the Ebbsfleet junction. Could be cumulative impact (reduced water quality) from development at Eastern Quarry Watling Street Swanscombe Kent and Eastern Quarry Wastewater Treatment Works both close to the Bean junction. Further contamination of water supply as well as increased risk of groundwater flooding as discussed in section 10.8 could occur although mitigation is likely to have been applied at the outside of Scheme developments (but details are unknown at this stage).
Human Health	4 **Amber / Green**	Some contaminative land uses identified nearby the option may have implications for construction workers on site. Workers may	Construction and Design Regulations (2015) and Safety at Work Act 1974	Appropriate PPE and adopting a watching brief reporting any indications of contamination will mitigate risks.	No cumulative impact

		come into exposure with contaminants if contamination present in near surface soils.			
People and Communities	**1 Red**	Permanent effects – Major Adverse, overall: 14, 15 and 16 Hope Cottages would be demolished and a total of 1ha of Grade 2 agricultural land would be required for the Scheme. Overall, vehicle travellers are expected to experience positive effects.	The Government's vision and strategic objectives for national networks, set out in National Networks National Policy Statement (2014), include supporting economic activity, improving journey quality, linking communities and delivering environmental goals.	Compensation arrangements in accordance with the National Compensation Code.	No significant cumulative effects have been identified at this stage.

Option B04bE01b					
Criteria	**Score (from table 2)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Ecology and Nature Conservation	**3 Amber**	Permanent and irreversible loss of a small section of the Thrift ancient woodland. Loss and permanent fragmentation of semi-natural woodland (not ancient); Temporary loss of high value hazel dormouse habitat and possible fragmentation of population. Localised loss or disturbance to other receptors, including possible loss of bat roosts.	The Thrift ancient woodland is protected through planning policy. Semi-natural woodland is a habitat of principal importance and as such a material consideration. Hazel dormouse and its habitat and bats and their roosts are protected under European legislation.	Ancient woodland is an irreplaceable resource. Planting to compensate for loss of woodland and hazel dormouse habitat. Hazel dormouse mitigation to include EPSL licence, habitat manipulation and/or translocation and construction of a hazel dormouse bridge to minimise fragmentation of population. Bats, if found, would require mitigation and could include construction of artificial roosts.	No option specific cumulative effects.
Landscape and Townscape	**3 Amber**	Residual significant large adverse effects on Darenth Wood Country Park and landscape character area Darenth Wood and Bean Woods Residual significance large adverse effect on Bean Village, residents of North Bean and Bean Farm Residual significant large adverse effects on residents of Hope Cottages and Bean House.	Country Park Designation under the Countryside Act 1968	Develop a sensitively routed and well-designed Scheme in line with DMRB Good Roads Guide to ensure good fit with the scale and character of the landscape and townscape resources; Develop landscape strategy for external hard and soft landscaped areas for highway corridors (to include use of native species of local provenance where possible) and for screening purposes including vegetation buffer and other visual barriers;	Vegetation screening along the A2 and junctions would be largely unaffected by the development with roadside planting retained to shield the development from the A2 Junction and other roads. Poor lighting design for the junction improvements, Land at Ebbsfleet and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.

				Develop integrated strategy for landscape, habitat creation/enhancement and access improvement works; Develop lighting design strategy to minimize light pollution. Divert rights of way where appropriate.	
Air Quality	**4 Amber / Green**	The Scheme is not predicted to cause any exceedances of the AQS objectives for NO_2 and PM_{10}. Additionally, there are no receptors in exceedance which increase in concentration as a result of the Scheme. All 'with Scheme' concentrations at receptors are well below the annual mean AQS objectives for NO_2 and PM_{10}. 8 receptors would have an increase in concentrations with the Scheme, and 11 receptors would have a decrease with the Scheme. No significant impacts at ecological receptors.	Compliance reported to EU by Defra. Government AQS objectives	Operational Phase: At this stage mitigation is unlikely as no significant impacts are predicted. The assessment would be further refined at future stages to incorporate updated traffic data etc.	Adjacent developments have been taken into account in the traffic data.
Noise and Vibration	**6 Green**	With a WebTAG value of £31,788 option B04bE01b is generally beneficial. In the short term there are 7 receptors predicted to experience a Major dis-benefit in noise, these receptors are largely	Of the 7 DEFRA identified Noise Important Areas on is expected to observe a perceptible increase in the short term however in the long term they are all	It is assumed that all new roads and all roads in the future year will be surfaced with low noise surfacing therefore minimising the tyre noise. It may also be prudent to implement noise barriers in order to protect certain groups of receptors.	The Traffic data used in the assessment is cumulative data so takes into account potential future changes that may influence traffic flows therefore the results provide a most likely scenario.

