highways england

M27 Southampton Junctions improvement scheme

Environmental Assessment Report

2018

1. Summary

This EAR has been undertaken to assess the impacts of the scheme on environmental topics. Due to the stage of works, PCF Stage 2, all technical topics have been considered in the assessment.

The assessment has predicted that with the exception landscape and potentially cultural heritage, neither Appraisal Option 1 nor 2 would result in 'significant' environmental effects.

The 'significant' effects associated with landscape are limited to individual views and are as a result of the removal vegetation and the gas holders on the gas works site.

The potential 'significant' effect associated with cultural heritage is to unknown undisturbed below-ground archaeological remains. The value of these assets (if present) is unknown therefore taking a worst-case scenario the effect pre-mitigation is assumed to be 'moderate/large' adverse. However, through undertaking of a detailed desk based assessment and if required intrusive investigations, any impacts to this heritage asset can likely be mitigated and resultant impacts thus might be considered likely to not be significant. (Requirement for intrusive investigations will depend upon the extent of physical works). Noise modelling has been undertaken, this has identified temporary adverse effects from noise and vibration are likely to occur during construction works associated with both Appraisal Option 1 and 2. However, it is recognised that the magnitude of the impact of the identified adverse effects should be reduced through the implementation of a Construction Environmental Management Plan (CEMP) in accordance with best practice measures.

The redistribution of the traffic on the network as a result of Appraisal Option 1 will result in the A3024 corridor being expected to manage greater amounts of traffic. For Appraisal Option 1 there is a much great number of Heavy Goods Vehicles (HGVs) predicted to use the route due to the removal of the current weight restriction on Northam Road Rail Bridge. The resultant effect is that Appraisal Option 1 is predicted to result in a permanent significant adverse effect on some residential areas along the A3024 (most of the receptors impacted are outside of the Scheme boundary).

Overall it is concluded that the impacts of Appraisal Option 2 are, due to the reduced scope of works, predicted to affect less receptors than Appraisal Option 1.

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2. Part 1: Introduction

2.1 Overview of the project report

2.1.1 Identify the scheme and stage of scheme

This Environmental Assessment Report (EAR) has been prepared by CH2M on behalf of Highways England at PCF Stage 2 for the proposed M27 Southampton Junctions Scheme. This follows the Environmental Study Report (ESR) prepared by WSP | Parsons Brinckerhoff on behalf of Highways England in Project Control Framework (PCF) Stage 1[1] to help inform the options identification and selection process for the proposed M27 Southampton Junctions scheme, hereafter referred to as 'the Scheme'.

The M27 Southampton Junctions scheme aims to reduce congestion and improve safety between M27 Junctions 8 and 5 (westbound). It seeks to do this through removing bottlenecks and increasing capacity on the local network along the A3024 corridor in order to encourage traffic to use the shorter, sign-posted routes to the city centre via Junction 8/A3024 rather than via Junction 5/A335.

If traffic congestion is not addressed on the M27 between Junctions 8 and 5, as well as in and around M27 Junction 8, then the service provision along the M27 will deteriorate, and local growth in housing and employment may suffer.

The preferred option will be selected at the end of PCF Stage 2. If the EIA Screening Determination of the selected option requires a Statutory Environmental Impact Assessment Report, it will be prepared during PCF Stage 3.

2.2 Overview of the project

2.2.1 Location of Scheme

The M27 Southampton Junctions scheme is located in South Hampshire, which is the most urbanised and highly populated area in the South East of England (outside London) and is one of the key gateways to mainland Europe.

The M27 runs approximately parallel both to the coast of the Solent and to the A27. It starts as an eastwards continuation of the A31 from Bournemouth and Poole, and links to the M271 to central Southampton at Junction 3. East of Junction 3, the M27 widens to a dual four lane motorway to Junction 4 with the M3, after which it narrows to a dual three lane motorway as it passes to the north of Southampton through Junction 5 to Junction 8. The M27 is dual four lanes between Junction 7 and 8, and dual three lanes east of Junction 8 where it runs alongside the West Coastway Railway Line south-east towards Fareham. The M27 then runs alongside the northern outskirts of Fareham, briefly with a fourth climbing lane in either direction, before Junction 12 with the M275 to Portsmouth.

The local road network consists of the A3024 - Eastern Access Corridor (via Windhover Roundabout), which connects to the M27 at Junction 8, and the A334 which connects to the M27 at Junction 7. Both routes provide access towards

[1] PCF Stage 1 Environmental Study Report (Document Number HE55154-WSP-GEN-PCF1-RP-EN-00002-S3-P01)

Southampton city centre. In the north of the city, the A335 Stoneham Way links to the M27 at Junction 5 and provides and alternative route into the city centre.

2.3 Legislative and policy framework

The Government adopted a National Policy Statement for National Networks (NPSNN [2]) in December 2014, which sets out the Government's policies to deliver Nationally Significant Infrastructure Projects (NSIPs) on the national road and rail networks in England. The Secretary of State will use the NPSNN as the primary basis for making decisions on development consent applications for national networks NSIPs in England.

The NPSNN states that improvements on the highways network are vital to alleviate congestion, particularly in the South East. Paragraph 2.17 states that:

"It is estimated that around 16% of all travel time in 2010 was spent delayed in traffic, and that congestion has significant economic costs: in 2010 the direct costs of congestion on the Strategic Road Network in England were estimated at £1.9 billion per annum."

The NPSNN indicates that options testing need not be considered by the examining authority or the decision-maker if projects have been subject to full options appraisal in achieving their status within Road or Rail Investment Strategies, or other appropriate policies or investment plans. For national road and rail schemes, proportionate consideration of alternatives will have been undertaken as part of the investment decision-making process.

At PCF Stages 0 and 1 it was considered that, due to the majority of the scheme being implemented on the local network, a Development Consent Order (DCO) was unlikely to be required. This position has been reviewed during PCF Stage 2 and following the completion of further environmental assessment work, which has led to the identification of potentially significant environmental effects, this position remains uncertain and thus is under review. Should the preferred scheme be confirmed as giving rise to significant environmental effects it would fall under the Planning Act 2008 and require a Development Consent Order (DCO).

Given the current uncertainty regarding Scheme with regards to its status as an NSIP, due regard has been given to the NPSNN as well as the National Planning Policy Framework (NPPF), relevant legislation and Highways England Guidance. Each technical chapter (Chapter 5 to 14) details the relevant legislation and policy framework specific to that technical discipline in a section' *Legislative and policy framework'*.

[2] National Policy Statement for National Networks (DfT, 2014); [online] available at: https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

2.4 Scope and content

For the purpose of assessment and simplicity, the proposed scheme in PCF Stage 2 has been sub-divided into four sub-schemes[3] (please refer to Drawing HE551514-CH2M-GEN-PCF2-SW ZZZZ-DR-001 in Appendix 1). The four sub-schemes are:

- Sub-scheme 1: Capacity upgrades to M27 Junction 8 and the Windhover Roundabout (A27/A3024/A3025);
- Sub-scheme 2: Highway network improvements aimed at enhancing traffic movements and capacity for all travel modes along the A3024 Eastern Access Corridor;
- Sub-scheme 3: Replacement of the existing A3024 Northam Road Rail Bridge over the railway in order to widen it from 2 to 4 lanes and increase its structural capacity; and
- Sub-scheme 5: Capacity upgrades to the existing Bitterne Rail Bridge to allow a minimum of two full lanes of traffic in the peak direction over the bridge.

This EAR is based on the Environmental Study Report (ESR) produced at PCF Stage 1. The information contained in this document has been reviewed and where appropriate, has been updated with new information.

Two 'Appraisal Options' have been considered in this EAR, which are described in Sections 1.4.1 and 1.4.2.

2.4.1 Appraisal Option 1

This option comprises all four sub-schemes, which are set out below in more detail.

- **Sub-scheme 1 – Junctions**: Local widening and signalisation of approach arms to the M27 Junction 8 and the A27 Windhover Roundabout. Refer to Figures HE551514-CH2-HGN-PCF2_SS1_ZZZZ-DR-CX-001_P07 and HE551514-CH2-HGN-PCF2_SS1_ZZZZ-DR-CX-002_P07 in Appendix 1.2.
- **Sub-scheme 2 – Eastern Access Corridor**: This sub-scheme involves a package of works comprising improvements and alterations to local junctions. The works include:
  - Signal upgrades, to signalised junctions along the A3024 between A27 Windhover roundabout and east of Six Dials junction in Southampton.
  - Local carriageway widening along the A3024 between A27 Windhover roundabout and east of Six Dials junction in Southampton.
  - Local accessibility and connectivity improvements along the A3024 to support active travel modes and public transport.

[3] In September 2016 Highways England made the decision to remove Sub-scheme 4: Wide Lane Bridge from the scope of assessment. The decision followed a review of the current problems that Sub-scheme 4 may address, and the likely benefits that could be achieved from the approximate £20m sub-scheme cost (based on the "most likely" Stage 0 cost estimate).

Refer to Figures HE551514-CH2-HGN-PCF2_SS1_ZZZZ-DR-CX-001_P07 and HE551514-CH2-HGN-PCF2_SS2_ZZZZ-DR-CX-001_P07 to HE551514-CH2-HGN-PCF2_SS2_ZZZZ-DR-CX-018_P07 in Appendix 1.2

- **Sub-scheme 3 – Northam Road Rail Bridge Replacement:** Replacement of the existing A3024 Northam Road Rail Bridge with a new dual carriageway bridge arrangement with segregated pedestrian and cycleway and upgrading the current two-way single lane crossing with two-way dual crossing.

  Refer to Figure HE551514-CH2-HGN-PCF2_SS3_ZZZZ-DR-CX-001_P07. in Appendix 1.2

  - **Sub-scheme 5** – Bitterne Rail Bridge: Provision of a new segregated pedestrian and cycleway to the north of the existing Bitterne Bridge (works to the existing carriageway and junction are included as part of Sub-scheme 2).

  Refer to Figures HE551514-CH2-HGN-PCF2_SS1_ZZZZ-DR-CX-001_P07 and HE551514-CH2-HGN-PCF2_SS2_ZZZZ-DR-CX-008_P07 in Appendix 1.2

  (NOTE: In September 2016, Sub-scheme 4: Wide Lane Bridge was removed from the scope of the scheme by Highways England).

2.4.2 Appraisal Option 2

The components of Appraisal Option 2 are limited to Sub-scheme 1 and the Botley Road junction improvements from Sub-scheme 2 only. The Appraisal Option comprises widening and traffic signal improvement to Junction 8 on the M27 and Windhover Roundabout and widening of the A3024 between these two roundabouts along with improvements to the Botley Road junction on the A3024. Please refer to drawing HE551514-CH2-GEN-PCF2_SW_ZZZZ-DR-ZZ-0002 in Appendix 1.2.

2.5 Structure of the Report

Sections **Error! Reference source not found.** and **Error! Reference source not found.** of this EAR introduce and describe the Scheme; Section **Error! Reference source not found.** describes the alternatives which have been considered in the assessment; Section **Error! Reference source not found.** describes the environmental assessment approach including the overall scope and significance criteria used; Sections **Error! Reference source not found.** to 14 cover the following topics:

- Air Quality
- Cultural Heritage
- Landscape
- Biodiversity
- Geology and Soils
- Materials (including Waste)
- Noise and Vibration
- People and Communities;
- Road Drainage and the Water Environment; and

- Climate.

Section 15 provides a consideration of the cumulative effects, Section **Error! Reference source not found.**6 summarises the findings and conclusions of the EAR. Section 17 provides a list of acronyms used in this report.

The structure and contents of the EAR take account of the legal obligations and HE's requirements as set out in Highways England; Interim Advice Note (IAN) 125/15; Annex D; and giving regards to the relevant 2017 'EIA regulations':

- The Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017
- Part 5A of the 1980 Act (environmental impact assessments); and
- Planning Act 2008 (as amended): for delivery of Nationally Significant Infrastructure Projects (NSIPs).

3. Part 2: The Project

3.1 Need for the project

3.1.1 Background to the project

The Solent to Midlands Route Strategy Study, completed during 2014 (Highways England, 2014)[4], was a high-level route assessment and identified long-standing congestion hot spots and safety concerns on the Strategic Road Network (SRN). It confirmed the need for improvement options along the M27 between Junction 8 and Junction 5. Subsequently the M27 Southampton Junctions scheme was included in the Department for Transport's (DfT's) Road Investment Strategy (RIS): for the 2015/16 - 2019/20 Road Period (March 2015).

The need for the Scheme was confirmed in the Autumn Statement 2014 and through inclusion in RIS 1. The M27 Junctions Improvement Scheme is included in the Highways England Delivery Plan 2015-2020[5].

By improving the M27 Junction 8 and the A3024 corridor the Scheme aims to encourage city-centre bound traffic from the east of Southampton to use the shorter sign-posted routes via the M27 Junction 8 /A3024. This in turn will improve traffic flow and reliability on the M27 between Junctions 8 and 5.

The scope of works for the M27 junctions project, hereafter referred to as 'the Scheme' includes:

- removal of bottlenecks on the local road network between Windhover Roundabout and east of Six Dials junction in Southampton on the A3024; and
- creation of capacity for city-centre bound traffic on the M27 J8.

3.1.2 The proposed Works

At PCF Stage 2 the scope of works includes the following for each sub-scheme.

- **Sub-scheme 1** – Junctions:
  - Local widening and signalisation of approach arms to the M27 J8 and A27 Windhover Roundabout based on the preferred option developed by Hampshire County Council.
- **Sub-scheme 2** – Eastern Access Corridor:
  - Identify a package of options for local junction improvements and alterations, including signal upgrades, to signalised junctions along the A3024 between A27 Windhover Roundabout and east of Six Dials junction in Southampton.
  - Local carriageway widening along the A3024 between A27 Windhover Roundabout and east of Six Dials junction in Southampton.
  - Local accessibility and connectivity improvements along the A3024 to support active travel modes and public transport where such modes are directly

[4] Solent to Midlands Route Strategy Evidence Report (Highways England April 2014) Available at http://assets.highways.gov.uk/our-road-network/route-strategies/Solent%20to%20Midlands.pdf
[5] Available on line at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/424467/DSP2036-184_Highways_England_Delivery_Plan_FINAL_low_res_280415.pdf

impacted by any planned highway capacity changes. To be developed and implemented alongside a wider integrated local transport strategy supported by Southampton City Council.

- **Sub-scheme 3** – Northam Road Rail Bridge Replacement:
  - Replacement of the A3024 Northam Road Rail Bridge, upgrading the current two-way single lane crossing with two-way dual crossing.
- **Sub-scheme 5** – Bitterne Rail Bridge:
  - Investigate options over Bitterne Rail Bridge, to mitigate the single carriageway pinch point.

3.2 Project objectives

The Solent to Midlands Route Strategy Study, completed during 2014, was a high-level route assessment that identified long-standing congestion hot spots and safety concerns on the Strategic Road Network (SRN). It confirmed the need for improvement options along the local road network in order to reduce traffic demand along the M27 between Junction 8 and Junction 5. Subsequently the M27 Southampton Junctions Scheme was included in the Department for Transport's Road Investment Strategy (RIS).

The scheme need was confirmed by the Autumn Statement 2014 and through inclusion in RIS 1. It forms part of the Highways England Delivery Plan 2015-2020.

The project has both primary and secondary objectives which have not changed during PCF Stage 2 of the evaluation of the options identified in PCF Stage 1.

For the details of the project objectives refer to the Transport Objectives section contained within the Client Scheme Requirements (CSR), document reference HE551514-CH2-GEN-PCF2_XX_ZZZZ-RP-ZZ-0005, and also PCF Stage 1 Technical Appraisal report (TAR), document reference HE551514-WSP-GEN-PCF1-RP-PM-00008) paragraph 3.4 Scheme Objectives.

3.3 Project location

An overview of the existing land use in the immediate surrounds of the sub-schemes and the proposed land take for the sub-schemes is described below.

The majority of land that would be required is within public ownership of key stakeholders (within HE, SCC or Hampshire County Council (HCC) highways boundaries or on Network Rail controlled land). The final extent of all land take (including land take requirements for construction compounds) is not known at the current stage of design. However, identified potential permanent and temporary land take requirements are described in the following sections.

3.3.1 Sub-scheme 1

Land use in the immediate area of Sub-scheme 1 comprises arable land (generally located to the north and east of Windhover Roundabout). Various light industrial and commercial uses lie within 500m of the scheme footprint to the south and south east, including, but not limited to; pub/restaurant housing, automotive repair, car/caravan dealerships, a car boot sale market site (potential location for

construction compound) and a supermarket store. The village of Bursledon is located immediately to the south of Windhover Roundabout.

Areas of undeveloped land to the north east of junction 8 and to the north east of Windhover Roundabout are currently under consideration as temporary construction compounds for the Scheme. Whilst the use of these areas is subject to further consultation and programming constraints, for the purposes of the assessment presented in this EAR it has been assumed that these areas will be used as temporary construction compounds.

Land to the immediate south west of the Junction 8 is required to facilitate proposals, specifically to allow for carriage way widening of the off-slip road and improved Non Motorised User (NMU) facilities. It is understood that this land is within the adopted highway however the boundaries here are close to the existing highway and further investigation is required during PCF Stage 3 to establish ownership in this area.

Further areas of land take may be required in order to accommodate localised widening and retaining walls and to mitigate impacts on the environment.

3.3.2 Sub-scheme 2

The A3024 corridor predominately passes through built-up residential, light industrial commercial areas between Windhover Roundabout in the east and to the end of Northam Road up to, but not including, Six Dials junction in the west. The western and central part of Sub-scheme 2 is predominantly urban, whilst the eastern extent of the corridor (between Botley Road junction and Windhover Roundabout approaching the M27) is less urbanised with more rural/agricultural land uses including areas of allotments and public open space.

Sub-scheme 2 follows the existing A3024 alignment over a length of approximately 7 km of existing road.

Some of the localised road widening and junction improvements will require some land take, including potential encroachment on private residential properties and areas of public land (allotments). At present no demolition of buildings or private property is envisaged. The extent of land take will be dependent on the final scheme proposals, which will be informed by further assessment work to be undertaken at PCF Stage 3.

3.3.3 Sub-scheme 3

Northam Road Rail Bridge is owned partially by Network Rail and partially by SCC, and carries the A3024 over the Brighton Main Line (BML2) and Southampton Eastern Docks Branch (SOY) lines. Adjacent to the north of the bridge are areas of overgrown unused land owned by SCC and Network Rail. Land use to the west of Northam Road Rail Bridge is predominantly residential, becoming more industrial to the east of the bridge with Shamrock Quay fronting the River Itchen. Immediately south of the bridge is a former gas works site, currently owned by Southern Gas Networks (SGN). Southampton Football Club (which is located approximately 100m to the south) previously aspired to develop this area of land to create a park. It is now understood that a private developer is considering development of this land to provide residential properties.

Permanent land take to the north-west side of Northam Road Rail Bridge is required to facilitate the construction of the permanent new bridges.

Temporary land take will be required to facilitate the construction at Northam Road Rail Bridge. The current proposal is to locate the temporary construction compound on the former gas works site to the immediate south of the existing bridge.

3.3.4 Sub-scheme 5

Bitterne Bridge is a Network Rail structure carrying the A3024 over the St Denys Junction to Portcreek Junction (SDP1) rail line. Bitterne Manor Primary School is located adjacent to the south of the bridge. Other land uses in the immediate surrounding area include residential (north and south of the existing structure), light industrial and commercial.

A small area of land take to the north of Bitterne Bridge is required to install a new segregated pedestrian and cycle bridge, a further area of land take is required on the northern side of the carriage way to the east Bitterne bridge between the bridge and junction with the A3035, Burseldon Road.

Temporary land take will be required to facilitate the construction of the new bridge. The current proposal is to locate the temporary construction compound on an existing carpark to the north side of the A3024 carriage between the A3024 and Macnaghten Road, east of Bitterne Bridge.

3.4 Construction, operation and long-term management

The construction, operational and long-term management arrangements are not known at this stage. Any assumptions made within this assessment relating to the construction, operational or management arrangements are based on prior experience of similar schemes. The anticipated programme assumes the project is not DCO and allows for design progression and likely third-party programme constraints.

The key programme dates are currently anticipated to be:

- Construction Commencement Year: 2020
- Opening Year: 2022

The construction periods for individual sub-schemes vary and, depending on how the implementation of the scheme is procured, the practical completion date of some or all elements of the scheme may extend beyond 2022. This will be refined in future stages.

4. Part 3: Assessment of Alternatives

4.1 Assessment methodology

4.1.1 Design Options Examined in PCF Stage 0

PCF Stage 0 identified the following sub-schemes:

- Sub-scheme 1: Capacity upgrades to M27 Junction 8 and the Windhover Roundabout (A27/A3024/A3025);
- Sub-scheme 2: A3024 Eastern Corridor;
- Sub-scheme 3: A3024 Northam Road Rail Bridge Replacement; and
- Sub-scheme 4: Wide Lane Bridge Widening.

4.1.2 Design Options Examined in PCF Stage 1

During PCF Stage 0, Bitterne Bridge widening was considered as part of the A3024 Eastern Corridor (Sub-scheme 2). At an early point in PCF Stage 1, following a joint site visit by the project team, Highways England and Southampton City Council (SCC) it was identified as a potential traffic flow pinch point which needed to be addressed as part of Stage 1. Bitterne Bridge widening was separated out into Sub-scheme 5 in order to allow specific alternative options for this pinch-point to be developed and costed.