		focussed in Ebbsfleet with one being located in Bean. In the short term 26 receptors are predicted to benefit from a reduction in noise greater than 5dB, a change classed as Major Beneficial. In the long term 2 dwellings are forecast to be subject to Major Adverse noise increases of over 10dB, these are both in Bean village. In the same scenario 11 dwellings are predicted to benefit from a reduction on noise greater than 10dB.	predicted to benefit from a decrease in noise.		
Historic Environment	**3 Amber**	Regionally designated and potential nationally significant sites permanently affected with minimal opportunity to reverse impacts. Settings minimally impacted and effects could be reduced over time with planting or fencing.	Several regionally designated and potential nationally significant sites permanently affected. These sites relate to the Roman settlement at Springfield and include a burial ground and a landing stage and other settlement activity such as a kiln, courtyard and well. Planning (Listed Buildings and Conservation Areas) Act 1990 and Ancient Monuments and Archaeological Areas Act	Mitigation likely to be required. Conflicts with preservation in situ but extent of survival of remains below existing roadways is unknown.	Additional planned development in the surrounding area would largely not affect the archaeological resource as much of the development is occurring in previously developed land where survival of archaeological remains is unlikely. Furthermore the setting of the heritage assets within the study area does not extend into the areas of proposed development such that any impact from the development would be considered negligible to the significance of the asset. The Springhead Enterprise Park

			1979 are of key importance.		And CTRL Alignment along with the scheme has the potential to have moderate or slight adverse cumulative impact to the non-designated remains of Springhead Roman Town.
Road Drainage and the Water Environment – Water Supply / Quality	**3 Amber**	**Ebbsfleet Option 1b** Development associated with the option will take place within SPZ 1's as well as being above principal and secondary A aquifers. No proposed cuttings or pilings minimise the risk of impact to the groundwater below but there may be local ground works (gantries etc.) that could change this. No proposed soakaways or infiltration ditches proposed either. Caution should still be taken however as the water table in the Ebbsfleet junction area is very shallow. **Bean Option 4b** Although development associated with the option will take place above a SPZ 2, infiltration ditch would still be present above the SPZ 1. This presents the greatest risk. Deep water table will reduce risk to a degree.	A source protection zone 1 is a highly sensitive resource. SPZs are not statutory. However, SPZ1 has been noted in statutory guidance as the minimum area under the former Groundwater Directive that is identified for the protection of drinking water. SPZs are also recognised within the Environmental Permitting Regulations (EPR) as a zone where certain activities cannot take place. DMRB also states that no drainage outfall to ground shall be permitted in a SPZ1)	The principal aquifer is an irreplaceable resource. Mitigation would involve addition of pollution controls (if not already in place), reducing discharge volumes and/or other mitigation to be agreed with the Environment Agency at a later design stage once further surveys and assessments have been undertaken.	Could be cumulative impact (combination of diffuse and point source contamination e.g. from mostly accidental spillages but only if no mitigation) from development at 'Land At Ebbsfleet Bounded By A2' and 'Northfleet West Sub Station Southfleet Road Swanscombe Kent' which are both close to the Ebbsfleet junction. Could be cumulative impact from development at Eastern Quarry Watling Street Swanscombe Kent and Eastern Quarry Wastewater Treatment Works both close to the Bean junction. Further contamination of water supply as well as increased risk of groundwater flooding as discussed in section 10.8 could occur although mitigation is likely to have been applied at the outside of Scheme developments (but

					details are unknown at this stage).
Human Health	**4 Amber / Green**	Some contaminative land uses identified nearby the option may have implications for construction workers on site. Workers may come into exposure with contaminants if contamination present in near surface soils.	Construction and Design Regulations (2015) and Safety at Work Act 1974	Appropriate PPE and adopting a watching brief reporting any indications of contamination will mitigate risks.	The construction may result in releasing more contaminants in turn increasing the risk to construction workers.
People and Communities	**2 Red / Amber**	Permanent effects - Major Adverse, overall: Buildings and land at the Spirits Rest Horse Sanctuary would be required, a Public Right of Way would be permanently severed and 1.9ha of Grade 2 agricultural land would be required for the Scheme. Overall, vehicle travellers are expected to experience positive effects.	The Government's vision and strategic objectives for national networks, set out in National Networks National Policy Statement (2014), include supporting economic activity, improving journey quality, linking communities and delivering environmental goals.	Compensation arrangements in accordance with the National Compensation Code.	No significant cumulative effects have been identified at this stage.