In September 2016, Sub-scheme 4: Wide Lane Bridge was removed from the scope of the scheme by Highways England.

Environmental impact assessment during PCF Stage 1 is normally undertaken on a qualitative basis in accordance with the Design Manual for Road and Bridges (DMRB), and this approach has been followed for the M27 Southampton Junctions scheme. However, during PCF Stage 1, traffic modelling data were available that enabled an initial quantitative view of the change in traffic on the network in the scheme study area. These data were used for an initial high-level assessment of potential air quality and noise impacts due to the combinations of sub-schemes represented by the Do Something scenarios.

The traffic data were provided from the Sub-Regional Transport Model (SRTM) (managed by Solent Transport) for the model horizons of 2019 and 2036. As these model horizons are close to the assumed scheme opening year at PCF Stage 1 the 2019 and 2036 model horizons data were used, as it was not proportionate to create new horizons in the SRTM.

During PCF Stage 1, the environmental impacts of sub-scheme options were assessed individually (i.e. on a sub-scheme level), and a number of combinations of sub-schemes were also assessed. These scenarios represented - for the purposes of the environmental, operational and economic assessments - the ‘Do Something’ options, and were compared to the ‘Do Minimum’ Do minimum being no Scheme.

The details of each of the sub-scheme options are described in Sections 3.2 of the PCF Stage 1 Environmental Study Report (Document Number HE55154-WSP-GEN-PCF1-RP-EN-00002-S3-P01), the combinations of sub-scheme options

assumed in the Do Something scenario options at PCF Stage 1 are given in Table 3.1 of the PCF Stage 1 Environmental Study Report.

During PCF Stage 1 it was not feasible to assess all the potential combinations of options, but the focus was to identify and assess a limited number that were considered to provide a representative range of the likely viable, best performing option combinations.

Do Something 1: represented the combination of sub-scheme options that would be most likely to achieve the scheme objectives, whilst minimising land take and minimising environmental impacts (based on qualitative information available at the mid-point of PCF Stage 1).

Do Something 1 included:

- localised widening at M27 Junction 8 and Windhover Roundabout (Sub-scheme 1 - Option 1),
- the dualling of the A3024 corridor (Sub-scheme 2 - Level 3),
- the replacement of Northam Road Rail Bridge (Sub-scheme 3 - Option 3A), and
- assumed that the tidal flow system is implemented at Bitterne Bridge, i.e. the bridge is not widened (Sub-scheme 5 - Option 1).

Option 1 was included in Sub-scheme 1 on the basis that it is the most likely design to be implemented, having been developed in some detail by Hampshire County Council (HCC) and shown to represent high value for money, prior to inclusion in the M27 Southampton Junctions scheme. Individual sub-scheme options for Sub-scheme 1 may represent a worse environmental impact (e.g. Option 5, which includes tunnelling under Windhover Roundabout), and these are assessed in detail at a sub-scheme level.

This scenario option would - based on preliminary traffic modelling evidence - represent the largest increase in traffic flows along the A3024 corridor and was used to represent the "worst case" in environmental terms based on the risks regarding air quality and noise impacts identified during PCF Stage 0.

Do Something 2: represented the combination of sub-schemes that minimised land take along the A3024 corridor (with the exception of Northam Road Rail Bridge).

Do Something 2 is the same as Do Something 1 with the exception that the A3024 corridor would not be dualled, and only minimal intervention in terms of traffic signal control implemented (Sub-scheme 2 - Level 1).

This option represented a lower cost option that - subject to traffic modelling assessment – it was felt that this option may provide a similar benefit to Do Something 1 and would thus allow for comparison of the benefits / value for money between Do Something 1 and Do Something 2.

Do Something 3: represents a reduced scope scheme including only for Sub-scheme 1, based on historic evidence of this sub-scheme's viability. This option would have an impact on the rest of the A3024 corridor as it would address existing congestion issues at M27 Junction 8 and Windhover Roundabout, which in turn would likely route traffic through the A3024 without any works along that road.

A high-level assessment has therefore been made based on combinations of the sub-scheme options (Do Minimum, Do Something 1, Do Something 2, Do Something 3).

The scheme appraisal assumed that the M27 Smart Motorway Scheme (Junction 4 to Junction 11) would be in place between Junctions 8 and 5 of the M27 prior to the implementation of any elements of the M27 Southampton Junctions scheme.

4.2 Reasonable alternatives studied

4.2.1 Scenario Options for Consideration in Environmental Assessment

The following sub-scheme options have been carried forward for assessment in PCF Stage 2.

- Sub-scheme 1 – PCF Stage 1 'Option 1'
- Sub-scheme 2 – a combination of Level 1 and Level 2 options from PCF Stage 1
- Sub-scheme 3 – PCF Stage 1 'Option 3A'
- Sub-scheme 5 – An entirely new proposal for Bitterne Bridge on the A3024.

The sub-scheme options have been combined into two scenarios referred to as 'Appraisal Option 1' and 'Appraisal Option 2'. The details of each sub-scheme associated with Appraisal Options are taken from the Client Scheme Requirements, document reference HE551514-CH2-GEN-PCF2_XX_ZZZZ-RP-ZZ-0005 within the Options section and are provided below.

Appraisal Option 1

- **Sub-scheme 1** – Junctions:

  Local widening and signalisation of all approach arms to M27 J8 and A27 Windhover Roundabout based on the preferred option developed by Hampshire County Council (HCC). This includes improvements to NMU facilities.

- **Sub-scheme 2** – Eastern Access Corridor:

  This section of the A3024 corridor extends from the A27 Windhover Roundabout in the west to Six Dials Junction (A3024/A33 Kingsway / A33 St Andrews Road / New Road) in Southampton. The assessment for Sub-scheme 2 excludes Northam Road Rail Bridge (Sub-scheme 3) and Bitterne Rail Bridge (Sub-scheme 5), which are assessed separately.

  Works include local carriageway widening at Junctions along the A3024 between A27 Windhover Roundabout and east of Six Dials junction in Southampton comprising minor changes to kerblines at junctions (introducing flares and turning pockets) to improve localised stop-line capacity and removal of existing bus lanes between Windhover Roundabout and Six Dials. From east to west works are each junction are summarised in Table 3.1.

Table 3.1 Summary of works at each junction of the A3024

Junction	Current arrangement	Proposed works
Botley Road/ Bursledon Road	Signal junction	Widening to provide two lanes exiting Botley Road (south), A3024 to have two straight ahead lanes in each direction (that merge after the junction). Pedestrian / cycle crossing to be improved through inclusion of signalled crossings and widened footpaths that will become shared facilities. Botley Road (north) to remain as existing with no opening to Hedge End village.
Coates Road/ Warburton Road	Signal junction	Improved coordination between two sets of signals. Pedestrian crossing to be provided outside Highpoint Centre. Contraflow cycle lane on Coates Road. Widening to provide right turn waiting area for Warburton Road and into garage.
Orpen Road	Signal junction	Extended A3024 left turn lane into Orpen Road. AM bus lane to be converted to use for all traffic on exit side of junction. Optimised traffic signal timings.
Gavan Street (Retail Park)	Signal junction	A3024 inbound to operate with right run. AM peak bus lane to be used by all traffic. Optimised traffic signal timings.
Kathleen Road/ Hinkler Road	Signal junction	Optimised traffic signals. AM peak turning restrictions to be removed on both side roads and Bittern Gating System* signal timing restrictions no longer to be imposed. AM peak bus lane on A3024 to be used by all traffic. Carey Road Junction onto Hinkler Road to be closed off to prevent access to the southern side of Carey Road. Access will be maintained to the northern side of Carey Road.
Sedgewick Road	Road Closure	Close access from A3024 to make a cul-de-sac; and provide turning head on Sedgewick Road
North East Road	Signal junction	Optimised traffic signals. Widening to A3024 eastbound side to provide right turn waiting lane into North East Road
Upper Deacon Road	Signal junction	Existing signals to be removed and replaces with give way junction. Widening to A3024 eastbound side to provide right turn waiting lane into Upper Deacon Road.
Deacon Road	Signal junction	Optimised traffic signals.
Bath Road/ Ruby Road	Signal junction	Existing AM peak right turn prohibition from Bath Road will be removed as this road will no longer be an attractive bypass from Bitterne Road East as the 'gating scheme' traffic signal timing restrictions will be removed. It is proposed however that both A3024 right turns into these side roads are prohibited as not possible to physically accommodate separately signalled right turn bays on the A3024 due to restrictions caused by private property boundaries. It is not considered safe to allow right turns without these bays due to number of opposing lanes and risk of tail-end shunts with straight-through vehicles travelling behind.
Chatsworth Road	Road Closure	Close access from A3024 to make a cul-de-sac; and provide turning head on Chatsworth Road
White's Road	Signal junction	Optimised traffic signals New dedicated and signalled right turn lane to be provided from A3024 eastbound into White's Road. Widening to A3024 westbound in order to provide realigned central traffic islands.
A3024/A33 Bitterne Road East	Signal junction	Optimised traffic signals and "gating scheme" restrictions removed.

Junction	Current arrangement	Proposed works
West End Road/ Lances Hill	Signal junction	Optimised traffic signals and "gating scheme" restrictions removed.
Midanbury Lane, Chessel Crescent, Glenfield Avenue, Juniper Road, Garfield Road	No changes to highway alignment other than providing priority cycle crossing facilities / markings across each junction.	
Bullar Road/ Cobbett Road/ Athelstan Road	Signal junctions	Optimised traffic signals Ban right turn (except for buses) into Bullar Road in PM peak
Quayside Road/ Hawkeswood Road	No changes	
Rampart Road	Signal junction	Existing pedestrian crossing over A3024 to be moved to eastern side of the junction.
Union Road/Princes Street	Existing A3024 turn left lane (into Princes Street) is to be increased to provide more capacity. Right turn out of Princes Street to be prohibited (Summers Street cul-de-sac to be removed and Summers Street to be connected to the A3024. Leyton Road to be made one-way southbound) Improved pedestrian crossing facilities on the A3024	
Kent Street	No changes other than removal of bus lane on A3024 to allow all traffic to use this section of road.	
Britannia Road	Signal junction	Optimised traffic signals No changes to junction. However, the A3024 on its approach to the junction will be two lanes of traffic in either direction and the bus lane removed to allow all traffic to use this section of road.
Brinton's Road, Old Northam Road and Six Dials Junctions	Signal junctions	Optimised traffic signals
* The Bitterne Gating System is a series of measures to manage traffic capacity and promote public transport along the A3024 corridor. It controls the traffic signal junctions between Bursledon Road/ Kathleen Road/ Hinkler Road and Northam Road/ Britannia Road during the morning peak period. It restricts the amount of in-bound traffic that can join the route to prevent the downstream pinch point at the Northam Rail Bridge from causing flow breakdown.		

- **Sub-scheme 3** – Northam Road Rail Bridge Replacement: Works here include replacement of the existing bridge with new bridges to provide two lanes in both and east and westbound direction; and improved pedestrian and cycle facilities. The new bridge structures will be constructed off site at the adjacent gas works site (to the south of Northam Bridge). The first section of bridge will be constructed and craned into place to the north of the existing bridge, which will remain in place an operational for traffic until the new section of bridge can be prepared, this will enable traffic movement to be maintained throughout the construction period. The existing bridge will then be demolished during a period of railway closure and the second section of bridge will then be craned into position.

  Improvements to the existing pedestrian and cycle facilities will be provided. The existing footbridge from the south side of Northam Road Rail Bridge to St Mary's football stadium, which also crosses the railway adjacent to Northam Road Rail Bridge, will be removed and replaced with a new and separate pedestrian and cycle bridge to the southern side of the new Bridge.

  As part of the Scheme the existing footpath and cycle subway underneath Northam Road will be closed permanently with proposals to route a shared footpath and

cycleway between the railway boundary and the eastern abutment with the same width as the closed subway linking to both the existing northern and southern side of Northam Road.

- **Sub-scheme 5** – Bitterne Rail Bridge:

  No works are proposed to the bridge itself, but adjacent to the existing bridge it is proposed to provide a new bridge to the northern side only for non-motorised users. Traffic signal upgrades are proposed either side of Bitterne Rail Bridge.

Appraisal Option 2

Reduced scope of works. On Junction 8 of the M27 it is proposed to widen both the north and southbound exit slips to provide a dedicated turn left lane onto the A3024, Bert Betts Way and Dodwell Lane respectively; and to provide new 3 m wide shared NMU routes on the south of the roundabout. At Windhover Roundabout, it is proposed to widen each arm to provide a dedicated turn left lane off the roundabout and to provide new 3 m wide shared NMU routes to the south of the A3024, Bert Betts Way; and across the centre of the Roundabout from the A27 West End Road to the A27 Providence Hill.

At the A3024 Botley Road Junction, it is proposed to widen the carriage way to provide two lanes exiting Botley Road (south), A3024 to have two straight ahead lanes in each direction (that merge after the junction). Pedestrian and cycle crossings here are to be improved through inclusion of dedicated crossing points. It should be noted that Botley Road (north) would remain as existing with no opening to Hedge End village.

5. Part 4: Environmental assessment methodology

5.1 Environmental scoping

5.1.1 General Approach

This Environmental Assessment Report (EAR) follows the assessment approach set out in the Design Manual for Roads and Bridges (DMRB) Volume 11 and relevant IANs (including IAN 125/15). Sections 1 and 2 of the DMRB describe the approach for Simple and Detailed Assessment and IAN 125/15 sets out the topic structure for Environmental Study Reports (ESRs) now known as EARs.

For the purposes of this PCF Stage 2 assessment, a scheme opening year of 2022 has been assumed, and a forecast design year of 2036. It should be noted that the construction periods for individual sub-schemes may vary and, depending on how the implementation of the scheme is procured, the practical completion date of some or all elements of the scheme may extend beyond 2022. This will be refined in future stages.

5.1.2 Baseline Traffic flows

Traffic modelling flows considered as the “baseline traffic flow data” in the environmental assessment (particularly Sections dealing with effects on Noise and Vibration and Air Quality) were made available in August/September 2017 and are based upon datasets from the Sub Regional Transport Model (SRTM), (managed by Solent Transport). A Do Minimum scenario with Smart Motorways and a Do Something Scenario dataset was used as an input for the purposes of the environmental assessment at PCF Stage 2.

The traffic data from the SRTM includes model horizons of 2019 and 2036. As these model horizons are close to the assumed scheme opening year of 2022 and design year of 2036, for the purposes of this assessment the 2019 and 2036 model horizons data were used, as it was not proportionate to create new horizons in the SRTM for this purpose during PCF Stage 2.

5.1.3 Scoping

During PCF Stage 1, no formal scoping exercise was undertaken. However, an informal scoping exercise was undertaken to determine the level of environmental assessment that was appropriate at that stage of the design process.

The level of assessment and proposed approach for each topic has been reviewed as part of PCF Stage 2 and was agreed through the submission of an Appraisal Summary report (ASR). The scope of the EAR is summarised in Error! Reference source not found..

As no formal Scoping has been undertaken at this stage of the project; all topics have been scoped into this assessment. Simple assessments have been undertaken for each topic to provide proportionate assessments given the level of information available at this stage.

Table 5.1 Environmental Topics and Level of Assessment

Topic	Level of Assessment
Air Quality	Simple Assessment. High level preliminary assessment based on DMRB, Volume 11, Section 3, Part 1 Air Quality, May 2007; IAN 174/13[6] Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA 207/07); and the Institute for Air Quality Management (IAQM), Guidance on the Assessment of dust from demolition and construction, January 2014. Use of baseline traffic flow data has informed the assessment.
Cultural Heritage	Simple Assessment. High level preliminary assessment based on Historic England guidance, Historic Environment Good Practice Advice in Planning Note 3 (Historic England 2015); the Cultural Heritage Section (Volume 11, Section 3, Part 2) of the DMRB (Highways Agency, 2007); Chartered Institute for Archaeologists (CIfA) Standard and Guidance for Historic Environment Desk-based Assessment (2014) and CIfA Code of Conduct (2014) [7].
Landscape	Simple Assessment Based on IAN 135/10[8] Landscape and Visual Effects Assessment (Highways Agency 2010); the Guidelines for Landscape and Visual Impact Assessment (GLVIA) (3rd Edition) (Guidelines for Landscape and Visual Impact Assessment (GLVIA), 2013); and the Landscape Effects Section (Volume 11, Section 3, Part 5) of the DMRB (Highways Agency, 2007).
Biodiversity	Simple Assessment. Based on the guidelines for Ecological Impact Assessment (EcIA) produced by the Chartered Institute of Ecology and Environmental Management (CIEEM) (2016); and the Ecology and Nature Conservation Section (Volume 11, Section 3, Part 4) of the DMRB (Highways Agency, (2007). Use of baseline traffic flow data has informed the assessment).
Geology and Soils	Simple Assessment. High level assessment based on DMRB Volume 11, Section 3, Part 11 Geology and Soils, (June 1993); CIRIA C552; (2001): Contaminated Land Risk Assessment – A Guide to Good Practice.
Materials	Simple Assessment High level assessment based on IAN 153/11[9] (Highways Agency, 2011) on the environmental assessment of material resources.
Noise and Vibration	Simple Assessment Simple assessment of construction phase noise and vibration impacts in accordance with British Standards: BS 5228:2009+A1:2014; Code of practice for noise and vibration control on construction and open site – Part 1 and 2 (2014); and simple assessment of operational phase impacts following guidance in DMRB, Volume 11, Section 3, Part 7 – Noise and Vibration HD 213/11 - Revision 1.
People and Communities	Simple Assessment High level assessment based on the approach in IAN 125/15[10], which combines DMRB Volume 11, Section 3, Parts 6 (Land Use), 8 (Pedestrians, Cyclists, Equestrians and Community Effects) and 9 (Vehicle Travellers) into one assessment of People and Communities. The published guidance for these topics has been used.

6 Interim Advice Note (IAN) 174/13; Highways England; Web Reference http://www.standardsforhighways.co.uk/ha/standards/ians/index.htm
7 Chartered Institute for Archaeologists Regulations Standards and Guidelines; [online] available at: http://www.archaeologists.net/codes/cifa
8 IAN 135/10; Highways England; Web Reference http://www.standardsforhighways.co.uk/ha/standards/ians/index.htm
9 IAN 153/11; Highways England; Web Reference http://www.standardsforhighways.co.uk/ha/standards/ians/index.htm
10 IAN 125/15; Highways England; Web Reference http://www.standardsforhighways.co.uk/ha/standards/ians/index.htm

Topic	Level of Assessment
Road Drainage and the Water Environment	Simple Assessment High level assessment based on DMRB Volume 11, Section 3, Part 10 (HD 45/09).
Climate	Simple Assessment A high level assessment has been undertaken using professional judgement to provide a qualitative description of the nature of impacts. With no consolidated methodology, consideration has been given to advice within: TAG Unit A3 Environmental Impact Appraisal (DfT, 2015). Chapter 4 Greenhouse Gases; and PAS 2080:2016 Carbon management in infrastructure.

5.2 General assumptions and limitations

This report follows the assessment approach set out in the DMRB Volume 11 and relevant IANs (including IAN 125/15). Sections 1 and 2 of the DMRB describe the approach for Simple and Detailed Assessment and IAN 125/15 sets out the topic structure for EARs.

Construction periods for individual sub-schemes may vary, depending on how the implementation of the scheme is procured, the practical completion date of the scheme may extend beyond 2021. The construction period will be will be refined in future stages.

No ‘new’ survey data has been gathered to inform the PCF Stage 2 assessment. Unless otherwise stated, data from PCF Stage 1 has been used to inform the assessment undertaken.

5.3 Significance criteria

The topic sections provide a high-level assessment of the potential of the scheme to have significant adverse environmental effects. The significance of an effect is a factor of the importance or value of the resource affected, and the magnitude of the impact upon it. Unless otherwise stated, guidance in DMRB Volume 11, Section 2, Part 5, was used to determine the value of an affected resource, the magnitude of impact and the significance of effect. Any use of other guidance has been explained and justified within the individual technical topic.

IAN 125/15 stresses that the prediction of significant effects does not require absolute certainty. Instead it is about taking a reasonable view over likelihood. Furthermore, the determination of significance is only expected to be made using readily available information.

Receptors and/or the receiving environment likely to be impacted on by the Scheme have been identified within a defined study area (as specified within each technical chapter). The value (or sensitivity) of the identified receptor/resource has then been determined with regards to the guidance set out within DMRB Volume 11, Section 2, (reproduced at

Table 5.).

Table 4.2: Environmental Value (or Sensitivity) and Typical Descriptors

Value (sensitivity)	Typical Descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution.
Low (or Lower)	Low or medium importance and rarity, local scale.
Negligible	Very low importance and rarity, local scale.

The nature and characteristics of the impact have then been established and described to determine the magnitude of impacts, giving due regards to the guidance set out within DMRB Volume 11, Section 2, (reproduced at

Table 5.3). The impacts have been quantified where possible and the known characteristics clearly stated.

Table 4.3: Magnitude of Impact

Magnitude of Impact	Description
Major	Loss of resource and/or quality and integrity; 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	Significant impact on the 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 of 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.

The overall significance of effects was assessed using the matrix in DMRB Volume 11, Section 2, Part 5 (reproduced at

Table 5.4). Unless stated otherwise within technical chapters. Adverse effects of ‘Moderate’ or greater are considered ‘significant’ in terms of the EIA Regulations. This approach to assessing significance is used throughout the assessments, unless specified in the topics.

Table 5.4 Arriving at the Significance of Effects

		MAGNITUDE OF IMPACT (DEGREE OF CHANGE)				
		No change	**Negligible**	**Minor**	**Moderate**	**Major**
ENVIRONMENTAL VALUE (SENSITIVITY)	**Very High**	Neutral	Slight	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Neutral or Slight	Slight	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

5.3.1 Mitigation enhancement

Mitigation is defined as ‘measures intended to avoid, reduce and, where feasible, remedy significant adverse environmental effects’ (DMRB Volume 11, Section 1, Part 7 (HA 218/08)). Enhancement measures are defined as 'measures over and above normal mitigation' (IAN 125/15).

Some initial mitigation and enhancement measures have been identified in the topic sections. However, further measures will be considered at a later stage in the design process, once further design information is available.

6. Air Quality

This chapter presents the findings of the Air Quality assessment undertaken for two scheme options (Appraisal Option 1 and Appraisal Option 2).

This chapter should be read in conjunction with **Appendix 5-1** and **Appendix 5-2** and **Figures 5-1 – Figure 5-7**.

6.1 Legislative and policy framework

6.1.1 National Legislation

National Air Quality Strategy

The European Union (EU) has established common, health-based and ecosystem based ambient concentration Limit Values for main pollutants in the European Directive on ambient air quality and cleaner air for Europe (2008/50/EC) (the Air Quality Directive). Limit Values are set for individual pollutants and are made up of a concentration value, an averaging time over which it is to be measured, the number of exceedances allowed per year, if any, and a date by which it must be achieved. Target Values are set out in the same way as Limit Values, and are to be attained where possible, taking all necessary measures not entailing disproportionate costs.

The UK government is responsible to the European Commission (EC) for ensuring that it complies with the provisions of the EU Directives. Part IV of the Environment Act 1995 provides that the UK Government will produce a national Air Quality Strategy (AQS), which contains standards, objectives and measures for improving ambient air quality. The current AQS for England, Scotland, Wales and Northern Ireland (Defra, 2007) provides the policy framework for air quality management and assessment in the UK. The Environment Act 1995 also requires local authorities to review the quality of air within their area and provide an assessment as to whether any prescribed air quality standards or objectives are being achieved or are likely to be achieved within the period prescribed by regulations.

The UK air quality objectives are consistent with EU Limit values. The UK government is responsible to the EC for ensuring that it complies with the provisions of the EU Directives. The air quality objectives of most relevance to the Scheme are shown in Table 6.1.

Table 6.1 Air Quality Objectives for NO_2 and PM_{10}

Pollutant	Concentration	Averaging Period
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-Hour Mean
	40 µg/m^3	Annual Mean
Particles (PM_{10}) (gravimetric)	50 µg/m^3, not to be exceeded more than 35 times a year	24-Hour Mean
	40 µg/m^3	Annual Mean

Defra Air Quality Plan

In April 2015, ClientEarth, a non-government organisation (NGO), took the UK government to the UK Supreme Court for illegal air pollution. Defra's action plan

showed that compliance would not be achieved until 2025 for some zones within the UK. The Supreme Court ordered the UK government to produce new plans to meet legal limits in the shortest time possible. This was followed by the publication of a new action plan by Defra in December 2015 which forecasted compliance by 2020 for five cities, and by 2025 for London. The plan stated that each of the cities identified will be mandated to introduce a Clean Air Zone (CAZ) for specified classes of vehicles and European Vehicle Emission Standards (Euro Standards) by 2020 or sooner. Southampton was one of these five cities outside London that was not expected to meet compliance for roadside annual mean nitrogen dioxide (NO_2) concentrations.

In 2016, ClientEarth took the UK government back to the Supreme Court over their inadequate plan and again the UK government was ordered to draw up a new action plan. In July 2017, Defra published the UK Government's Air Quality Plan for nitrogen dioxide (Defra, 2017), setting out a detailed plan to reduce roadside NO_2 concentrations.

6.1.2 Local Planning Policy

National Planning Statement for National Networks (NPSNN)

NPSNN Statements 5.3 - 5.15 relate to air quality. The information presented in Statements 5.12 and 5.13 relate to situations where substantial weight should be given to air quality considerations in the decision-making process and when refusal, after considering mitigation should be determined. The text of Statements 5.12 and 5.13 are quoted below:

"The Secretary of State must give air quality considerations substantial weight where, after considering 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."

"The Secretary of State should refuse consent where, after considering 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."

The NPSNN also separately states in Statement 5.18 that "…any increase in carbon emissions is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the proposed Option are so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets".

National Planning Policy Framework (NPPF)

The NPPF was published in March 2012 and states in paragraphs 109 – 125 that: "The planning system should contribute to and enhance the natural and local environment by: preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability". There are national and local policies for the control of air pollution and local action plans

for the management of local air quality within the air quality study area applied to this assessment.

Paragraph 124 of the NPPF states that:

"Planning policies should sustain compliance with and contribute towards EU limit values or national objectives for pollutants, considering the presence of Air Quality Management Areas. Planning decisions should ensure that any new development in Air Quality Management Areas is consistent with the local air quality action plan."

Local Air Quality Management

Local authorities have no legal requirement to meet air quality objectives but are expected to do so to meet statutory EU Directives. The Local Air Quality Management (LAQM) process, as set out in Part IV of the Environment Act (1995) and the AQS places an obligation on all local authorities regularly to review and assess air quality in their areas, and to determine whether air quality objectives are being achieved or not. Where it is anticipated that an air quality objective will not be met, it is a requirement of the Act that an Air Quality Management Area (AQMA) be declared. Where an AQMA is declared, the local authority is obliged to produce an Action Plan in pursuit of the achievement of the air quality objectives.

The Scheme is located within the administrative boundary of Southampton City Council (SCC) and Eastleigh Borough Council (EBC). Both councils regularly review, assess and report air quality measured within their administrative boundaries. Further to this, there are 13 declared AQMAs, 10 of which are in the SCC and 3 in EBC. All the AQMA's have been declared as a result of exceedances within the annual mean Air Quality Standard Objective for NO_2. Source appointment has indicated that road vehicle emissions are the main source of air pollution in these areas.

6.2 Study area

The study area for both construction and operation was defined based on guidance from DMRB, Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07) (Highways Agency, 2007) and associated Interim Advice Notes. The DMRB criteria used to determine the extent of the air quality study area, also referred to as the Affected Road Network (ARN) is:

- Road alignment change by 5 m or more; or
- Daily traffic flows change by 1,000 Annual Average Daily Traffic (AADT) or more; or
- Heavy Duty Vehicle (HDV) flows change by 200 AADT or more; or
- Daily average speeds change by 10 km/hour or more; or
- Peak hour speed change by 20 km/hour or more.

The following scenarios have been considered in the local air quality assessment:

- 2015: Base Year
- 2019: Opening Year Do-Minimum (DM) (without the Scheme)
- 2019: Opening Year Do-Something (DS) (Option Appraisal 1)
- 2019: Opening Year Do-Something (DS) (Option Appraisal 2)
- 2036: Design Year Do-Minimum (DM) (without the Scheme)
- 2036: Design Year Do-Something (DS) (Option Appraisal 1)
- 2036: Design Year Do-Something (DS) (Option Appraisal 2)

The operational local air quality assessment was based on the most recent Opening Year (2019) scenario. Although the assumed scheme Opening Year is planned for 2022, it was not considered proportionate to create new traffic model years in the SRTM for this purpose during PCF Stage 2. The assessment of 2019 is considered a worst-case approach as future year improvements due to the introduction of cleaner technologies on vehicles is expected to bring improvements in ambient air quality.

6.3 Baseline conditions (including value/sensitivity of resources and receptors)

6.3.1 Introduction

The baseline air quality information considered covers the neighbouring Local Authorities of SCC, EBC and Test Valley Borough Council (TVBC). A desk study was carried out to gather baseline air quality data from the following sources:

- Southampton Air Quality Annual Status Report (2016)
- Eastleigh Borough Council Air Quality Updating and Screening Assessment (2012)
- Test Valley Air Quality Annual Status Report (2017)
- Southampton City Council Website (https://www.southampton.gov.uk/planning/air-quality-planning)
- Eastleigh Borough Council Website (https://www.eastleigh.gov.uk/waste,-recycling-environment/environmental-health/pollution/air/air-quality)
- Test Valley Borough Council Website (https://www.testvalley.gov.uk/housingandenvironmentalhealth/environmentalprotection/air-quality)
- Department for Environment Food and Rural Affairs (Defra) Local Air Quality Management (LAQM) Website (https://laqm.defra.gov.uk)
- Air Pollution Information System (APIS) Website (http://www.apis.ac.uk)

6.3.2 Air Quality Management Areas (AQMAs)

A review of the information held on the Defra LAQM website (https://uk-air.defra.gov.uk/aqma/list) indicates that there are 13 AQMAs (10 in SCC and three in EBC) that are in the vicinity of the Scheme options, as presented in Table 6.2. There is a single AQMA within 200m of the Scheme that is Bitterne Road West AQMA which is within the Scheme boundary.

All 13 AQMAs have been declared as a result of exceeding the annual mean Air Quality Standard Objective for NO_2. Source appointment has indicated that road vehicle emissions are the main source of air pollution in these areas. There are currently no AQMAs within Test Valley area. Table 6.2 presents an overview of each AQMA that falls within proximity of the Scheme.

Table 6.2: Designated AQMAs within proximity to the Scheme

Council Area	AQMA	Description
Southampton Council	AQMA No.1 (Bevois Valley)	Includes an area encompassing a number of properties from Charlotte Place Roundabout to Bevois Valley Road.
	AQMA No.2 (Bitterne Road West)	Encompasses a number of properties from Northam Road and along Bitterne Road West.
	AQMA No.3 (Winchester Road)	An area encompassing residential properties at the Winchester Road/Hill Lane Junction.
	AQMA No.4 (Town Quay to Platform Road)	An area encompassing a number of properties from Town Quay to Platform Road.
	AQMA No.5 (Redbridge to Millbrook Road)	Encompasses a number of properties along Redbridge/Millbook Road.
	AQMA No.6 (Romsey Road)	An area encompassing a number of properties along Romsey Road from Teboura Way to Shirley High Street.
	AQMA No. 7 (merged with AQMA 5)	
	AQMA No.8 (Commercial Road)	Includes an area encompassing a number of properties along Commercial Road at the junction with Havelock Road extending West along Commercial Road to the junction with Water Lane.
	AQMA 9 - Burgess Road	An area encompassing a number of properties along Burgess Road at the junction with The Avenue.
	AQMA 10 - New Road	Includes an area encompassing a number of properties along New Road.
	AQMA 11 - Victoria Road	Encompasses a number of properties along Victoria Road at the junction with Portsmouth Road.
Eastleigh Borough Council	Eastleigh AQMA No. 1 (A335)	Encompasses the area extending 30m to either side of the A335 between the junction of Leigh Road and Bournemouth Road to Wide Lane.
	Eastleigh AQMA No. 2 (M3)	Includes the area extending either side of the M3 motorway between junctions 12 and 14.
	Eastleigh AQMA No. 3	Encompasses a number of properties along Hamble Lane, Bursledon between the junctions of Jurd Way and the A3025, Portsmouth Road.

Figure 6.1 presents the Air Quality Constraints in relation to the Scheme extent.

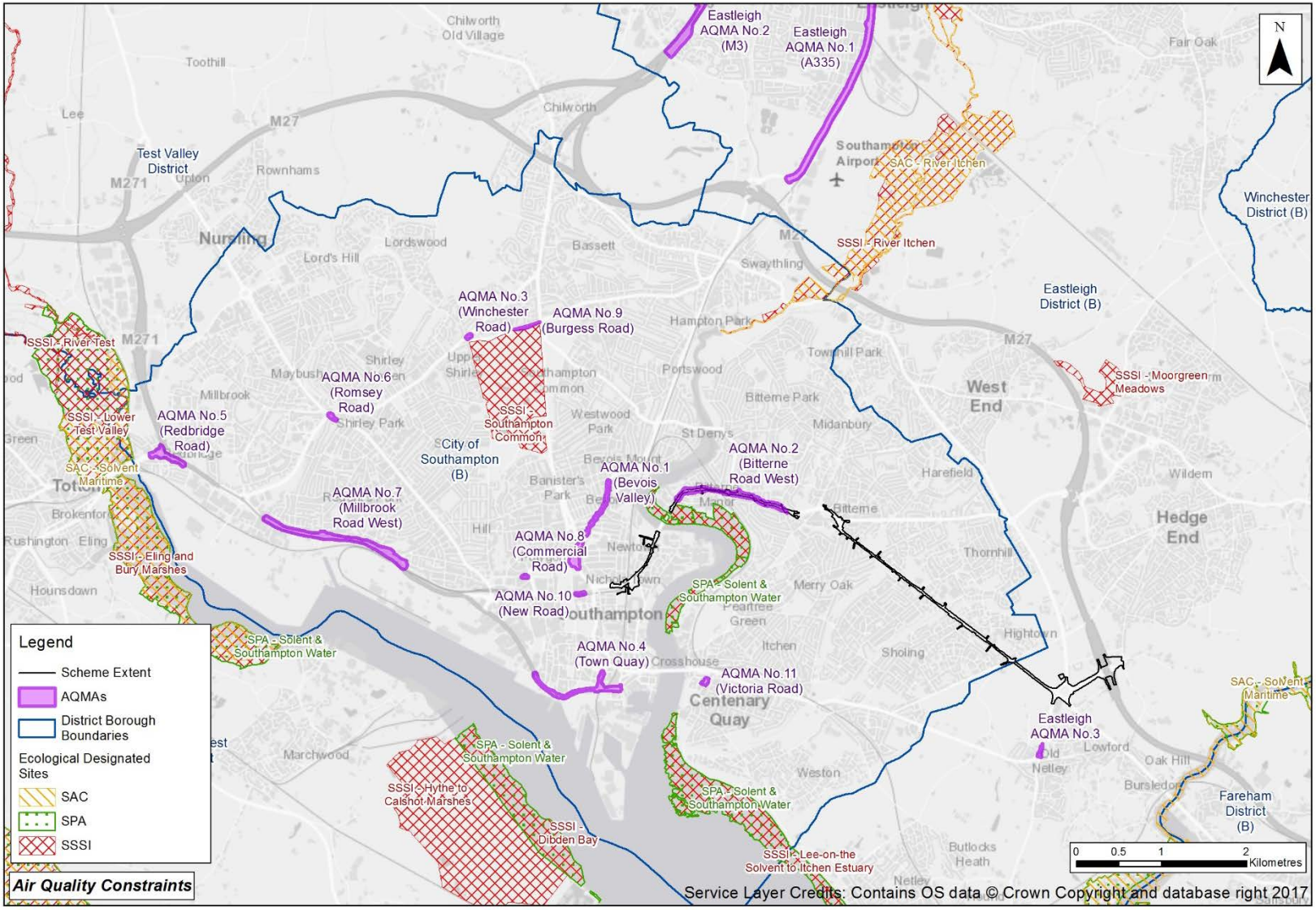

Figure 6.1: Air Quality Constraints

6.3.3 Local Authority Monitoring Data

There are two principal methods used for measuring air quality, either using passive sampling techniques such as diffusion tubes or using sophisticated continuous monitoring equipment. Local authorities progressively adapt their air quality monitoring strategies in accordance with the air quality issues specific to the area and to the requirements of the Local Air Quality Management (LAQM) system. The majority of monitoring undertaken within local authorities focuses on NO_2 and Particulate Matter (PM_{10} and $PM_{2.5}$), as the concentrations of other pollutants generally fall below levels that are considered to be harmful.

Available air quality monitoring data for the areas within the administrative boundaries of SCC, EBC and TVBC have been collated and presented in this section. Monitoring data for monitoring networks in the areas surrounding the Scheme are discussed in the sections below, providing a description of the baseline air quality environment in which the Scheme is proposed. The locations of the monitoring data discussed are presented in Figure 6.2.

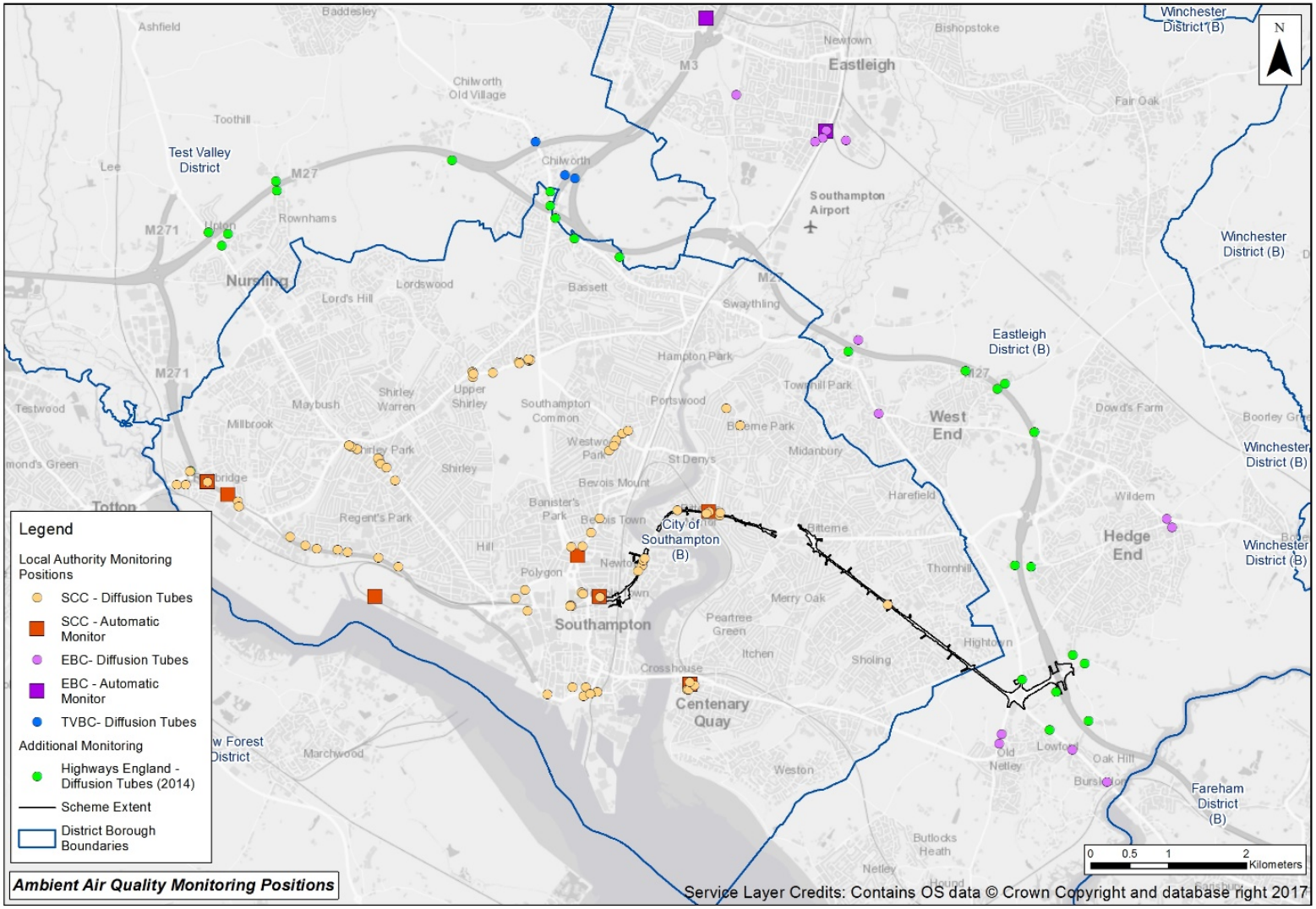

Figure 6.2: Air Quality Monitoring Data

Southampton City Council (SCC) Monitoring Network

SCC monitor NO_2, PM_{10} and $PM_{2.5}$ concentrations by automatic monitors, as well as NO_2 concentrations from a network of diffusion tubes positioned at various locations throughout the city. The latest annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations recorded by the continuous monitors and the annual mean NO_2 concentration data from diffusion tubes for 2012-2016, obtained from the SCC Quality ASR (2016), are presented in Table 6.3 and Table 6.4 respectively.

Table 6.3 provides the annual average NO_2, PM_{10} and $PM_{2.5}$ concentrations from the SCC automatic monitoring data for the years 2012 to 2016. The closest SCC automatic monitoring station to the Scheme is located at CM1, approximately 50 m west of Sub-scheme 3 (Northam Road Rail Bridge). No exceedances of the annual mean AQS Objective for NO_2 of 40 µg/m^{-3} were recorded at CM1 for the period between 2012 and 2016. No exceedances with the AQS Objective for PM_{10} and $PM_{2.5}$ for the years 2012 to 2015 were recorded. At the time of this study, no particulate matter data were available for 2016.