Option B05E01b					
Criteria	**Score (from table 2)**	**Temporal and Spatial**	**Designation/ Policy / legislative**	**Standard Mitigation**	**Cumulative**
Ecology and Nature Conservation	**4 Amber / Green**	Loss of small area of high value hazel dormouse habitat. Localised loss or disturbance to other receptors, including possible loss of bat roosts.	Hazel dormouse and its habitat and bats and their roosts are protected under European legislation.	Hazel dormouse mitigation to include EPSL licence, habitat manipulation and/or a translocation of individuals and compensatory habitat planting and landscape planting reinstated. Bats, if found, would require mitigation and could include construction of artificial roosts.	No option specific cumulative effects.
Landscape and Townscape	**4 Amber / Green**	Residual significant large adverse effects on Hope Cottages.		Develop a sensitively routed and well-designed Scheme in line with DMRB Good Roads Guide to ensure good fit with the scale and character of the landscape and townscape resources; Develop landscape strategy for external hard and soft landscaped areas for highway corridors (to include use of native species of local provenance where possible) and for screening purposes including vegetation buffer and other visual barriers; Develop integrated strategy for landscape, habitat creation/enhancement and access improvement works; Develop lighting design strategy to minimize light pollution.	Vegetation screening along the A2 and the eastern side of Eastern Quarry would be largely unaffected by the development with roadside planting retained to shield the development from the A2 Junction and other roads. Poor lighting design for the junction improvements, Land at Ebbsfleet and Eastern Quarry could have a combined negative impact on light spill and lighting pollution.

				Divert rights of way where appropriate.	
Air Quality	**4 Amber / Green**	The Scheme is not predicted to cause any exceedances of the AQS objectives for NO_2 and PM_{10}. Additionally, there are no receptors in exceedance which increase in concentration as a result of the Scheme. All 'with Scheme' concentrations at receptors are well below the annual mean AQS objectives for NO_2 and PM_{10}. 11 receptors would have an increase in concentrations with the Scheme, and 16 receptors would have a decrease with the Scheme. No significant impacts at ecological receptors.	Compliance reported to EU by Defra. Government AQS objectives	Operational Phase: At this stage mitigation is unlikely as no significant impacts are predicted. The assessment would be further refined at future stages to incorporate updated traffic data etc.	Adjacent developments have been taken into account in the traffic data.
Noise and Vibration	**6 Green**	With a WebTAG value of £58,823 option B05E01b is generally beneficial. In the short term 7 receptors are predicted to suffer from an adverse increase of more than 5dB, this is classed as major Adverse. The dwellings are spread across the study area. There are 37 receptors predicted to benefit from a decrease in excess of 5dB, this is classed as a Major Benefit.	Similar to Option B04bE01b of the 7 NIA's one is predicted to perceive an increase of over 1dB in the short term. In the long term they are all predicted to benefit from a noise reduction.	It is assumed that all new roads and all roads in the future year will be surfaced with low noise surfacing therefore minimising the tyre noise. It may also be prudent to implement noise barriers in order to protect certain groups of receptors.	The Traffic data used in the assessment is cumulative data so takes into account potential future changes that may influence traffic flows therefore the results provide a most likely scenario.

		In the long term 2 receptors are predicted to suffer increases greater than 10dB, these receptors are located to the north of the Bean junction on the A2. In the same scenario 25 receptors are predicted to experience a major beneficial noise reduction in excess of 10dB.			
Historic Environment	**3 Amber**	Regionally designated and potential nationally significant sites permanently affected with minimal opportunity to reverse impacts. Settings minimally impacted and effects could be reduced over time with planting or fencing.	Several regionally designated and potential nationally significant sites permanently affected. These sites relate to the Roman settlement at Springfield and include a burial ground and a landing stage and other settlement activity such as a kiln, courtyard and well. Planning (Listed Buildings and Conservation Areas) Act 1990 and Ancient Monuments and Archaeological Areas Act 1979 are of key importance.	Mitigation likely to be required. Conflicts with preservation in situ but extent of survival of remains below existing roadways is unknown.	Additional planned development in the surrounding area would largely not affect the archaeological resource as much of the development is occurring in previously developed land where survival of archaeological remains is unlikely. Furthermore the setting of the heritage assets within the study area does not extend into the areas of proposed development such that any impact from the development would be considered negligible to the significance of the asset. The proposed Springhead Enterprise Park And CTRL Alignment along with the scheme has the potential to have moderate or slight adverse cumulative impact to