Table 6.3: Southampton City Council Automatic Monitoring - Annual mean NO_2, PM_{10} and $PM_{2.5}$ (µg/m^3)

ID	Site	Location	2012	2013	2014	2015	2016
Annual Mean NO_2 Concentrations (µg/m³)							
CM1	Southampton Centre (Brintons Rd) AURN	Urban Centre	32.0	30.0	32.0	32.0	34.0
CM2	Redbridge School	Roadside	-	**45.0**	Decommissioned		
CM3	Bitterne Road	Roadside	32.0	32.0	Decommissioned		
CM4	Onslow Road	Roadside	**44.0**	**40.0**	**41.0**	**42.0**	**45.0**
CM5	Millbrook Road	Roadside	**43.0**	**41.0**	**42.0**	Decommissioned	
CM6	Victoria Road	Roadside	**44.0**	**43.0**	**44.0**	**42.0**	**43.0**
CM7	Southampton A33 Roadside AURN	Roadside	-				**40.0**
Annual Mean PM_{10} Concentrations (µg/m³)							
CM1	Southampton Centre (Brintons Rd) AURN	Urban Centre	19.8	21	20.9	16.5	NA
CM2	Redbridge School	Roadside	18.8	17.6	Decommissioned		
CM3	Bitterne Road	Roadside	21.6	22.8	Decommissioned		
Annual Mean $PM_{2.5}$ Concentrations (µg/m³)							
CM1	Southampton Centre (Brintons Rd) AURN	Urban Centre	14.7	15.0	14.5	10.0	NA

(1) Exceedances with the AQS Objectives are shown in **bold**.

(2) NA – No available data.

(3) – Site not commissioned.

As presented in Table 6.4 there were 63 NO_2 diffusion tubes located around the SCC area in 2016, which measured an annual mean NO_2 concentration ranging from 26.2 to 54.3 µg/m³. Of the 63 diffusion tubes, 23 were noted as exceeding the

AQS objective. The monitors closest to the Scheme (N110, N111, N112, N113, N114, N123, N125, N126 N137, N142, N144, N145, N146 and N166) all recorded annual mean NO_2 concentrations well below the AQS Objective for 2016. The monitors N108, N113, N114 and N125 fall within the AQMA No. 2 (Bitterne Road West), and N142 falls within AQMA No. 10 (New Road).

Table 6.4: SCC NO_2 Diffusion Tube Monitored Annual mean NO_2 ($\mu g/m^3$)

Site ID	Site Name	2011	2012	2013	2014	2015	2016
N101	Redbridge School AMS	**42.6**	**44.6**	**42.7**	**41.7**	**44.7**	**54.3**
N102	64 Burgess Road		32.0	33.3	33.3	29.8	33.5
N103	485 Millbrook Road	33.6	34.7	32.3	34.9	31.7	33.7
N104	Regents Park Junction	**42.4**	**41.6**	**41.2**	**42.3**	**38.4**	**40.3**
N105	32 Burgess Road	Disbanded as well below					
N106	2 Romsey Road, Oakhill	37.5	**40.0**	39.9	**43.6**	37.9	39.9
N107	Cranbury Place	**50.4**	**51.2**	**49.4**	**49.1**	**53.7**	**52.7**
N108	81 Bitterne Road	Decommissioned					
N109	72 Bevios Valley	37.4	38.7	**41.2**	38.9	37.2	40.0
N110	Brintons Road 1	27.2	29.1	29.5	29.2	25.4	26.5
N111	Brintons Road 2	28.1	29.1	29.4	29.2	25.9	27.0
N112	Brintons Road 3	28.2	29.6	28.6	29.2	26.1	26.2
N113	206 Bitterne Road	34.9	38.9	39.9	37.9	34.9	38.2
N114	Bitterne Library	37.2	39.5	39.7	39.5	32.8	35.9
N115	54 Redbridge Road	**40.2**	**43.3**	37.5	37.9	36.4	38.4
N116	57 Redbridge Road	**40.3**	**43.2**	**42.1**	**41.9**	38.1	**40.5**
N117	Victoria Road (lamp post)	**40.0**	**44.2**	**42.5**	**42.0**	36.4	36.1
N118	3 Rockstone Lane	34.8	35.2	35.3	35.8	34.8	37.1
N120	6-9 Canute Road	32.1	34.0	33.6	31.9	38.0	**40.3**
N121	Hill Lane	**42.0**	**41.5**	**44.8**	**43.8**	Decommissioned	
N122	151 Paynes Road	33.4	36.3	30.4	32.6	31.5	32.8
N123	102 St. Andrews Road	NA	34.1	38.1	36.2	32.8	35.5
N124	305 Millbrook Road	**40.1**	**43.1**	39.9	**41.1**	37.3	**40.2**
N125	Princes Court	38.4	39.4	**42.6**	**40.7**	35.3	38.7
N126	107 St Andrew's Road	37.4	35.2	36.3	36.9	32.8	36.4
N127	Western Esplanade	Decommissioned					
N128	290 Bursledon Road	Decommissioned					
N129	SW House	32.8	34.3	37.7	32.0	28.8	30.7
N130	367A Millbrook Road	**45.6**	**47.9**	**42.2**	**46.6**	**44.8**	**44.9**
N131	142 Romsey Road	38.3	39.2	**40.4**	**41.6**	37.9	38.2

Site ID	Site Name	2011	2012	2013	2014	2015	2016
N132	347A Winchester Road	**40.8**	39.6	**40.7**	**40.0**	Relocated to facade	
N133	539 Millbrook Road	33.3	34.5	31.5	32.4	30.7	31.4
N134	Ladbrokes	**40.3**	39.2	**41.2**	39.6	37.6	41.2
N135	24 Victoria Road	33.5	38.4	36.7	35.6	31.4	NA
N136	23 Victoria Road	31.9	34.6	35.7	35.6	31.1	NA
N137	Bitterne AMS	32.5	32.8	32.7	36.0	29.6	NA
N138	66 Burgess Road	**41.9**	**45.5**	**44.5**	**49.8**	**43.8**	**46.8**
N140	5 Commercial Road	**47.5**	**43.5**	**45.3**	**50.5**	**49.6**	**49.0**
N141	Town Quay Road	39.0	39.2	**40.7**	**43.9**	30.5	36.8
N142	10 New Road	**40.0**	39.7	**42.6**	38.3	NA	NA
N143	102 Romsey Road	37.1	34.1	36.9	40.1	34.4	37.3
N144	208 Northam Road	35.8	35.6	34.4	33.5	31.8	36.4
N145	145 Northam Road						
N146	222 Northam Road	31.4	31.7	29.1	31.1	28.7	30.5
N147	123 Burgess Road	Closed					
N148	143 Burgess Road	Closed					
N149	44B Burgess Road	28.9	33.1	34.3	36.1	32.5	34.3
N150	148 Romsey Road	**49.0**	**51.6**	**45.2**	**51.3**	NA	NA
N151	134 Romsey Road	**44.5**	**38.8**	**40.2**	**40.9**	37.4	**40.0**
N152	M271	**47.1**	**44.0**	**40.9**	**40.9**	**49.1**	**52.2**
N153	Consiton Road	**42.3**	35.5	31.7	37.7	31.2	33.7
N154	Oceana Boulevard DG5	-	**44.2**	**40.6**	**40.8**	32.9	33.9
N155	24 Queens Terrace	-	**43.8**	**42.8**	36.1	26.6	NA
N156	Union Castle House (Relocated)	-	32.8	32.8	36	Relocated	
N157	Admiralty House	-	34.6	35.0	34.8	27.8	28.5
N158	24 Portsmouth Road	-	39.3	28.3	37.6	36.6	**40.4**
N159	35 Portsmouth Road	-	30.2	32.3	29.3	25.9	32.7
N160	2 Dorset Street	-	-	33.7	32.0	32.6	33.0
N161	30 Addis Square	-	-	37.0	35.2	32.5	35.4
N162	263A Portswood Road	-	-	**44.3**	**41.9**	37.7	37.1
N163	285 Portswood Road	-	-	31.6	32.6	27.8	31.4
N164	164-166 Portswood Road	-	-	**40.8**	39.0	32.3	35.7
N165	8 The Broadway	-	-	**49.3**	**57.2**	32.3	34.0
N166	14 New road	-	**46.2**	**40.7**	NA	38.1	39.8

Site ID	Site Name	2011	2012	2013	2014	2015	2016
N167	13 Romsey Road	-	34.0	38.1	38.0	33.5	36.3
N168	23 Romsey Road	-	35.9	**43.0**	**43.3**	36.4	**40.6**
N169	150 Romsey Road	-	-	-	36.6	**40.6**	**42.5**
N170	Union Castle House (2)	-	-	-	37.5	38.7	**41.7**
N172	4 New Road	-	-	-	-	**42.9**	**45.1**
N173	19A Burgess Road	-	-	-	-	26.8	31.0
N174	166A Bitterne Road West	-	-	-	-	36.9	NA
N175	38 Shirley High Street	-	-	-	-	39.4	38.8
N176	Salisbury Arms, Shirley High Street	-	-	-	-	38.4	**43.1**
N177	95 Shirley High Street	-	-	-	-	37.1	38.3
N178	2 Gover Road	-	-	-	-	27.9	27.0
N179	38 Old Redbridge Road	-	-	-	-	-	30.2
N180	Redbridge Causeway 1	-	-	-	-	-	**53.9**
N181	Redbridge Causeway 2	-	-	-	-	-	**48.6**
N182	166A Bitterne Road West	-	-	-	-	-	**42.8**
N183	206 Bitterne Road	-	-	-	-	-	38.0
N184	Redbridge new AMS roof	-	-	-	-	-	**42.7**
N185	Archers Road/Hill Lane	-	-	-	-	-	33.0
N190	Opposite 5 commercial road theatre	-	-	-	-	-	39.0

(1) Exceedances of the Annual Mean NO_2 AQS Objective of 40 µg/m^3 are shown in **bold**.

(2) NA stands for no available data.

(3) "-" Site not commissioned

Eastleigh Borough Council (EBC) Monitoring Network

EBC monitor NO_2 concentrations from a network of automatic monitoring and diffusion tubes at various locations throughout the council. The latest annual mean NO_2 concentrations recorded at the automatic samplers and the annual mean NO_2 concentration data from diffusion tubes located within 2 km of the M27, for 2012-2016, obtained from the EBC, are presented in Table 6.5 and Table 6.6 respectively.

Table 6.5 provides the latest annual average NO_2 and PM_{10} concentrations from the EBC automatic monitoring data for 2016. The closest EVC automatic monitoring station to the Scheme is located at ES1, located approximately 5 km north of the Scheme, close to where the M27 Junction 4 joins the M3 Junction 14. An exceedance of the annual mean AQS Objective for NO_2 was recorded at ES1 during 2016. No exceedances with the AQS Objective for PM_{10} were recorded.

Table 6.5: EBC Automatic Monitored Annual mean NO_2 ($\mu g/m^3$)

Site		Location	2016
Annual Mean NO_2 Concentrations ($\mu g/m^3$)			
ES1	Southampton Road	Roadside	**40.8**
ES2	Steele Close	Background	19.0
Annual Mean PM_{10} Concentrations ($\mu g/m^3$)			
ES1	Southampton Road	Roadside	22.2
(1) Exceedances of the Annual Mean NO_2 AQS Objective of 40 $\mu g/m^3$ are shown in **bold**.			
(2) NA – No available data.			
(3) – Site not commissioned.			

As presented in Table 6.6 there were 15 diffusion tubes located in the EBC area within 2 km of the M27 in 2016, which measured an annual mean NO_2 concentration ranging from 29.6 to 49.8 $\mu g/m^3$. Of the 15 diffusion tubes, 6 were noted as exceeding the annual mean NO_2 AQS Objective. However, the monitor closest to the Scheme (AL) recorded NO_2 concentrations below the annual mean AQS Objective.

Table 6.6: EBC Diffusion Tube Monitored Annual mean NO_2 ($\mu g/m^3$)

ID	Site	Location	2012	2013	2014	2015	2016
HL	Hamble Lane	Roadside	**44.2**	36.5	37.2	32.0	38.9
HL2	Hamble Lane 2	Roadside	**42.1**	37.9	38.1	30.5	**46.9**
OH	Oakhill	Roadside	-	-	-	-	**43.2**
BDG	Bridge Road	Roadside	-	-	-	-	32.2
KCA	Kings Copse Avenue	Roadside	-	-	-	-	34.7
GR	Grange Road	Roadside	-	-	-	-	31.8
SWA	Swaythling Road	Roadside	-	-	-	-	33.4
AL	Allington Lane	Roadside	31.0	28.9	30.1	26.1	29.6
SRAN(A)	Southampton Road / Analyser (A)	Roadside	**48.4**	**42.8**	**44.7**	34.1	**41.5**
SRAN(B)	Southampton Road / Analyser (B)	Roadside	-	-	-	32.9	**43.6**
SRAN(C)	Southampton Road / Analyser (C)	Roadside	-	-	-	35.2	**41.8**
SR1	Southampton Road 1	Roadside	**56.3**	**49.9**	**52.6**	**46.2**	**49.8**
CA	Chestnut Avenue	Roadside	27.4	27.6	27.4	24.7	30.1
CR	Campbell Road	Intermediate	-	-	-	30.4	34.8
PA	Passfield Avenue	Roadside	-	-	-	-	33.2
(1) Exceedances of the Annual Mean NO_2 AQS Objective of 40 $\mu g/m^3$ are shown in **bold**.							
(2) NA – No available data.							
(3) – Site not commissioned							

Test Valley Borough Council (TVBC) Monitoring Network

TVBC monitors NO_2 concentrations from a network of diffusion tubes at various locations. TVBC does not conduct automatic monitoring. The latest annual mean NO_2 concentration data from diffusion tubes located within 2 km of the M27 for the period 2012-2016 obtained from the TVBC Quality ASR (2017) are presented in Table 6.7.

Three diffusion tubes are located in the TVBC area within 2 km of the M27 in 2016, which measured an annual average NO_2 concentration ranging from 23.3 to 34.5 µg/m³ in 2016, which are all below the annual mean NO_2 AQS Objective.

Table 6.7: TVBC Diffusion Tube Monitored Annual mean NO_2 (µg/m^3)

ID	Site Name	Location	2012	2013	2014	2015	2016
CHIL12	Chilworth Road	Roadside	36.9	35.1	37.7	30.9	34.5
CHIL13	Winchester Road, Chilworth	Intermediate	25.2	26.0	24.9	23.5	23.3
CHIL14	Bracken Place	Intermediate	26.9	28.0	28.0	25.5	25.8
(1) Exceedances of the Annual Mean NO_2 AQS Objective of 40 µg/m^3 are shown in **bold**.							

6.3.4 Scheme Specific Monitoring Data

Highways England undertook a 12-month air quality monitoring survey to verify the NO_2 concentrations in the study area between 23/08/2013 and 20/08/2014 using selected NO_2 diffusion tube locations within the vicinity of the M27.

Results of the monitoring relevant to the Scheme, between junctions 3 and 8 as displayed in Figure 6.2, are presented in Table 6.8.

The Highways England monitoring results show an exceedance of the AQS objective for NO_2 at site 023, located on Basset Green Road just 95m south of the M3 and 120m south of the M27. The exceedance seems to be caused by the cumulative contribution of the two motorways and by local traffic on Basset Green Road. Site 022, which is located on the same road, also record high concentrations (i.e. 37.6 µg/m^3) but being located further away from the M3, the recorded NO_2 annual average remains below the limit. All other monitoring sites suggest NO_2 is well below the AQS objective along the M27. As a 2015 Base Year was used, this data could not be utilised during the assessment.

Table 6.8: Highways England NO_2 Diffusion Tube Monitoring Results (µg/m^3)

ID	Scheme	X	Y	2014(1)
M27J4J11_004_0813	M27 J4 to J11	437330.6	113865.2	26.8
M27J4J11_007_0813	M27 J4 to J11	437562.4	116928.7	36.6
M27J4J11_008_0813	M27 J4 to J11	437732.7	116756.6	14.5
M27J4J11_009_0813	M27 J4 to J11	437811.7	116913.5	24.9
M27J4J11_011_0813	M27 J4 to J11	438440.9	117466.7	25.8
M27J4J11_012_0813	M27 J4 to J11	438424.4	117587.9	22.3
M27J4J11_013_0813	M27 J4 to J11	440690.3	117858.9	23.1
M27J4J11_019_0813	M27 J4 to J11	441947.1	117454.5	22.5

ID	Scheme	X	Y	2014[(1)]
M27J4J11_020_0813	M27 J4 to J11	441948.6	117271.0	30.6
M27J4J11_022_0813	M27 J4 to J11	442017.0	117110.9	37.6
M27J4J11_023_0813	M27 J4 to J11	442263.1	116848.6	**40.0**
M27J4J11_024_0813	M27 J4 to J11	442837.4	116609.7	25.8
M27J4J11_026_0813	M27 J4 to J11	445776.8	115399.6	27.1
M27J4J11_027_0813	M27 J4 to J11	447282.5	115152.5	28.1
M27J4J11_028_0813	M27 J4 to J11	447692.5	114915.5	29.1
M27J4J11_029_0813	M27 J4 to J11	447792.4	114983.4	28.2
M27J4J11_030_0813	M27 J4 to J11	448169.8	114364.8	32.4
M27J4J11_034_0813	M27 J4 to J11	448124.3	112634.3	23.6
M27J4J11_035_0813	M27 J4 to J11	447920.0	112649.7	28.3
M27J4J11_036_0813	M27 J4 to J11	448008.1	111182.0	29.5
M27J4J11_037_0813	M27 J4 to J11	448659.5	111496.9	32.8
M27J4J11_038_0813	M27 J4 to J11	448813.2	111387.2	23.4
M27J4J11_039_0813	M27 J4 to J11	448448.2	111022.4	24.9
M27J4J11_040_0813	M27 J4 to J11	448359.9	110533.4	31.8
M27J4J11_041_0813	M27 J4 to J11	448859.5	110652.5	28.7

[(1)] Exceedances of the Annual Mean NO_2 AQS Objective of 40 µg/m^3 are shown in **bold**.

6.3.5 Ecological Receptors

Ecological receptors refer to habitats and species within designated nature conservation sites that contain features sensitive to air pollution. These include Special Areas of Conservation (SAC), Special Protection Areas (SPA), Sites of Special Scientific Interest (SSSI) and Ramsar sites. According to the guidance of DMRB HA207/07 Annex F, sites that fall within 200 m of the Scheme are considered to be potentially affected by the project.

The pollutants of most concern in relation to vegetation and ecosystems near roads are oxides of nitrogen (NO_x). NOx refers to a group of largely colourless gases which may be absorbed through the stoma of plants. NO_2 is one of the significant compounds of NO_x. Excessive exposure to NO_x, particularly NO_2, can cause death in plants and roots and damage the leaves of many agricultural crops as a result of the lowering of pH of soil and surface and groundwater.

The identified ecological receptors that may potentially be impacted by the Scheme contain ecological features that could be sensitive to changes in nitrogen levels, which could have direct and indirect effects on vegetation affecting species composition and ecosystem health.

The following ecological receptors (designated sites) have been identified within 200m of roads that may be affected by the Scheme, as shown in Figure 6.1:

- SAC, River Itchen,
- SPA, Solent & Southampton Water,
- SAC, Solent Maritime; and
- SSSI, Moorgreen Meadows.

Baseline nitrogen deposition data for 2014 (as the average of the period from 2013 to 2015) have been obtained from the APIS reports at a grid resolution of 5 km^2. These data have been projected forward to the base year (2015) and the modelled opening year (2019), assuming a 2% decrease per year (HA 207/07). Table 6.9 presents the critical load ranges and baseline nitrogen deposition rates for all designated sites located within Southampton that are susceptible to nitrogen effects. **Table 6.9** summarises this information below.

Table 6.9: Designated site critical loads for nitrogen deposition and baseline nitrogen deposition (kg N h^{-1} y^{-1})

Designated Site	Habitat Type	Critical Load	Nitrogen Deposition (Average 2013 – 2015)	Base Year (2015) Nitrogen Deposition	Opening Year (2019) Nitrogen Deposition
SAC River Itchen	Dwarf shrub health	10 - 20	17.0	16.7	15.4
	Rivers and Streams	No critical loads available for this feature	14.0	13.8	12.7
SPA Solent & Southampton Water	Supralittoral sediment (acidic type)	8 - 10	11.6	11.4	10.5
	Supralittoral sediment	10 - 15	11.6		

Designated Site	Habitat Type	Critical Load	Nitrogen Deposition (Average 2013 – 2015)	Base Year (2015) Nitrogen Deposition	Opening Year (2019) Nitrogen Deposition
	(calcareous type)				
	Supralittoral sediment	10 - 20	11.6		
	Littoral sediment	20 - 30	11.6		
	Arable and horticulture	No critical loads available for these features	11.6		
	Improved grassland		11.6		
	Neutral grassland		11.6		
	Standing open water and canals		10.6	10.4	9.6
SAC Solent Maritime	Supralittoral sediment	8 - 15	11.0	10.8	10.0
	Littoral sediment	10 - 20	11.0		
	Inshore sublittoral sediment	20 - 30	9.7	9.5	8.8
	Rivers and streams	No critical loads available for this feature	9.7		
SSSI Moorgreen Meadows	Broadleaved deciduous woodland	10 - 20	27.6	27.0	25.0
	Moist and wet oligotrophic grasslands: Molinia caerulea meadows	15 - 25	17.2	16.9	15.6
	Rich fens	15 - 30	17.2		
	Low and medium altitude hay meadows	20 - 30	17.2		

Baseline nitrogen deposition rates across the ecological receptors are not within acceptable limits in both the Base and Opening year, as the Nitrogen Deposition rate is anticipated to be above the lower limit of the critical load ranges, except for the SSSI Moorgreen Meadows Low and medium altitude hay meadows.

Although the APIS values used form the basis for the assessment as they are the only source of information available.

It is important to note that there is uncertainty attached to these values. This has implications for the interpretation of the data. Critical loads presented by APIS are based on empirical data from field experiments and observations. There is high uncertainty associated with these values as they are based on professional judgement.

6.3.6 Background mapped concentrations

The background concentration of a pollutant is determined by regional, national and international emissions and often represents a significant proportion of the

total pollutant concentration. The local component is determined by local pollutant sources such as road traffic and chimney stacks. Diffusion Tube Urban Background concentration monitoring is undertaken within the administrative boundaries of SCC, EBC and TVBC. Background monitoring was undertaken at two sites in the SCC and six sites in the EBC within 2 km of the M27. Although background monitoring is undertaken within the TVBC, none of the sites is within 2 km of the M27 and therefore are not considered to be representative of the environment in the vicinity of the Scheme. Table 6.10 presents the available annual mean NO_2 concentrations for the background areas within the relevant council areas between 2012 and 2016.

The closest background monitors to the Scheme are located within the SCC, including monitors N100 and N171. The 2016 annual mean NO_2 concentrations recorded at N100 and N171 are 18.6 µg/m^3 and 20.1 µg/m^3 respectfully, both of which are well below the AQS Objective.

Table 6.10: Urban Background Diffusion Tube Monitored Annual mean NO_2 (µg/m^3)

Site ID	Site Name	Area	2012	2013	2014	2015	2016
N100	6 Sandringham Road	Southampton	19	20.4	20.5	17.2	18.6
N171	132 Newton Road	Southampton	-	-	23.1	17.2	20.1
UNC	Upper Northam Close	Eastleigh	35.5	29.1	29.5	28.3	30.8
JW	Jukes Walk	Eastleigh	-	-	-	-	29.4
SSQ	Sparrow Square	Eastleigh	33.1	31.6	32.4	26.6	32.0
DD(A)	Dove Dale (A)	Eastleigh	38.1	35.3	36.3	32.1	35.7
DD(B)	Dove Dale (B)	Eastleigh	-	-	-	30.8	35.2
DD(C)	Dove Dale (C)	Eastleigh	-	-	-	30.3	36.7

(1) Exceedances with the Annual Mean NO_2 AQS Objective of 40 µg/m^3 are shown in **bold**.

(2) – Site not commissioned

Data from the grid squares relevant to the Scheme have been downloaded from the Defra website and are summarised in Table 6.11.

As indicated in Table 6.11, average background concentrations for both 2015 and 2019, are below the respective AQS objectives. Maximum NO_2 concentrations for 2015 and 2019 are below the AQS objective, however NO_x is expected to exceed the respective AQS objectives. The Defra background concentrations are estimated to be at a 16.5% higher concentration than the SCC monitored results for the 2015 period.

Table 6.11: Defra Background Pollutant Concentrations for the Scheme

Pollutant	2015 Maximum Concentration (µg/m³)	2015 Average Concentration (µg/m³)	2019 Maximum Concentration (µg/m³)	2019 Average Concentration (µg/m³)
NO_x	64.6	16.5	62.9	14.0
NO_2	34.9	11.7	34.3	10.0
PM_{10}	19.0	14.6	18.5	14.2

Exceedances with the AQS Objectives are shown in **bold**.

6.4 Potential impacts

The overall the Scheme is expected to lead to an increase in traffic flows within and adjacent to the Scheme option extent to reduce congestion and promote freer flowing traffic along the M27 along Southampton (between Junctions 3 and 8).

The Scheme is predicted to increase traffic by up to 10 – 15% through Bitterne Road West AQMA. The Scheme proposals are also expected to bring traffic closer to sensitive receptors. The two Appraisal Options being considered in this assessment both have the potential to bring road traffic and emissions closer to sensitive receptors.

Reasonably foreseeable effects associated with the risks of major accidents and/or disasters relevant to air quality relate to road traffic accidents on either the proposed Scheme or the surrounding road network (in particular the M27 motorway and A3024).

6.5 Assessment methodology

6.5.1 General Approach

A simple level air quality assessment was undertaken using traffic data from the SRTM transport model to determine the Affected Road Network (ARN) for two scheme options. The assessment made use of the DMRB model which is a spreadsheet screening tool regarded as being adequate at this stage. It is however recommended that should the Scheme progress to the next PCF Stage, that the preferred route alignment be re-assessed at a proportionate level to PCF Stage 3 work using more detailed dispersion modelling tools.

The assessment of the local and regional air quality impacts during both construction and operational phases followed key guidance documents:

- DMRB, Volume 11, Section 3, Part 1 ‘Air Quality’ (HA207/07);
- Relevant Interim Advice Notes: (IAN 170/12v3 (long term trend), IAN 174/13 (significance impact), IAN 175/13 (EU compliance) and IAN 185/15 (speed banding)
- Defra’s Local Air Quality Management Technical Guidance (Defra TG16)

The latest version of the DMRB model was used for determining the local and regional air quality impacts at sensitive receptors.

At PCF Stage 3, potential impacts of major accidents and/or disasters will be qualitatively considered and where appropriate mitigation measures considered.

6.5.2 Assessment Methodologies

The assessment of the Scheme options for the construction and operational phase air quality effects has been completed in accordance with the assessment methodology set out in DMRB HA207/07 and with reference to Defra TG16 where applicable. Highways England have also issued the following IANs to accompany DMRB, which were followed for the air quality assessment:

- IAN 170/12v3 - Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality'
- 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)
- 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 Noise.

6.5.3 Construction assessment

The air quality impacts resulting from the construction phase are concern the generation and subsequent deposition of dust, as measured by elevated PM_{10} concentrations.

Dust deposition onto properties can be considered a nuisance, and may lead to complaints.

Deposition within sensitive habitat areas can also affect photosynthetic and other biological functions that can cause permanent ecological damage. Elevated PM_{10} concentrations in an area of poor air quality may have adverse human health effects.

The assessment of air quality impacts associated with the construction phase follows DMRB HA207/07, which recognises that air quality impacts associated with the construction phase are likely to occur at sensitive receptors located along the Scheme, including residential areas, schools, hospitals and designated species or habitats.

The DMRB construction phase assessment for air quality requires that:

- Sensitive receptors within 200 m of the Scheme are identified.; and
- Mitigation measures to reduce potential effects of dust emissions during the construction phase of the Scheme are set out in the CEMP for the proposed scheme which will be implemented by the selected construction contractor.

Sensitive receptors have been identified within 200 m of the Scheme.

The potential for adverse dust effects upon these sensitive receptors has been qualitatively assessed, by combining the estimated magnitude of each construction activity and combining it with the area sensitivity. The area sensitivity is determined by the number and proximity of receptors to the construction boundary and the background ambient air concentrations.

This qualitative analysis provides the overall level of risk of impacts for dust deposition, human health and ecology. The level of risk of each impact is then used to identify appropriate mitigation measures for consideration in the CEMP.

6.5.4 Operational assessment

This section describes the general approach used to assess local operational air quality effects for the Scheme. The assessment focuses on key road traffic pollutants, NO_2 and PM_{10}.

Where existing monitoring data indicates that exceedances of an air quality objective are likely to occur in the opening year of a scheme, or the proposed scheme cannot be adequately assessed using a simple level of assessment, a detailed level assessment must be undertaken. The level of assessment that is carried out is based upon an understanding of the potential for significant adverse effects of the scheme options following guidance provided in IAN 174/13.

A simple level assessment approach was adopted at this stage making use of the DMRB model to estimate pollutant concentrations.

Operational air quality impacts may occur on the existing road network where the Scheme leads to changes in traffic that trigger the DMRB HA207/07 criteria. The study area covers receptors within 200 m of affected roads.

Local Air Quality Management (LAQM) guidance and tools, such as the NO_x to NO_2 conversion approach (Defra, 2016b) and background maps (Defra, 2016c), have also been used as required by DMRB and associated IANs. Further details of the assessment methodology including the inputs used in the DMRB model approach, post-processing (e.g. NO_x to NO_2 conversion) and the approach employed for verification (including all monitoring locations used in the verification process) are presented in **Appendix 5-1**.

6.5.5 Assessment Scenarios

As noted previously; the following scenarios have been considered in the local air quality assessment:

- 2015: Base Year
- 2019: Opening Year Do-Minimum (DM) (without the Scheme)
- 2019: Opening Year Do-Something (DS) (Option Appraisal 1)
- 2019: Opening Year Do-Something (DS) (Option Appraisal 2)

Although 2022 is currently the assumed scheme opening year, the assessment of 2019 is considered a worst-case approach as future year improvements due to the introduction of cleaner technologies on vehicles is expected to bring improvements in ambient air quality.

6.5.6 Receptors

Receptors were selected to represent worst-case locations where people and designated ecological sites might experience a maximum change in concentrations in local air quality within 200 m of affected roads. Base year model predictions were validated against baseline air quality monitoring data. The validation process was carried out for different areas, accounting for spatial variability in pollutant sources and background concentrations. Verification factors for each area were applied to the modelled NO_2 and PM_{10} concentrations to adjust modelling results. The validation process is described in detail in Appendix 5-1.

6.5.7 Background pollutant concentrations

Total air pollutant concentrations comprise background and local components. The background concentration is determined by regional, national and international emissions and often represents a significant proportion of the total pollutant concentration. Background pollution concentrations were obtained from current Defra 2013 reference year background maps[11] projected to the Base Year (2015) and Opening Year (2019). The NO_2 adjustment for NO_x Sector Removal Tool was used to remove all in-square road contributions. This reduces the risk of double counting road contributions in the DMRB model. A comparison of these background pollutant concentrations was also carried out with the background monitoring data available to validate the background monitoring data used.

6.5.8 NO_x to NO_2

Emissions of NO_x and PM_{10} pollutants were calculated for each affected road link within 200 m of worst-case receptors using the DMRB model. NO_2 concentrations were calculated using the Defra NO_x/NO_2 calculator (version 5.1, June 2016).

6.5.9 Long Term Trends (Gap Analysis)

A key element of the local operational assessment is the assumption of the rate of improvement in air quality over time as cleaner road vehicles enter the national vehicle fleet. The methodology outlined within IAN 170/12, on the assessment of future NOx and NO_2 projections, has been used in this assessment. The background pollution maps and vehicle emission factors assume that air quality improves in future years as older vehicles are replaced with modern cleaner vehicles. However, UK monitored roadside and background NO_2 concentrations have not indicated a declining trend as expected in recent years. This trend is thought to be related to the increased use of modern diesel vehicles which emit more NOx than expected under urban driving conditions and have higher primary NO_2 emissions than petrol vehicles. A long-term trend gap analysis has therefore been carried out for NO_2, in accordance with IAN 170/12v3 (HA, 2012).

[11] http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html

6.5.10 Regional Assessment

Emissions have been calculated using EFT (v7.0) emission factors. It should be noted that EFT (v7.0) calculations are only valid until 2030. Therefore, 2030 emissions calculations are used to represent the Design Year (2036), which is considered a conservative approach due to vehicle turnover to cleaner technology and overall improvements to ambient air quality.

6.5.11 Ecological Assessment

The Defra Multi Agency Geographic Information System for the Countryside (MAGIC) website (www.magic.defra.gov.uk/), APIS and DMRB HA207/07 Annex F was used to identify designated ecological sites that contain features sensitive to air pollution within 200 m of the Scheme. The identified designated ecological receptors that may be impacted by the Scheme options and could be sensitive to changes in nitrogen levels are Special Areas of Conservation (SAC), Special Protection Areas (SPA), and Sites of Special Scientific Interest (SSSI).

The potentially affected designated ecological receptors are shown in Figure 6.1, and include:

- SAC, River Itchen,
- SPA, Solent & Southampton Water,
- SAC, Solent Maritime; and
- SSSI, Moorgreen Meadows.

The descriptors significant or not significant have been used to describe ecological impacts at receptors, dependent on whether the NOx annual mean objective and nitrogen deposition critical loads (described in baseline section) are above or below the legal limit (annual mean NOx of 30 µg/m^3). Where the assessment indicates a potentially significant effect on a designated site due to changes in NOx concentrations that lead to exceedances in the annual mean concentrations, further consideration to the magnitude of change will be considered. Where changes are less than 0.4 µg/m^3, effects are considered to be imperceptible. Where changes are greater than 0.4 µg/m^3, the scheme ecologist will use professional judgement to determine the significance of effects.

Developments likely to have a significant impact on a site of international importance such as an SPA, SAC or Ramsar site either alone or in combination with other projects, and which are not directly connected with or necessary to the management of the site, should be subject to an appropriate assessment in line with the requirements of the Habitats Directive (Council Directive 92/43/EEC).

6.5.12 Determining Significance of Effect

The significance of local operational air quality effects for the Scheme is based on the advice presented in the IAN 174/13. The advice provided in IAN 174/13 provides the process for evaluating the significance of local air quality effects in line with the EIA Directive requirements.

The scope of this guidance includes the assessment of significant effects for local air quality and European or nationally designated ecological sites. This guidance does not apply to regional air quality or construction dust effects which follow DMRB HA207/07 guidance only. Only receptors which exceed the AQS objective

(annual mean of 40 µg/m³ for NO_2) in either the Do Minimum or Do Something scenarios are used to inform significance. 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.

Table 6.12 provides a basis for assessment as set out in IAN 174/13. Where the differences in concentrations are less than 1% of the air quality threshold (e.g. less than or equal to 0.4 µg/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.

Table 6.12: Magnitude of change in NO2 and PM10 pollutant concentrations (IAN 174/13)

Magnitude of Change (µg/m^3)	Value of Change in Annual Average NO_2 and PM_{10}
Large (>4)	Greater than full measure of uncertainty (MoU) value of 10% of the air quality objective (4 µg/m^3)
Medium (>2 to 4)	Greater than half of the MoU (2 µg/m^3), but less than the full MoU (4 µg/m^3) of 10% of the air quality objective
Small (>0.4 to 2)	More than 1% of objective (0.4 µg/m^3) and less than half of the MoU i.e. 5% (2 µg/m^3). The full MoU is 10% of the air quality objective (4 µg/m^3)
Imperceptible (≤0.4)	Less than or equal to 1% of the objective (0.4 µg/m^3)

The DMRB model is used to predict concentrations and to provide an indication of whether any of the scheme options could lead to a significant impact based on IAN 174/13.

Table 6. 13 provides a basis for assessment as set out in IAN 174/13.

Table 6. 13: Air Quality Guidelines to Inform Significance (IAN 174/13)

Magnitude of Change in Annual Average NO_2 or PM_{10} (µg/m^3)	**Total Number of Receptors**	
	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

Where numbers of affected receptors are above the upper thresholds listed in Table 6. 13 for locations above the air quality objective, this may suggest significant air quality effects are more likely. The overall significance of predicted effects on local air quality is also evaluated in the context of relevant national (i.e. NPS NN and NPPF) and local air quality planning policy and the findings of the compliance risk assessment.

6.5.13 Compliance Risk Assessment

A compliance risk assessment was carried out to establish the potential effect of the Scheme operation upon the future compliance of zones as reported by the Defra to the European Commission. An assessment of compliance with the EU Directive on Ambient Air Quality (2008/50/EC) has been undertaken using the guidance set out in IAN 175/13.

Defra has recently published its revised action plan for achieving compliance with the EU Directive as soon as possible. This included updated Pollution Climate Mapping (PCM) model outputs which is the model Defra uses to report EU air quality compliance. It should be noted that Defra is reportedly about to face a fresh high court challenge that may lead to the revision of its air quality plan and anything attached to it. These most up to date compliance information published by Defra are what have been used to inform on compliance risk due to these two scheme options.

This assessment has used the results of the local air quality modelling overlaid on the Defra compliance network recently published[12] by Defra following their latest Air Quality Plan (July 2017) to establish whether, for each link, the change in NO_2 concentrations, would result in:

- A compliant zone becoming non-compliant; and/or
- Delay Defra's date for achieving compliance for the zone *i.e.* the change on a road link would result in a concentration higher than the existing maximum value in the zone; and/ or
- An increase in the length of roads in exceedance in the zone which would be greater than 1% when compared to the previous road length.

The purpose of this assessment is to identify risk of a scheme option being non-compliant with the Directive, and whether a Scheme Air Quality Action Plan (SAQAP) is required to be implemented. An SAQAP details required measures to mitigate any associated impacts back within the applicable air quality limits.

[12]2017 Defra Pollution Climate Mapping (PCM) NO_2 projections data (2015 reference year) Accessible from: https://uk-air.defra.gov.uk/library/no2ten/2017-no2-projections-from-2015-data

6.6 Assumptions and limitations of assessment

6.6.1 Construction assessment

Limitations associated with the construction assessment include:

- Limited knowledge of the construction programme and strategy,
- HGV movements have not been assessed in detail, therefore once the Scheme progresses to PCF Stage 3 with a preferred option a more detailed assessment will be required for the construction phase.

6.6.2 Operational phase assessment

Model uncertainties were minimised through adopting a worst-case approach. Measures taken to provide a more robust assessment included consideration of sensitive receptors at worst-case locations to predict pollutant concentrations, validating the modelled results to improve the accuracy with monitored results and applying a long-term trends gap analysis for NO_2 to account for uncertainty in future projections.

Due to the spatial distribution of monitoring points being limited, a comparison of Defra background mapping with background monitoring data was also carried out to account for any discrepancies. These were in reasonable agreement, and therefore use in the assessment, creating a higher degree of confidence in the assessment process.

It is worth noting this work is a high-level evaluation of the potential of there being significant differences in the Scheme design options being considered in respect to air quality impacts and outlining the potential risk for any of the Scheme options to not meeting the AQS Objectives. The assessment made use of the DMRB model which is a spreadsheet screening tool which is regarded as being adequate at this stage. It is however recommended that should the Scheme progress to the next PCF Stage, that the preferred route alignment be assessed more robustly and at a proportionate level to PCF Stage 3 work using more detailed dispersion modelling tools.

6.7 Design, mitigation and enhancement measures, including monitoring requirements

Where significant impacts on air quality are assessment, best practise, practical mitigation measures will be investigated and implemented as appropriate.

6.7.1 Mitigation

Construction

A detailed construction programme, indicating the main types of activities to be carried out during the course of the construction phase, and a CEMP is expected to be drafted during the next PCF Stage to support the implementation of mitigation measures.

Best practice mitigation measures would reduce construction dust impacts. However, construction dust is not considered further in this EAR.

Operation

The Scheme design does not include any operational air quality mitigation. The Scheme does pass through an AQMA and current baseline monitoring data suggests there are some exceedances of the AQS Objective for annual mean NO_2 along the Scheme. Generally, a scheme design that minimises occurrence of traffic congestion will support improvements in ambient air quality. In addition, future year improvements with progressive replacement of older, more polluting vehicle technologies with those that are less polluting will bring about improvements in ambient air quality.

However, significant improvements are unlikely to be possible if traffic congestion relief leads to an increase in capacity. With the Scheme's design aiming to reduce congestion but increase capacity and flow along the A3024 corridor, releasing demand elsewhere on the network, significant adverse impacts on air quality may occur, including those associated with roads passing through an AQMA.

6.8 Assessment of effects

6.8.1 Construction – Local Air Quality

There is a potential for adverse impacts from dust emissions to occur at sensitive receptors located in proximity to the Scheme options during the construction phase of the project.

The proposed construction programme for the Scheme is anticipated to last approximately 3.5 years. Based on the available information, the following types of activity are likely to generate dust during the construction phase:

- Movement of vehicles;
- Enabling works (e.g. verge clearance);
- Earthworks;
- Demolition (e.g. demolition of Northam Road Rail Bridge, concrete bases and footings);
- Excavation and installation of drains and communication ducts;
- Construction of retaining walls etc.;
- Surfacing works;
- Central reserve works;
- Installation of verge furniture and planting vegetation; and

- Stock piling/ storage.

Table 6.14 summarises the number of sensitive receptors located within 200 m of the Sub-scheme divisions.

Table 6.14: Sensitive Receptors within 200 m of the Scheme

Sensitive Receptors	Number of Sensitive Receptors			
	Sub-scheme 1	Sub-scheme 2	Sub-scheme 3	Sub-scheme 5
Educational	0	16	2	2
Residential Properties	176	6,117	1,104	210
Medical	2	12	3	0
Designated Ecological Receptors	0	1	1	0
Total Sensitive Receptors	178	6,146	1,110	212

There are many sensitive receptors within 200 m of the proposed construction works, therefore site-specific mitigation measures, in addition to standard mitigation measures, are required to avoid potentially significant temporary effects on air quality. Adoption of such measures would minimise the risks of significant adverse dust effects and statutory nuisance issues.

In order to mitigate against air quality effects at sensitive receptors during the construction period, Best Practice Measures (BPM) should be adopted. A CEMP will be prepared and implemented by the appointed construction contractor. The CEMP will include a range of best practice construction phase dust mitigation measures required in all works undertaken where there is potential for adverse effects on sensitive receptors.

Potential mitigation measures that are expected to reduce any potential impacts associated with dust during the activities involved in the construction phase are presented in Table 6.15.