					the non-designated remains of Springhead Roman Town.
Road Drainage and the Water Environment – Water Supply / Quality	**3 Amber**	**Ebbsfleet Option 1b** Development associated with the option will take place within SPZ 1's as well as being above principal and secondary A aquifers. No proposed cuttings or pilings minimise the risk of impact to the groundwater below but there may be local ground works (gantries etc.) that could change this. No proposed soakaways or infiltration ditches proposed either. Caution should still be taken however as the water table in the Ebbsfleet junction area is very shallow. **Bean Option 5** Development associated with the option will take place within two source protection zones (SPZ) 1. No proposed cuttings or pilings minimise the risk of impact to the groundwater below but there may be local ground works (gantries etc.) that could change this. No proposed soakaways or infiltration ditches proposed either. Caution should still be taken however.	A source protection zone 1 is a highly sensitive resource. SPZs are not statutory. However, SPZ1 has been noted in statutory guidance as the minimum area under the former Groundwater Directive that is identified for the protection of drinking water. SPZs are also recognised within the Environmental Permitting Regulations (EPR) as a zone where certain activities cannot take place. DMRB also states that no drainage outfall to ground shall be permitted in a SPZ1)	The principal aquifer is an irreplaceable resource. Mitigation would involve addition of pollution controls (if not already in place), reducing discharge volumes and/or other mitigation to be agreed with the Environment Agency at a later design stage once further surveys and assessments have been undertaken.	Could be cumulative impact (combination of diffuse and point source contamination e.g. from mostly accidental spillages but only if no mitigation) from development at 'Land at Ebbsfleet Bounded by A2' and 'Northfleet West Sub Station Southfleet Road Swanscombe Kent' which are both close to the Ebbsfleet junction. Could be cumulative impact from development at Eastern Quarry Watling Street Swanscombe Kent and Eastern Quarry Wastewater Treatment Works both close to the Bean junction. Further contamination of water supply as well as increased risk of groundwater flooding as discussed in section 10.8 could occur although mitigation is likely to have been applied at the outside of Scheme developments (but details are unknown at this stage). .

Human Health	**4 Amber / Green**	Some contaminative land uses identified nearby the option may have implications for construction workers on site. Workers may come into exposure with contaminants if contamination present in near surface soils.	Construction and Design Regulations (2015) and Safety at Work Act 1974	Appropriate PPE and adopting a watching brief reporting any indications of contamination will mitigate risks.	No cumulative impact.
People and Communities	**1 Red**	Permanent effects - Major Adverse, overall: 1 – 11 Ightham Cottages would be demolished and buildings and land at the Spirit's Rest Horse Sanctuary would be required. Overall, vehicle travellers are expected to experience positive effects.	The Government's vision and strategic objectives for national networks, set out in National Networks National Policy Statement (2014), include supporting economic activity, improving journey quality, linking communities and delivering environmental goals.	Compensation arrangements in accordance with the National Compensation Code.	No significant cumulative effects have been identified at this stage.

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Ref 11-16 Kent County Council Living Later Life to the Full: a policy framework for later life (2009)

Ref 11-17 Kent County Council Local Transport Plan for Kent (2011)

Ref 11-18 Communities and Local Government Localism Act (2011)

Ref 11-19 Ashford Borough Council Local Development Framework Core Strategy (2008)

Ref 11-20 Canterbury City Council Local Development Framework Core Strategy (2010)

Ref 11-21 Dartford Borough Council Core Strategy (2011)

Ref 11-22 Gravesham Local Plan Core Strategy (2014)

Ref 11-23 Maidstone Borough Council Core Strategy (2011)

Ref 11-24 Sevenoaks Core Strategy (2011)

Ref 11-25 Shepway District Council Core Strategy (2015)

Ref 11-26 Tonbridge and Malling Borough Council Local Development Framework Core Strategy (2007)

Ref 11-14 Department for Environment, Food and Rural Affairs Good Practice Guide for Handling Soils (2000)