Table 6.15: Construction Phase Mitigation Measures

Site Planning	Construction Traffic	Site Activities
• Machinery and dust causing activities should be located away from sensitive receptors where feasible. • Visual inspections should be regularly undertaken to determine whether there are any significant dust episodes resulting of the construction activities. • Adequate water supply should be made available on site for dust suppression, as and when required.	• All vehicles engines to be switched off when not in use (i.e. no idling of vehicles). • Effective vehicle cleaning and specific wheel-washing on leaving the site and damping down of haul routes, where there is a potential for carrying dust or mud off the site. • All loads entering and leaving the site to be covered. • On-road vehicles to comply to regulated emission standards. • Movement of construction traffic around the site should be minimised. • Impose and signpost maximum speed limits within the construction	• Ensure the disposal of any run-off from dust suppression activities, is in accordance with legal requirements. • Maintain all dust control equipment and record any maintenance activities. • Avoid double handling of material where possible. • Use water as a dust suppressant where required. • Ensure the mixing of cement, and other similar materials takes place in enclosed areas away from potential receptors. • Ensure slopes on any stockpiles are no steeper than the natural angle of repose of and maintain a

Site Planning	Construction Traffic	Site Activities
	areas. • Regularly inspect haul routes for integrity and undertake repairs as appropriate.	smooth profile. • Stockpiles should be covered and located away from sensitive receptors where possible.

Although a large number of receptors were identified within 200m of the Scheme; assuming best practice and standard dust mitigation measures are put in place prior to the commencement and during the construction phase, for both Appraisal Option 1 and Appraisal Option 2, short-term impacts can be avoided, and no significant residual effect is anticipated from the temporary construction works.

6.8.2 Operational – Local Air Quality

The affected roads considered in the assessment for Appraisal Option 1 are presented in Error! Reference source not found.. This includes the M27 Junction 8 and Windhover Roundabout (Sub-scheme 1), the full A3024 Corridor (Sub-scheme 2) stretching through Northam Road Rail Bridge (Sub-scheme 3) and Bitterne Rail Bridge (Sub-scheme 5) as well as the M27 from Junction 8 to Junction 3 joining with the M271 and parts of the A33 Redbridge and Millbrook West Road.

The changes in daily traffic flows are shown in Figure 6-3.

As expected, traffic flows re-route onto the A3024 Eastern Corridor and lead to increases in traffic flows along large sections of the A3024. This also results in reductions in traffic flow on other roads adjacent to the Scheme due to traffic re-routing onto the A3024 which would have more capacity, e.g. traffic which used the A3025 Hamble Lane onto Botley Road due to the capacity improvements at the Botley Road Junction is now forecast to re-route onto the A3024. Similarly, traffic using the A27 to access the A334 and the A3024 (westbound) now stays on the A3024.

The current network restricts HGVs due to the weight limit on the Northam Road Rail Bridge, which means that HGVs route around the city onto the M271. With the Scheme in place this weight restriction is lifted and hence the clear shift in HGV routing. Whether HGVs would necessarily route through the city centre will be dependent on what restrictions are imposed by the Southampton CAZ, with current Defra plans forecasting this is to be enforced by 2020. Little is known at this stage however it is expected the CAZ area will consist of Southampton city centre and its main arterial roads and will restrict the most polluting of the vehicle fleet in Southampton.

The modelled traffic data showed no significant change in daily average speeds along the Scheme and wider transport network. The Scheme is aimed at reducing congestion along the M27 along Southampton by shifting some of the traffic on the A3024. The increased capacity however along the Scheme will lead to increased traffic flows. The influence the Southampton CAZ would have on the Scheme effects would be dependent on the area, implementation time and the restrictions imposed. It is expected that a CAZ would lead to further restriction of the most-polluting vehicles along the A3024, thereby reducing the effects assessed here, however this can only be confirmed upon more details on the CAZ being known.

The change in pollutant concentrations due to the two Appraisal Do Something (DS) Options compared to Do Minimum (DM) concentrations have been quantified at selected sensitive receptors. All modelled results can be found in Appendix 5-2. The absolute magnitudes of pollutant concentrations in the baseline and DM scenarios have also been quantified and these have been used to consider the risk of the air quality limit values being exceeded in each of the two Appraisal Option

scenarios. Both Appraisal Options include widening and signalling at M27 Junction 8 and Windhover Roundabout and Botley Road Junction.

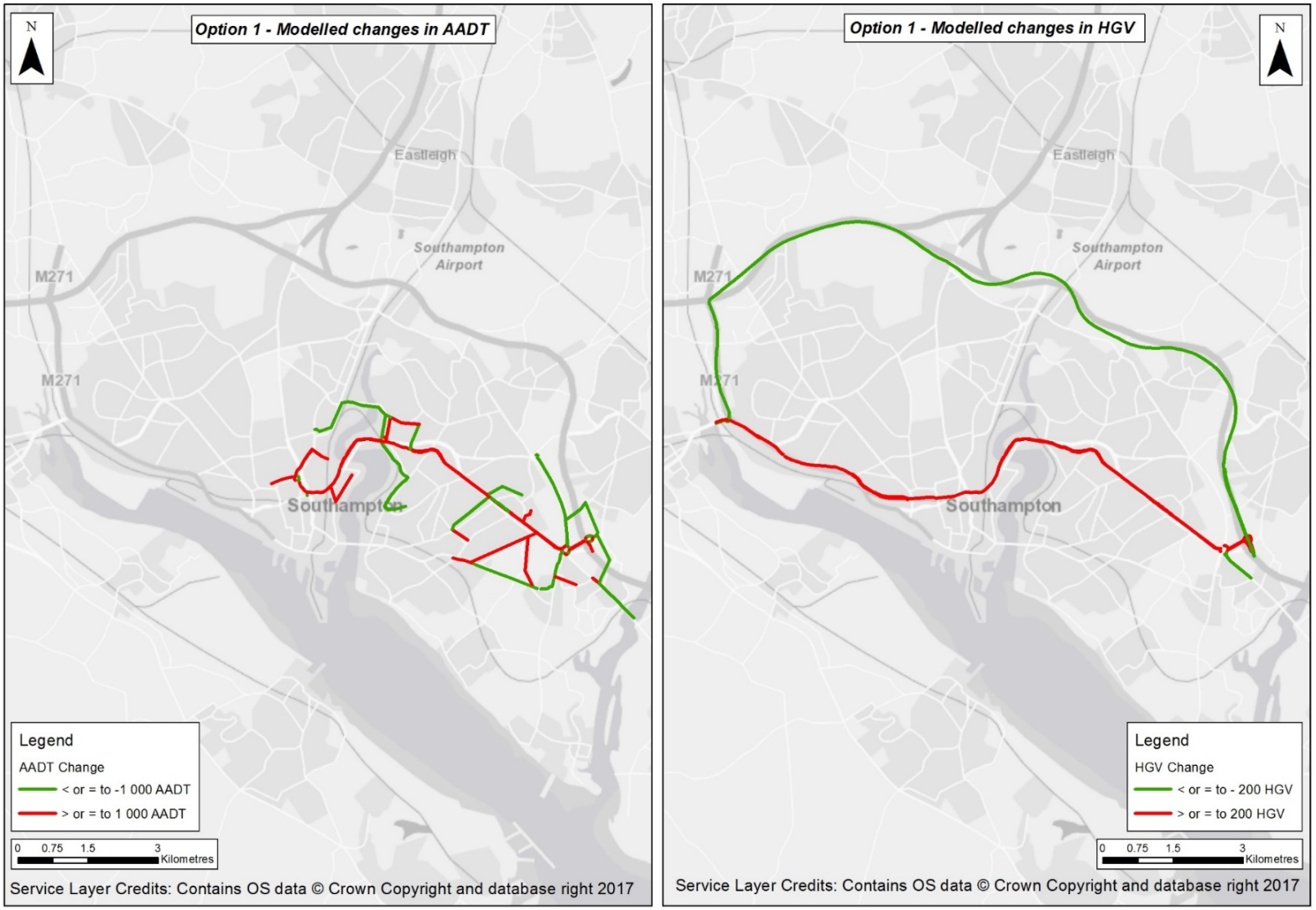

Figure 6-3: Appraisal Option 1 - modelled changes in AADT and HGV

6.8.3 Magnitude of Impacts – Appraisal Option 1

The discussion of the impacts of Appraisal Option 1 has been split up based on the areas used in the verification process (defined in Appendix 5-1, shown in Figure 6.1) due to the large geographic extent of the Scheme, and the spatial variability of pollutant concentrations.

The verification for Appraisal Option 1 assessment was split into five smaller areas representing different parts of the wider study area. The five verification areas were:

- A3024 Corridor;
- Southampton City Centre;
- Onslow Road;
- A33 Corridor; and
- M27 between Junction 3 and 8.

A3024 Corridor Area

Eighty-nine modelled receptors were considered in the assessment of the A3024 Corridor Area for Option Appraisal 1, which covers all worst-case sensitive receptors near the affected roads.

Table 6.16 presents the local air quality predicted annual NO_2 and PM_{10} concentrations at worst-case receptors within 200 m of affected roads along the A3024, defined in **Appendix 5.1**.

Table 6.16: Local Air Quality Predicted Annual NO_2 and PM_{10}Concentrations at worst-case receptors within 200 m of affected roads along the A3024 Area for Appraisal Option 1 (2019).

ID	IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM_{10} (µg/m^3)		
	LTT Adjusted DM	LTT DS	Difference between LTT DS and LTT DM	DM	DS	Difference between DS and DM
R1	25.9	25.4	-0.5	18.0	17.8	-0.2
R2	26.1	25.6	-0.5	19.4	19.2	-0.2
R3	19.7	19.6	-0.1	17.2	17.2	0.0
R4	19.4	19.7	0.3	17.1	17.2	0.1
R5	19.1	18.8	-0.3	16.9	16.8	-0.1
R6	19.5	19.2	-0.3	17.0	16.9	-0.1
R7	18.8	18.6	-0.2	16.9	16.7	-0.2
R8	16.0	15.8	-0.2	16.4	16.3	-0.1
R9	16.9	16.7	-0.2	15.2	15.1	-0.1
R10	18.4	18.1	-0.3	16.6	16.4	-0.2
R11	15.3	15.3	-0.0	15.6	15.6	0.0
R12	19.9	19.5	-0.4	16.8	16.7	-0.1

ID	IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM_{10} (µg/m^3)		
	LTT Adjusted DM	LTT DS	Difference between LTT DS and LTT DM	DM	DS	Difference between DS and DM
R13	28.4	29.8	1.4	18.1	18.5	0.4
R14	28.2	29.5	1.3	18.1	18.4	0.3
R15	28.2	29.9	1.7	18.1	18.5	0.4
R16	21.4	21.9	0.5	16.4	16.5	0.1
R17	20.3	20.6	0.3	16.1	16.2	0.1
R18	19.6	19.7	0.1	15.9	16.0	0.1
R19	28.9	30.7	1.8	18.3	18.8	0.5
R20	23.9	26.0	2.1	17.1	17.6	0.5
R21	24.5	25.8	1.3	17.2	17.5	0.3
R22	24.2	25.6	1.4	17.1	17.5	0.4
R23	21.2	22.6	1.4	16.4	16.8	0.4
R24	17.5	17.3	-0.2	15.6	15.5	-0.1
R25	17.5	17.3	-0.2	15.6	15.5	-0.1
R26	17.8	17.5	-0.3	15.7	15.6	-0.1
R27	20.0	20.2	0.2	16.2	16.3	0.1
R28	20.0	19.6	-0.4	15.9	15.8	-0.1
R29	21.6	21.0	-0.6	16.6	16.4	-0.2
R30	20.1	20.3	0.2	16.2	16.3	0.1
R31	18.1	18.8	0.7	15.7	16.0	0.3
R32	17.7	18.2	0.5	15.6	15.8	0.2
R33	26.0	25.6	-0.4	17.6	17.4	-0.2
R34	20.2	19.7	-0.5	16.3	16.1	-0.2
R35	20.8	21.7	0.9	16.0	16.2	0.2
R36	23.0	23.9	0.9	16.4	16.6	0.2
R37	20.7	24.7	4.0	15.9	17.0	1.1
R38	21.1	22.6	1.5	16.0	16.4	0.4
R39	18.2	18.8	0.6	15.4	15.6	0.2
R40	22.3	23.5	1.2	16.0	16.3	0.3
R41	19.5	20.1	0.6	15.3	15.4	0.2
R42	19.3	20.0	0.7	15.3	15.5	0.2
R43	24.4	26.5	2.1	16.4	16.9	0.5
R44	19.0	20.5	1.5	15.3	15.7	0.4

ID	IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM_{10} (µg/m^3)		
	LTT Adjusted DM	LTT DS	Difference between LTT DS and LTT DM	DM	DS	Difference between DS and DM
R45	19.3	22.0	2.7	15.2	15.8	0.6
R46	15.7	16.1	0.4	14.8	15.0	0.2
R47	17.1	18.2	1.1	15.3	15.7	0.4
R48	16.3	17.0	0.7	15.0	15.3	0.3
R49	17.9	17.4	-0.5	15.5	15.3	-0.2
R50	19.9	20.4	0.5	15.4	15.6	0.2
R51	16.3	16.7	0.4	14.9	14.9	0.0
R52	17.0	16.9	-0.1	15.2	15.1	-0.1
R53	16.5	16.3	-0.2	15.0	15.0	0.0
R54	19.1	18.8	-0.3	16.0	15.9	-0.1
R55	20.0	19.7	-0.3	15.7	15.6	-0.1
R56	19.7	19.4	-0.3	15.6	15.5	-0.1
R57	20.7	20.4	-0.3	15.9	15.8	-0.1
R58	19.4	19.2	-0.2	15.6	15.5	-0.1
R59	20.9	20.7	-0.2	16.0	15.9	-0.1
R60	20.9	20.7	-0.2	15.9	15.9	0.0
R61	21.0	20.6	-0.4	16.0	15.9	-0.1
R62	19.8	18.3	-1.5	15.6	15.2	-0.4
R63	17.7	17.0	-0.7	15.0	14.8	-0.2
R64	18.1	17.2	-0.9	15.2	14.9	-0.3
R65	19.1	19.5	0.4	15.4	15.5	0.1
R66	17.1	16.8	-0.3	15.3	15.2	-0.1
R67	17.6	17.4	-0.2	16.2	16.1	-0.1
R68	34.7	27.8	-6.9	18.6	18.2	-0.4
R69	20.6	20.4	-0.2	17.2	17.1	-0.1
R70	14.2	14.4	0.2	15.3	15.4	0.1
R71	31.7	33.2	1.5	19.0	19.4	0.4
R72	20.7	20.9	0.2	16.4	16.5	0.1
R73	22.5	24.0	1.5	16.7	17.1	0.4
R74	22.0	23.8	1.8	16.2	16.6	0.4
R75	17.2	17.7	0.5	15.1	15.2	0.1
R76	18.4	19.0	0.6	15.3	15.4	0.1

ID	IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM_{10} (µg/m^3)		
	LTT Adjusted DM	LTT DS	Difference between LTT DS and LTT DM	DM	DS	Difference between DS and DM
R77	19.6	20.4	0.8	15.4	15.5	0.2
R78	16.3	17.2	0.9	15.0	15.4	0.4
R79	17.1	17.8	0.7	15.1	15.4	0.3
R80	22.0	22.5	0.5	16.0	16.2	0.2
R81	18.3	17.7	-0.6	15.4	15.2	-0.2
R82	16.8	16.6	-0.2	16.0	15.9	-0.1
R140	26.2	26.0	-0.2	1.3	1.3	0.0
R141	22.7	22.3	-0.4	1.1	1.0	-0.1
R142	23.5	23.0	-0.5	1.3	1.2	-0.1
R143	24.5	23.5	-1.0	2.1	1.7	-0.4
R144	26.4	25.2	-1.2	2.6	2.2	-0.4
R145	25.8	24.8	-1.0	2.3	1.9	-0.4
R146	25.4	24.2	-1.2	2.3	1.9	-0.4
Exceedances with the Annual Mean NO_2 and PM_{10} AQS Objective of 40 µg/m3 are shown in **bold**.						

This area was a concern for the Scheme as it was expected to lead to an increase in traffic flows within AQMA No. 2 Bitterne Road West. Figure 6-4 presents the modelled receptors located within this AQMA. Recent NO_2 diffusion tube measurements within this AQMA recorded concentrations that were below the AQS Objective for annual mean NO_2, and Base Year (2015) predictions were in good agreement with the monitoring data for the same year (see Appendix 5-2).

Figure 6-4: Modelled receptors located within AQMA No. 2 Bitterne Road

For the A3024 Corridor Area, the largest predicted change in annual mean NO_2 concentration occurred at receptor R68 located at Cranbury Gardens off the A3025 Hamble Lane, which showed a predicted decrease of 6.9 µg/m^3 as a result of a decrease in traffic flows on the A3025 Hamble Lane. Traffic flows were predicted to decrease by almost 2,000 AADT as a result of Appraisal Option 1. This significant reduction in traffic flows is due to traffic utilising the A3024 either to access or to leave the M27 rather than using A3025 through Sholing.

The largest predicted increase in annual mean NO_2 concentration occurred at receptor R37 located at Bursledon Road (A3024) opposite Bath Road, which showed a predicted increase of 4.0 µg/m^3. This is one of the closest receptors to the A3024 Corridor, where traffic flows were predicted to increase by almost 5,000 AADT as a result of Appraisal Option 1. There is also a large increase in HGV movements per day along this route due to the lifting of the weight restrictions on the Northam Road Rail Bridge favouring this HGV route. The widening of the A3024 in some sections is also expected to be a minor contributing factor as it brings traffic closer to worst-case receptors, although will support a reduction in traffic congestion.

All Do Something NO_2 and PM_{10} concentrations are predicted to be below 40 µg/m³ which indicates there are unlikely to be any exceedances of AQS objective criteria as a result of the Appraisal Option 1 in the A3024 area.

A33 Redbridge Road/Millbrook Road West

Thirteen modelled receptors were considered in the assessment of the A33 Redbridge Road/Millbrook Road West Area which covers all worst-case sensitive receptors near the affected roads. The sensitive receptors considered for the A33 Redbridge/Millbrook Road West area were all located within the Millbrook Road and Redbridge Road AQMA. Figure 6-5 presents the modelled receptors located within this AQMA. Recent NO_2 diffusion tube measurements within this AQMA recorded two exceedances of the AQS Objective for annual mean NO_2 in 2015. Verified Base Year (2015) predictions were in good agreement (within 10%) with the monitoring data for the same year (see Appendix 5-2).

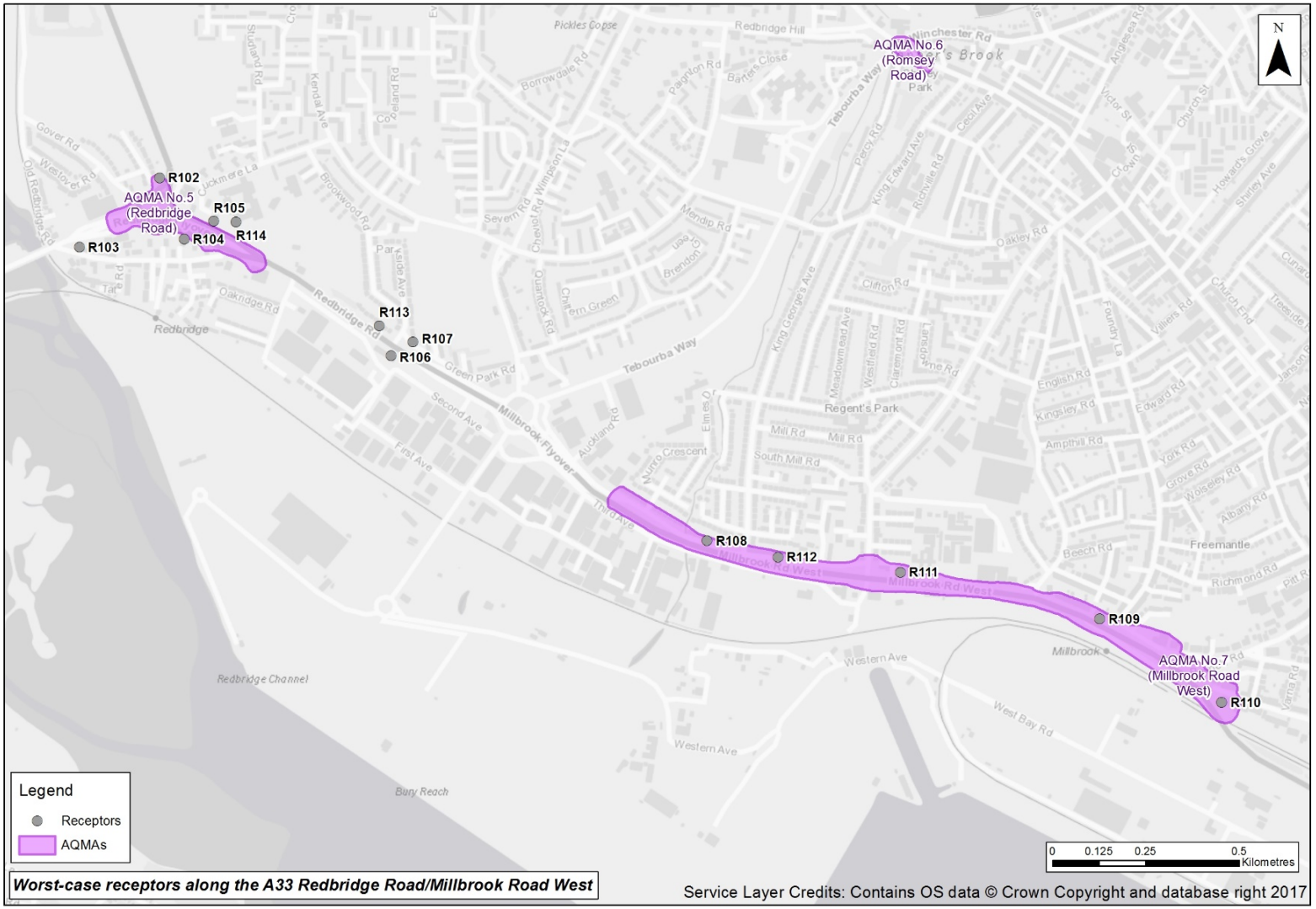

Figure 6-5: Modelled receptors located within AQMA No. 5 Redbridge Road and AQMA No. 7 Millbrook Road West

Table 6.17 presents the predicted annual NO_2 and PM_{10} concentrations at worst-case receptors within 200 m of affected roads along the A33 Redbridge Road and Millbrook Road West area, defined in **Appendix 5-1**. This road joins the A3024 with the M271 and A35 at Redbridge to the West of Southampton, with the M271 joining the M27 at Junction 3. The A33 Redbridge Road and A33 Millbrook Road West were screened in as affected roads based on DMRB HA207/07 due to changes in HGVs of between 200 and 400 movements per day.

Table 6.17: Local Air Quality Predicted Annual NO_2 and PM_{10} Concentrations at worst-case receptors within 200 m of affected roads along the A33 Redbridge Road/Millbrook Road West for Appraisal Option 1 (2019).

ID	IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM_{10} (µg/m^3)		
	LTT DM	LTT DS Option 1	Difference between LTT DS and LTT DM	DM	DS Option 1	Difference between DS and DM
R102	27.8	27.7	-0.1	20.3	20.3	0.0
R103	33.7	33.5	-0.2	21.5	21.5	0.0
R104	30.2	30.3	0.1	20.6	20.7	0.1
R105	30.1	30.2	0.1	21.1	21.1	0.0
R106	31.2	31.4	0.2	21.7	21.8	0.1
R107	24.8	25.0	0.2	18.4	18.5	0.0
R108	25.2	25.5	0.3	17.3	17.4	0.1
R109	41.8	42.2	0.4	21.6	21.7	0.1
R110	27.5	27.6	0.1	18.4	18.4	0.0
R111	44.4	45.0	0.6	21.2	21.4	0.1
R112	25.9	26.2	0.3	17.2	17.3	0.1
R113	32.6	32.9	0.3	22.2	22.3	0.1
R114	25.5	25.6	0.1	19.9	20.0	0.1
Exceedances with the Annual Mean NO_2 and PM_{10} AQS Objective of 40 µg/m^3 are shown in **bold**.						

The annual mean NO_2 AQS Objective in the Opening Year is predicted to be exceeded at two receptors, R111 and R109 both located on the A33 Millbrook Road West. The largest predicted increase in annual mean NO_2 concentration was 0.6 µg/m^3 for Receptor R111, which is located within 10 m of the A33 Millbrook Road West. This is a small increase (1.5% of the AQS Objective) due to a change of approximately 450 additional HGV movements as a result of the Appraisal Option 1. An evaluation of the number of additional receptors within a similar distance (10-15m) from the road was carried out to understand how many other sensitive receptors would also be susceptible to similar impacts in air quality. It is expected that the total number of sensitive receptors within a similar magnitude of change would not exceed five receptors.

As set out in IAN 174/13 and presented in Table 6. 13, only where the number of affected receptors are above the thresholds for locations above the air quality objective would it suggest significant air quality effects are more likely. In the case of this small magnitude impact, we are well below the minimum threshold from the range of between 30 to 60 receptors to constitute a significant air quality effect, and therefore it is unlikely that a significant air quality effect is expected for Appraisal Option 1 on the A33.

An exceedance of the annual mean NO_2 AQS Objective in the Opening Year is also predicted for R109. The changes in HGV movements due to the Scheme result in a marginal increase of 0.4 µg/m^3, which is 1% of the AQS Objective. Receptor R109 is also a worst-case receptor location, with all other sensitive receptors in the area being set further back from the A33 Millbrook Road West. It is therefore expected that all other sensitive receptors are unlikely to be at a risk of any significant impacts due to the Appraisal Option 1.

Do Something NO_2 and PM_{10} concentrations at all other receptors are predicted to be below 40 µg/m³. The changes due to Option Appraisal 1 along the A33 are imperceptible for predicted PM_{10} concentrations at all receptors.

M27 Southampton (Between Junctions 3 and 8)

Appraisal Option 1 shows a reduction of HGVs on the M27 between Junctions 3 and Junction 8 of between 100 – 500 HGV movements per day. This reduction in HGV movements is a result of the Appraisal Option 1 improvements, including the weight restriction lifting of Northam Bridge to allow HGVs to route through Southampton.

Twenty-five modelled receptors were considered in the assessment of the M27 Southampton between Junctions 3 and 8. These worst-case sensitive receptors are set back from the M27 by at least 30m from the road centreline. A Highways England NO_2 diffusion tube monitoring survey established that NO_2 concentrations were only exceeding the AQS Objective at one site in 2014, which is a site located close to other strategic roads and therefore likely to be a contribution of these two road contributions.

Table 6.18 presents the Local Air Quality Predicted Annual NO_2 and PM_{10} Concentrations at worst-case receptors within 200 m of affected roads along the M27 between Junctions 3 and 8 for Appraisal Option 1.

Table 6.18: Local Air Quality Predicted Annual NO_2 and PM_{10} Concentrations at worst-case receptors within 200 m of affected roads along the M27 between Junctions 3 and 8 for Appraisal Option 1 (2019).

ID	IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM10 (µg/m^3)		
	LTT DM	LTT DS Option 1	Difference between LTT DS and LTT DM	DM	DS Option 1	Difference between DS and DM
R115	23.2	23.3	0.1	17.3	17.3	0.0
R116	20.9	19.0	-1.9	17.5	17.2	-0.3
R117	20.4	20.1	-0.3	17.5	17.4	-0.1
R118	18.5	18.3	-0.2	16.9	16.9	0.0
R119	17.9	18.0	0.1	16.2	16.2	0.0
R120	35.0	34.8	-0.2	19.6	19.5	-0.1
R121	25.5	25.4	-0.1	17.8	17.8	0.0
R122	26.4	26.3	-0.1	18.0	18.0	0.0
R123	26.3	26.2	-0.1	19.0	19.0	0.0
R124	23.0	23.0	0.0	18.6	18.6	0.0
R125	21.2	21.1	0.0	17.1	17.1	0.0
R126	22.0	22.0	0.0	17.3	17.3	0.0
R127	26.8	26.8	0.0	18.8	18.8	0.0
R128	20.9	20.9	0.0	17.8	17.8	0.0
R129	25.6	25.6	0.0	18.9	18.9	0.0
R130	25.2	25.2	0.0	19.0	19.0	0.0
R131	31.6	31.6	0.0	20.7	20.7	0.0
R132	22.5	22.5	0.0	18.7	18.7	0.0
R133	15.4	15.4	0.0	16.4	16.4	0.0
R134	17.0	17.0	0.0	17.6	17.6	0.0
R135	19.7	19.7	0.0	15.1	15.1	0.0
R136	22.8	22.7	-0.1	16.8	16.7	0.1
R137	20.7	20.7	0.0	16.2	16.2	0.0
R138	20.2	20.2	0.0	16.8	16.7	0.0
R139	19.0	19.0	0.0	16.5	16.5	0.0

Exceedances with the Annual Mean NO_2 and PM_{10} AQS Objective of 40 µg/m^3 are shown in **bold**.

For Appraisal Option 1, the largest predicted change in annual mean NO_2 concentration for the M27 area occurred at receptor R116 (located on Dodwell Lane, off Junction 8 of the M27) which showed a predicted decrease of 2.1 µg/m^3

as a result of decreased traffic flows due to traffic routing around the M27 Junction 8 along Dodwell Lane shifting onto the junction and Windhover Roundabout.

All Do Something NO_2 and PM_{10} concentrations are predicted to be well below 40 µg/m³ which indicates there are unlikely to be any exceedances of AQS objective criteria at sensitive receptors as a result of the Appraisal Option 1 along the M27.

Southampton City Centre

The Southampton City Centre modelled receptors reported here are based on the verification area shown in Appendix 5-1, with Figure 6.1 in Appendix 5-2 showing the location of these modelled receptors. Twelve receptors have been modelled to cover all affected roads within this area.

Twelve modelled receptors were considered in the assessment of the Southampton City Centre. Table 6.19 presents the Local Air Quality Predicted Annual NO_2 and PM_{10} Concentrations at worst-case receptors within 200 m of affected roads within Southampton City Centre, excluding Onslow Road which is considered separately, discussed in the following section, for Appraisal Option 1.

Table 6.19: Local Air Quality Predicted Annual NO_2 and PM_{10} Concentrations at worst-case receptors within 200 m of affected roads within Southampton City Centre (excluding Onslow Road) for Appraisal Option 1 (2019).

ID		IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM_{10} (µg/m^3)		
		LTT DM	LTT DS Option 1	Difference between LTT DS and LTT DM	DM	DS Option 1	Difference between DS and DM
R83		30.4	31.2	0.7	17.1	17.2	0.0
R84		36.8	39.0	2.2	18.4	18.6	0.2
R85		34.1	33.9	-0.2	18.7	18.7	0.0
R86		28.9	30.8	1.8	18.0	18.5	0.5
R87		28.6	29.9	1.3	18.0	18.0	0.1
R88		33.5	33.6	0.2	18.7	18.7	0.0
R89		28.7	30.9	2.1	17.9	18.5	0.6
R90		27.4	28.7	1.3	17.7	18.1	0.4
R91		31.1	32.7	1.7	18.0	18.2	0.2
R92		21.7	22.0	0.3	16.4	16.5	0.1
R93		31.6	31.7	0.1	18.4	18.5	0.1
R94		28.7	28.8	0.1	17.6	17.7	0.0
	Exceedances with the Annual Mean NO_2 and PM_{10} AQS Objective of 40 µg/m^3 are shown in **bold**.						

For Appraisal Option 1, the largest predicted change in annual mean NO_2 concentration for the Southampton City Centre area occurred at receptor R84 (located on New Road, near Southampton Solent University), which showed a predicted increase of 2.2 µg/m^3 as a result of Appraisal Option 1.

HGV traffic along New Road increases by about 400 movements per day as a result of the improvements to the Northam Road Rail Bridge close which promotes HGV traffic through this traffic route. All Do Something NO_2 and PM_{10} concentrations are predicted to be below 40 µg/m³ which indicates there are unlikely to be any exceedances of AQS objective criteria as a result of Appraisal Option 1 in Southampton City Centre

Onslow Road

The Onslow Road area was considered separately from the other affected roads in Southampton City Centre as this road was located within the Bevois Valley AQMA. This road also had particular local characteristics including some road gradient effects and high buildings which influence road NO_2 concentrations. The modelled receptors considered for the Onslow Road area within the Bevois Valley AQMA are presented in Figure 6-6. Recent NO_2 diffusion tube measurements within this AQMA recorded two exceedances of the AQS Objective for annual mean NO_2 in 2015, both located on Onslow Road. Verified Base Year (2015) predictions were in good agreement (within 10%) with the monitoring data for the same year (see Appendix 5-2).

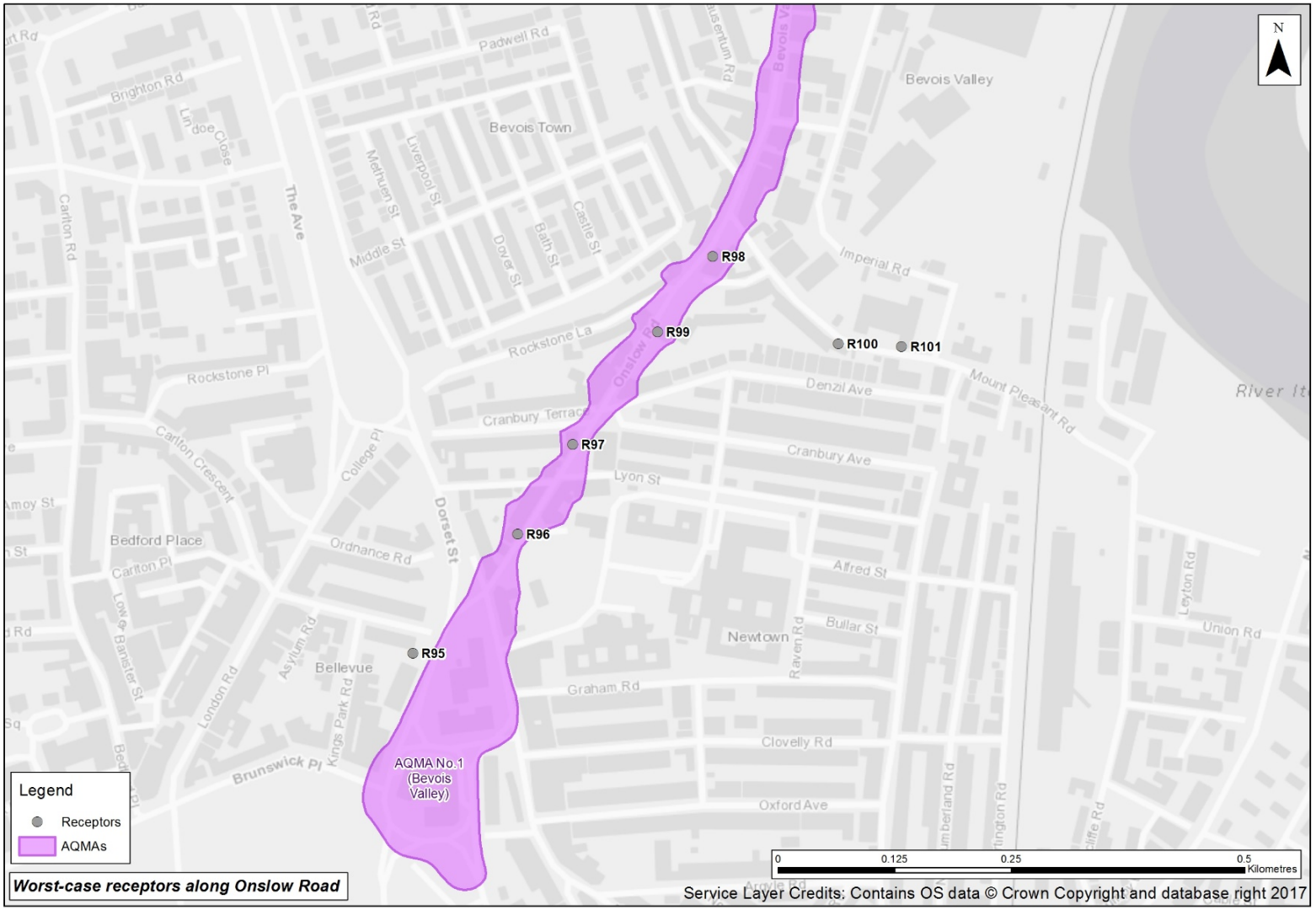

Figure 6-6: Modelled receptors located along Onslow Road

Seven modelled receptors were considered in the assessment of Onslow Road, which covers all worst-case sensitive receptors near the affected roads. Table 6.20 presents the Local Air Quality Predicted Annual NO_2 and PM_{10} Concentrations at worst-case receptors within 200 m of affected roads along the A33 Redbridge Road/Millbrook Road West for Appraisal Option 1.

Table 6.20: Local Air Quality Predicted Annual NO_2 and PM_{10} Concentrations at worst-case receptors within 200 m of affected roads along the A33 Redbridge Road/Millbrook Road West for Appraisal Option 1 (2019).

ID	IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM_{10} (µg/m^3)		
	LTT DM	LTT DS Option 1	Difference between LTT DS and LTT DM	DM	DS Option 1	Difference between DS and DM
R95	31.2	31.2	0.0	18.0	18.0	0.0
R96	37.8	38.3	0.5	20.5	20.7	0.2
R97	38.9	39.4	0.5	20.8	21.1	0.3
R98	34.0	34.5	0.5	19.9	20.1	0.3
R99	32.8	33.3	0.5	19.5	19.7	0.2
R100	33.1	35.8	2.7	19.0	20.0	1.0
R101	32.5	34.9	2.4	18.9	19.8	0.9
Exceedances with the Annual Mean NO_2 and PM_{10} AQS Objective of 40 µg/m^3 are shown in **bold**.						

The largest predicted change in pollutant concentration in this area was predicted at R100 (located at the end of Mount Pleasant Road, off Onslow Road) which showed a predicted annual mean NO_2 increase of 2.7 µg/m^3 due to the Scheme. Traffic flows along Mount Pleasant Road increased by approximately 4,000 AADT due to scheme.

Two receptors were predicted to be within 5% of the AQS Objective (R96 and R97). The changes at both these sensitive receptors was small (1% of AQS Objective), however similar magnitude changes would be expected at other sensitive receptors adjacent at similar distances to the road. Given how close to exceeding the objective these receptors are, it is recommended these sensitive receptors be considered using a more detailed approach involving dispersion modelling in PCF Stage 3 should this option is progressed to preferred route. All Do Something NO_2 and PM_{10} concentrations are predicted to be below 40 µg/m³ which indicates there are unlikely to be any exceedances of AQS objective criteria as a result of Option Appraisal 1 around the Onslow Road area.

6.8.4 Magnitude of Impacts – Appraisal Option 2

Appraisal Option 2 includes Sub-scheme 1 Junction 8 and Windhover Roundabout improvements and the A27/A3024/A3025 network, with some overlap with Sub-scheme 2. The affected roads considered in the operational air quality assessment for Appraisal Option 2 are presented in Figure 6.7.

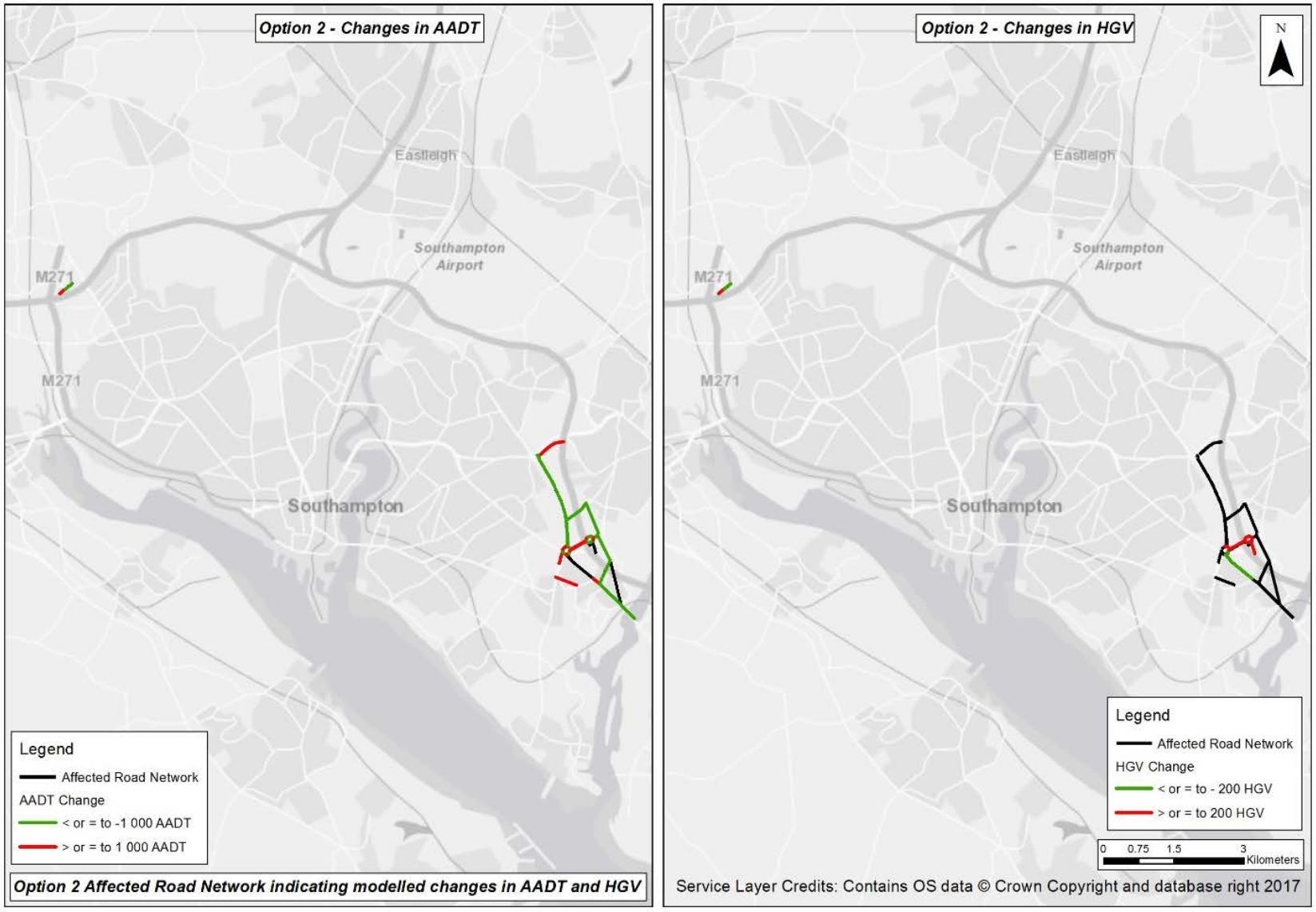

Figure 6.7 Appraisal Option 2 - Modelled changes in AADT and HGV

Twenty modelled receptors were considered in this operational assessment which cover all the worst-case sensitive receptors nearest to these affected roads.