Ref 11-14 Department for Environment, Food and Rural Affairs Construction Code of Practice for Sustainable Use of Soils on Construction Sites (2009)

Abbreviations

AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic
AIES	Assessment of Implications on European Sites
ALC	Agricultural Land Classification
AOD	Above Ordnance Datum
AONB	Area of Outstanding Natural Beauty
AQAP	Air Quality Action Plan
AQMAs	Air Quality Management Areas
AQS	Air Quality Strategy
ARN	Affected Road Network
B03E01b	Bean Option 3 and Ebbsfleet Option 1b
B04bE01b	Bean Option 4b and Ebbsfleet Option 1b
B05E01b	Bean Option 5 and Ebbsfleet Option 1b
BAP	Biodiversity Action Plan
bgl	Below Ground Level
BLTP	Dartford Borough Council Biodiversity and Landscape Technical Paper
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CRTN	Calculation of Road Traffic Noise
CTRL	Channel Tunnel Rail Link
CWS	County Wildlife Site
DaSTS	Delivering a Sustainable Transport System
DBC	Dartford Borough Council
DEFRA	Department of Environment, Farming and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EAR	Environmental Assessment Report
EC	European Council

ECoW	Ecological Clerk of Works
eDNA	Environmental DNA
EIA	Environmental Impact Assessment
EPSL	European Protected Species Licence
GBC	Gravesham Borough Council
Ha	Hectare
HADDMS	Highways Agency Drainage Data Management System
HAWRAT	Highways Agency Water Risk Assessment Tool
HDV	Heavy Duty Vehicle
HHJV	Halcrow Hyder Joint Venture
HHJV	Hyder Halcrow Joint Venture
HIS	Habitat Suitability Index
HoPI	Habitat of Principal Importance
JNCC	Joint Nature Conservation Committee
KBG	Kent Bat Group
KCC	Kent County Council
KMBRC	Kent and Medway Biological Records Centre
KOS	Kent Ornithological Society
KRAG	Kent Reptile and Amphibian Group
LAK	Landscape Assessment of Kent
LAQM	Local Air Quality Management
LCA	Landscape Character Area
LDF	Local Development Framework
LNR	Local Nature Reserve
LOAEL	Lowest Observed Adverse Effect Level
LTT	Long Term Trend
LV	Limit Values
LVIA	Landscape Visual Impact Assessment
LWS	Local Wildlife Site

MAGIC	Multi-Agency Geographic Information for the Countryside
MCZ	Marine Conservation Zones
MPA	Marine Protected Areas
MPI	Major Projects' Instruction
NE	Natural England
NERC	Natural Environment and Rural Communities
NIA	Noise Important Areas
NIR	Noise Insulation Regulations
NMU	Non-Motorised User
NN NPS	National Networks National Policy Statement
NNR	National Nature Reserve
NO2	Nitrogen Dioxide
NOEL	No Observed Effect Level
NOx	Oxides of Nitrogen
NPPF	National Planning Policy Framework
NPSE	National Policy Statement for England
NPSNN	National Policy Statement for National Networks
NSIP	Nationally Significant Infrastructure Project
ONS	Office of National Statistics
OS	Ordnance Survey
PCF	Project Control Framework
PCM	Pollution Climate Mapping
PM10	Particulates
PRoW	Public Right of Way
pSPA	proposed Special Protection Area
RSS	Regional Spatial Strategy
SAC	Special Areas of Conservation
SEEPB	South East England Partnership Board
SFRA	Strategic Flood Risk Assessment

SINC	Sites of Importance for Nature Conservation
SOAEL	Significant Observed Adverse Effect Level
SoPI	Species of Principal Importance
SoS	Secretary of State
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SuDS	Sustainable Drainage Systems
TPO	Tree Preservation Order
UKBAP	United Kingdom Biodiversity Action Plan
WFD	Water Framework Directive
WCA	Wildlife and Countryside Act
ZTV	Zone of Theoretical Visibility

Glossary of terms

Term	Meaning
Assessment	An umbrella term for description, analysis and evaluation
A-weighting	In addition to its non-linear amplitude response, the human ear has a non-linear frequency response; it is less sensitive at low and high frequencies and most sensitive in the range 1 kHz to 4 kHz (cycles per second). The A-weighting is applied to measured sound pressure levels so that these levels correspond more closely to the subjective response. A-weighted noise levels are often expressed in dB(A).
AAWT	Annual Average Weekday Traffic.
Ambient Noise	Ambient noise is the total sound in a given situation at a given time usually composed of sound from many sources, near and far.
Baseline year	For an assessment of noise and vibration, the baseline year is taken as the opening year of the road project.
Basic Noise Level (BNL)	The BNL is a measure of source noise at a reference distance of 10m from the nearside carriageway edge. It is determined from obtaining the estimated noise level from the 18 hour flow and then applying corrections for vehicle speed, percentage of heavy vehicles, gradient and road surface as described in CRTN.
CRTN	The technical memorandum issued by the Department of Transport and Welsh Traffic Noise (CRTN) Office that describes the procedures for calculating noise from road traffic.
Decibel	This is the unit of measurement used for sound pressure levels and noise levels are usually quoted in decibels (dB). The decibel scale is logarithmic rather than linear. The threshold of hearing is zero decibels while, at the other extreme, the threshold of pain is about 130 decibels. In practice these limits are seldom experienced and typical levels lie within the range of 30 dB(A) (a quiet night time level in a bedroom) to 90 dB(A) (at the kerbside of a busy street).
Dwelling	A building used for living purposes. A mobile home used for permanent living should be included in an assessment. If calculations are being conducted for compensation purposes then some mobile homes are dealt with under the Highways Noise Payments and Moveable Homes Regulations.
Environmental baseline	The existing (pre-development) context of a study area
Facade Sound Level	A facade sound level is that determined 1 metre in front of a window or door in a facade. Sound is reflected from hard surfaces in a similar manner to light by a mirror and the effect is to produce a slightly higher (about 2.5 dB) sound level than would occur if the building was not there. For façade levels at dwellings required for this assessment process, the

	level 1 metre from the façade should be calculated with a reflection correction.
Free-Field Sound Level	The sound level which is measured or calculated, in the open, without any reflections from nearby surfaces. For free-field levels at dwellings required for this assessment process, the level one metre from the most exposed façade should be calculated without a reflection correction.
Future assessment year	The future assessment year is the year between baseline and the 15th year where the maximum impact from the road project would occur.
L_{A10} index	L_{A10} is the A-weighted sound level in dB that is exceeded 10% of the measurement period. This is the standard index used within the UK to describe traffic noise.
L_{A90} index	The background noise level is commonly quoted using the L_{A90} index. This is the A-weighted sound level in dB that is exceeded 90% of the measurement period.
$L_{A10,18h}$ index	The $L_{A10,18h}$ noise level is arithmetic mean of all the levels of L_{A10} during the period from 06:00 to 24:00. From research it has been found that subjective response to road traffic noise is closely linked to higher noise levels experienced and is correlated well with the $L_{A10,18h}$ index
L_{Aeq} index	The equivalent continuous sound level L_{Aeq} is the level of a notional steady sound, which at a given position and over a defined period of time would have the same A-weighted acoustic energy as the fluctuating noise.
L_{Amax} index	The maximum A-weighted level measured during a given time period.
Lnight index	The Lnight index in DMRB is a facade noise index derived from the $L_{A10,18h}$ index using TRL conversion method.
Lnight,outside	Index for the purpose of night-time noise assessment in DMRB, the Lnight,outside index is the equivalent continuous sound level $L_{Aeq,8h}$ for the period 23:00 to 07:00 hours assessed outside a dwelling and is free-field.
Magnitude	A combination of the scale, extent and duration of an effect.
Mitigation	Measures, including any process, activity or design to prevent, reduce and where possible offset any significant adverse environmental effects of a development project
Nuisance	In DMRB nuisance is intended to generally refer to ‘bother’ or ‘annoyance’ and is not necessarily the same as that used in some statutory documents.
Project extent	The area under consideration during the options appraisal process for the widening of the A2 Bean and Ebbsfleet Junctions

Receptor	An asset, facility, area or population group associated with value in a certain environmental topic
Scheme	All works associated with the construction and operation for the widening of the A2 Bean and Ebbsfleet Junctions, as described in Chapter 2
Sensitivity	The susceptibility of a receptor to change, and the capacity of that receptor to accommodate change
Sensitive receptor	Receptors which are potentially sensitive to noise and vibration. Examples include dwellings, hospitals, schools, community facilities, designated areas (e.g. AONB, National Park, SAC, SPA, SSSI, SAM), and PRoW.
Study Area	Extent of consideration of baseline and assessment for a particular environmental receptor