Table 6.21: Local Air Quality Predicted Annual NO_2 and PM_{10} Concentrations at worst-case receptors within 200 m of affected roads for Appraisal Option 2.

ID	IAN170/12 Long Term Trend Adjusted Annual Mean NO_2 (µg/m^3)			Annual Mean PM_{10} (µg/m^3)		
	LTT DM	LTT DS	Difference between LTT DS and LTT DM	DM	DS	Difference between DS and DM
R115	23.2	23.3	0.1	17.3	17.3	0.0
R116	20.9	18.9	-2.0	17.5	17.1	-0.4
R117	20.4	20.1	-0.3	17.5	17.4	-0.1
R118	18.5	18.3	-0.2	16.9	16.9	0.0
R119	17.9	18.0	0.1	16.2	16.2	0.0
R138	20.2	20.3	0.1	16.8	16.8	0.0
R139	19.0	19.0	0.0	16.5	16.5	0.0
R1	25.9	25.3	-0.6	18.0	17.8	-0.2
R2	26.1	25.4	-0.7	19.4	19.1	-0.3
R3	19.7	19.5	-0.2	17.2	17.1	-0.1
R4	19.4	19.6	0.2	17.1	17.2	0.1
R5	19.1	18.9	-0.2	16.9	16.9	0.0
R6	19.5	19.3	-0.2	17.0	17.0	0.0
R7	18.8	18.7	-0.1	16.9	16.7	-0.2
R8	16.0	15.9	-0.1	16.4	16.3	-0.1
R9	16.9	16.8	-0.1	15.2	15.2	0.0
R10	18.4	18.3	-0.1	16.6	16.5	-0.1
R11	15.3	15.3	0.0	15.6	15.6	0.0
R12	19.9	19.7	-0.2	16.8	16.7	-0.1
R68	34.7	34.7	0.0	18.6	18.6	0.0
Exceedances with the Annual Mean NO_2 and PM_{10} AQS Objective of 40 µg/m^3 are shown in **bold**.						

The largest predicted change in pollutant concentrations was predicted at R116 on Dodwell Lane as a result of decreases in traffic flows due to traffic routing around M27 Junction 8 along Dodwell Lane shifting onto the junction and Windhover Roundabout.

All Do Something NO_2 and PM_{10} concentrations are predicted to be below 40 µg/m³ which indicates there are unlikely to be any exceedances of AQS objective criteria as a result of Option Appraisal 2.

6.8.5 Significance of Effects

The significance of effects was determined based on the guidance set out in IAN 174/13, also summarised in the methodology section. For Appraisal Option 1, there were less than five sensitive receptors in total along the A33 Millbrook West that experienced a small change in air quality. These changes were within the Millbrook Road and Redbridge Road AQMA. The total number of receptors leading to worsening in NO_2 was below the 30 to 60 band range assigned for small magnitudes of pollutant changes. Based on IAN 174/13 guidance it would therefore be unlikely that these changes in NO_2 would constitute a significant effect. Should Appraisal Option 1 be progressed to PCF Stage 3, a more robust assessment of these effects is expected to be carried out in particular focusing on this area and Onslow Road (located within the Bevois Valley AQMA) where the predicted concentrations were closest to the AQS Objective for annual mean NO_2, to ensure that Appraisal Option 1 does not contribute to any significant effects.

With the exception of the A33 and Onslow Road for Appraisal Option 1, all other predicted concentrations were all well below the AQS objectives both with and without the Scheme for both Appraisal Option 1 and 2.

Sensitive receptors along the Bitterne Road West AQMA were all predicted to be well below the AQS Objective for NO_2 and PM_{10} concentrations for 2019. Recent air quality monitoring data within this AQMA suggested there were no measured exceedances of the AQS Objective. The largest traffic changes along the A3024 Corridor within the Bitterne Road West AQMA therefore did not result in any predicted significant impacts due to either Appraisal Option.

Both Option Appraisal 1 and Option Appraisal 2 are therefore unlikely to lead to any significant impact on local air quality.

6.8.6 Cumulative Effects

Based on a forecasted 2019 opening year for the Scheme our assessment could not include the Southampton CAZ which is expected to be implemented by 2020. This is expected to include charging or access restrictions for certain vehicle types within a designated CAZ zone that will likely include parts of the City of Southampton and its major arterial roads.

It is recommended that should the Scheme progress to the next PCF Stage, that the preferred route alignment be re-assessed at a proportionate level to PCF Stage 3 work using more detailed dispersion modelling tools, accounting for the Southampton CAZ, should the information be available.

6.8.7 Operational – Regional Air Quality

Emissions of NO_x, PM_{10} and CO_2 have been predicted for the Base Year (2015), Opening Year (2019) and Design Year (2036) scenarios, based on the DMRB

regional criteria defined in the methodology section and the same AADT traffic data used for the local air quality assessment.

The affected roads for Appraisal Option 1 consisted of the entire length of the Scheme between Windhover roundabout and Southampton City Centre along the A3024. Major roads in the affected road network for Appraisal Option 1 included the A33, M271 and the M3 (between junctions 13 and 14). Unlike the local air quality affected road network, the M27 mainline between junctions 3 and 8 did not screen in against DMRB regional air quality criteria.

Affected roads for Appraisal Option 2 comprised the Windhover roundabout and most links surrounding the M27 junction 8.

Emissions of NO_x, PM_{10} and CO_2, associated with the roads comprising the assessment study area for Appraisal Option 1, are shown in Table 6.22.

Table 6.22: Annual NO_x, PM_{10} (kg/year), and CO_2 Emissions (tonnes/year) for the Base (2015), Opening (2019) and Design Year (2036) for Appraisal Option 1

Pollutant	Base 2015	DM 2019	DS 2019	DS-DM Change	DM 2036	DS 2036	DS-DM Change
NO_x (kg/yr)	219544	130316	135828	+5512	54621	56385	+1765
PM_{10} (kg/yr)	16440	13651	14110	+459	11222	11621	+399
CO_2 (T/yr)	82461	72434	74863	+2429	60061	62243	+2182

Appraisal Option 1 leads to small increases in the emissions of NO_x, PM_{10} and CO_2 of between 3-5% in the Opening Year (2019). There are also small increases in emissions in the Design Year (2036), which are of a similar percentage difference changes as the Opening Year. These predicted regional emission increases are expected to be a combined result of general traffic growth to the Scheme in 2019, and due to wider transport improvements and traffic growth in the area for both forecasts.

Emissions of NO_x, PM_{10} and CO_2, associated with the road traffic in the assessment study area for Appraisal Option 2, are shown in Table 6.23.

Table 6.23: Annual NO_x, PM_{10} (kg/year), and CO_2 Emissions (tonnes/year) for the Base (2015), Opening (2019) and Design Year (2036) for Option 2

Pollutant	Base 2015	DM 2019	DS 2019	DS-DM Change	DM 2036	DS 2036	DS-DM Change
NOx (kg/yr)	120748	67784	68026	-243	14594	14644	+50
PM_{10} (kg/yr)	8757	6713	6629	-85	3170	3157	-13
CO_2 (T/yr)	45637	38023	37919	-104	15430	15548	+118

Appraisal Option 2 predicted changes up to 0.4% increase in NO_X emissions, and a decrease of 1.3% for PM_{10} and CO_2 emissions in the opening year. These are similar magnitudes in the design year, and are much smaller than Appraisal Option 1, suggesting these may be mainly attributed to traffic growth in the area.

6.8.9 Ecological Assessment

Impacts to ecological receptors were assessed for the SSSI/SAC River Itchen, the SPA Solent and Southampton Water and the SSSI Moorgreen Meadows. Habitats within these designated sites are all sensitive to changes in nitrogen levels which can have both direct and indirect impacts on ecosystem health.

The SAC Solent Maritime was not considered in the ecological assessment as the habitats within 200 m of the Scheme ARN include rivers and streams (within the River Hamble), which are not sensitive to nitrogen levels.

Ecological impacts were only considered for Appraisal Option 1, as no ecological designated sites were identified within 200 m of affected roads for Appraisal Option 2.

Concentrations have been compared against the objective of 30 µg/m^3, as recommended by DMRB HA207/07 Annex F. The nitrogen deposition flux has been calculated following the methodology outlined in Section 5.6 in this report and compared against critical loads, as recommended by DMRB HA207/07.

Total NO_X concentrations and nitrogen deposition rates have been calculated along three transects extending into each designated site. The locations of these ecological transects are described in Table 6.24 along with the road in the ARN used to assess the ecological impacts.

Table 6.24: Transects used in the ecological assessment of the M27 Southampton schemes

Transect	Designated Site	Road
E1-E5	SSSI/SAC River Itchen	M27
E6-E9	SSSI Moorgreen Meadows	M27
E10-E14	SPA Solent and Southampton Water	Bitterne Road West (A3024)

Total NO_X concentrations, for each scenario, were calculated by combining the road-traffic contributions with background concentrations. Background NO_X concentrations used in the assessment for the existing baseline year (2015) and the forecast DM and DS scenarios (2019) were obtained from Defra LAQM backgrounds and are presented in Table 6.25.

Table 6.25: Background NO_X concentrations (µg/m^3) in the Base and Opening Years for the M27 Southampton schemes

Transect	Easting (m)	Northing (m)	Background NO_x	
			Base Year (2015)	Opening Year (2019)
E1-E5	445500	115500	27.5	23.0
E6-E9	447500	114500	27.2	22.9
E10-E14	443500	113500	33.7	29.3
Exceedances with the Annual Mean NO_x AQS Objective of 30 µg/m^3 are shown in **bold**				

The AQS objective for NO_X (30 µg/m^3) is the concentration above which direct adverse effects on receptors may occur (APIS, 2016). This is the critical level for all vegetation susceptible to nitrogen effects, shown in Table 6.25. As recommended by the DMRB guidance, Appraisal Option 1 impact magnitudes for NO_X follow the same criteria as those for NO_2 and PM_{10} impacts. Table 6.26 shows total annual mean NO_X concentrations for the Base Year (2015), DM and DS (2019) scenarios.

Table 6.26: Annual Mean NO_X Concentrations Predicted along Transects in each of the Designated Sites for M27 Southampton schemes in the Base, Do-Minimum and Do-Something Scenarios

Receptor (Site)	Distance from the Scheme (m)	NO_X Concentration (µg/m^3)				Magnitude of Change
		Base	DM	DS Option 1	Change (DS - DM)	
E1 – E5 (SSSI/SAC River Itchen)	13.6	**81.2**	**69.2**	**68.7**	-0.5	Small Decrease
	47.3	**47.7**	**39.2**	**39.1**	-0.1	Imperceptible
	86.5	**40.2**	**32.6**	**32.5**	-0.1	Imperceptible
	124.0	**36.6**	29.4	29.4	0.0	Imperceptible
	162.1	**34.5**	27.6	27.6	0.0	Imperceptible
E6 – E9 (SSSI Moorgreen Meadows)	17.5	**71.4**	**64.4**	**64.1**	-0.3	Small Decrease
	68.9	**42.8**	**36.8**	**36.7**	-0.1	Imperceptible
	119.9	**37.4**	**31.3**	**31.2**	-0.1	Imperceptible
	168.4	**34.7**	28.5	28.5	0.0	Imperceptible
E10 – E14 (SPA Solent and Southampton Water)	16.6	**47.1**	**36.8**	**39.0**	2.2	Medium Increase
	63.0	**38.7**	**30.3**	**31.0**	0.7	Small Increase
	108.6	**36.8**	28.8	29.3	0.5	Small Increase
	153.2	**35.9**	28.1	28.5	0.4	Imperceptible
	199.9	**35.4**	27.7	28.0	0.2	Imperceptible
Exceedances with the Annual Mean NO_x AQS Objective of 30 µg/m^3 are shown in **bold**						

The results show that NO_X concentrations exceed the annual mean objective at all receptors in the base scenario. NO_X concentrations improve in the Opening Year scenario, due to more stringent emission controls on vehicles, and national fleet turnover. However, for all transects, the NO_X objective is still exceeded between 60 and 120 m from the associated road.

NO_X concentrations decrease slightly in the SSSI Moorgreen Meadows and SSSI/SAC River Itchen in the DS scenario due to decreases in the number of HGV movements on the M27 around Southampton. Changes are imperceptible for both M27 transects after approximately 20 m.

Results for the SPA Solent and Southampton show increases of NO_X concentrations as a result of the Scheme, with a Medium Increase at the nearest point of the transect to the Scheme. This is reflected in the traffic data, which shows HGVs rerouting from the M27 onto the A3024 through Southampton City

Centre. There are small increases of NO_X up to about 150 m and changes are imperceptible closer to 200 m.

Table 6.27 shows the nitrogen deposition rates predicted for each scenario at the receptors along the three transects extending into each designated site. Nitrogen deposition rates have been compared against the critical loads presented in Table 6.27 in the Baseline Conditions section of this Chapter. It should be noted that due to the fact that each designated site contains multiple habitats, each with different critical load ranges and baseline deposition rates, the widest range of the critical load and the highest baseline deposition rate were used to assess impacts and significance. This was considered to provide the most conservative approach whilst being applicable to all habitats within each designated site. Table 6.27 presents the critical load and nitrogen deposition rates used in the assessment.

Table 6.27: Nitrogen Deposition Rates Predicted along Transects into the each of the Designated Sites for the Base, Do-Minimum and Do-Something Scenarios

Transect (Designated Site)	Nitrogen Deposition (N kg ha^{-1} yr^{-1})		
	Critical Load Range	Base Year (2015)	Opening Year (2019)
E1 – E5 (SSSI/SAC River Itchen)	10 - 20	16.7	15.4
E6 – E9 (SSSI Moorgreen Meadows)	10 -30	27.0	24.9
E10 – E14 (SPA Solent and Southampton Water)	8 - 30	11.4	10.5

Baseline nitrogen deposition rates in the SSSI/SAC River Itchen exceed the critical load range in the Base Year (2015) and Opening Year (2019) for Appraisal Option 1.

The change in nitrogen deposition rates due to Appraisal Option 1 for each designated site are presented in Table 6.28.

Table 6.28: Nitrogen Deposition Rates (kilogram of Nitrogen per hectare per year - kg N/ha/yr) predicted along transects for each of the Designated Sites in the Base (2015), Do-Minimum and Do-Something (2019) Scenarios

Receptor (Site)	Distance from the affected road (m)	Nitrogen Deposition (kg N/ha/yr)				
		Base	DM	DS	DS-DM Magnitude	Percentage Change DS-DM (%)
E1 – E5 (SSSI/SAC River Itchen) – transect off M27 between J5 – J6	13.6	19.2	17.7	17.6	0.0	-0.1%
	47.3	17.7	16.3	16.3	0.0	0.0%
	86.5	17.4	16.0	16.0	0.0	0.0%
	124.0	17.2	15.8	15.8	0.0	0.0%
	162.1	17.2	15.8	15.8	0.0	0.0%
E6 – E9 (SSSI Moorgreen Meadows) transect off M27 between J6 – J7	17.5	29.3	27.1	27.1	0.0	-0.1%
	68.9	28.0	25.9	25.9	0.0	0.0%
	119.9	27.7	25.6	25.6	0.0	0.0%
	168.4	27.6	25.5	25.5	0.0	0.0%
E10 – E14 (SPA Solent and Southampton Water) - transect off Northam Bridge	16.6	12.2	11.3	11.4	0.1	1.0%
	63.0	11.8	10.9	11.0	0.0	0.4%
	108.6	11.7	10.9	10.9	0.0	0.2%
	153.2	11.6	10.8	10.9	0.0	0.2%
	199.9	11.6	10.8	10.9	0.0	0.2%

Predicted nitrogen deposition rates for all scenarios are within the respective critical load ranges for all habitats in each designated site in both the Base and Opening Year. The impact of the Scheme on Nitrogen deposition is small for all receptors. The maximum impact is at the SPA Solent and Southampton Water off the A3204, with increases in deposition rates of up to 0.01 kg N kg ha^{-1} yr^{-1}. There are small decreases of deposition rates in the SSSI Moorgreen Meadows, and no changes in the SSSI/SAC River Itchen.

Overall, the increase in nitrogen deposition as a result of Appraisal Option 1 is at most 1.0% at all receptors, which constitutes a small to negligible change in nitrogen deposition, and these changes are at worst-case locations within 10-20m from the road. It should be noted this only applies to SPA Solent and Southampton Water, where nitrogen deposition rates are in the lower range of the critical load and are therefore of low risk of significant effects due to nitrogen levels in this ecosystem. These effects are also expected to dissipate with distance from the road.

As highlighted in the Biodiversity Chapter, due to protected species, habitats and sites in the vicinity of the scheme already being subjected to impacts associated with the roads in the area, it is unlikely that the scheme would have a significant effect on ecological designed sites.

6.8.10 Compliance Risk Assessment

The results from the operational local air quality operational assessment have been used to determine compliance risks with the EU Air Quality Directive, following the guidance set out within the IAN 175/13.

A comparison between the results of the local air quality operational assessment and those links reported by Defra in their PCM model as non-compliant are described below.

The comparison noted that three road links (A33, A35 and M27) are anticipated to be non-compliant with the AQS objective annual mean of 40 µg/m^3 for NO_2 for the opening year (2019) of the Scheme.

The PCM modelled links within 200 m of affected roads that were assessed are:

- A33 Redbridge Road Link, from where the A33 meets the A3024 up to the roundabout with the M271, and onto the A35 Redbridge Causeway;
- A35 link from the A33 Milbrook Roundabout to the A33 connection near Bassett Avenue;
- The M27 Link to the M3 via the A27; and
- The M27 motorway.

Table 6.29 presents the Compliance Risk Assessment Inputs and Outputs for each Appraisal Option which are further described below.

Table 6.29: Compliance Risk Assessment Inputs and Outputs

Inputs				Defra PCM Model and Compliance Information								
Scheme	Defra's PCM Data			Total NO2 (ug/m3)			Compliance Info		Annual Mean NO2 Concentration (ug/m3) (Nearest Receptor to Defra Link)			
				Proceeding Year	Following Year	Equivalent Opening Year	Maximum Modelled Conc in Zone 2015	Projected Compliance Year	DM	DS	Change (DS-DM)	Equivalend PCM DS (ug/m3)
HA Link ID	Defra Link Census ID	Zone / Agglomeration Ref No	Is it a Compliant Zone?	NO2 (T)	NO2 (T)	NO2 (T)						
APPRAISAL OPTION 1												
A33	56347	UK0019	No	50.1	46.3	48.3	54.8	2024	44.4	45.0	0.6	48.9
A35	6368	UK0019	No	48.9	43.6	46.3	57.7	2022	32.6	32.9	0.3	46.6
M27	75259	UK0019	No	48.1	43.8	46.1	51.7	2022	20.9	20.9	0.0	46.1
APPRAISAL OPTION 2												
A33	56347	UK0019	No	50.1	46.3	48.3	54.8	2024	44.4	44.6	0.2	48.5
A35	6368	UK0019	No	48.9	43.6	46.3	57.7	2022	32.6	32.7	0.1	46.4
M27	75259	UK0019	No	48.1	43.8	46.1	51.7	2022	20.9	20.9	0.0	46.1

HA Link ID	Compliance Descriptors						Outcome	
	A - Change (increase) greater than 1% of EU LV	B- Does the Scheme cause a compliant zone to become noncompliant?	C - Delay Defra Compliance?	D- Does the Scheme Increase Change in Road Length that Exceeds	E - Does the scheme worsen air quality overall?	If the answer to A,B,C or D is Yes Proceed to AQAP	AQAP effective?	Compliance Risk Rating (High / Neutral / Low)
APPRAISAL OPTION 1								
A33	1.2%	No	No	No	No	NA	Yes	Low
A35	0.6%	No	No	No	No	NA	Yes	Low
M27	0.0%	No	No	No	No	NA	Yes	Low
APPRAISAL OPTION 2								
A33	0.4%	No	No	No	No	NA	Yes	Low
A35	0.2%	No	No	No	No	NA	Yes	Low
M27	0.0%	No	No	No	No	NA	Yes	Low

As a result of Appraisal Option 1, 2019 annual mean NO_2 roadside concentration within the Millbrook Road and Redbridge Road AQMA (A33 PCM non-compliant link) results in a slight worsening of air quality at less than five receptors which exceed AAQS in the Opening Year. A maximum change of 1.2% of the Limit Value was predicted within this area. It is also worth noting that a 2019 Opening Year has been assumed, which is a few years before the anticipated first full operational year now expected for Appraisal Option 1 (2022). Based on the affected area within the A33 having active Air Quality Action Plans (AQAPs) in place, the assessment has resulted in a Low Risk outcome. The change might therefore be expected to be diminished from these predicted values as a result of improvements to ambient air quality due to vehicle turnover and technology improvements, as well as benefits from the Southampton CAZ.

A more detailed dispersion modelling assessment is recommended should Appraisal Option 1 be taken to PCF Stage 3, to establish better the risk of non-compliance.

All other non-compliant PCM links within our Appraisal Option 1 and 2 ARN were not predicted to have a worsening effect on these non-compliant areas and therefore considered unlikely to impact on compliance with the EU Air Quality Directive in the Opening Year. Based on available knowledge, both Appraisal Options are considered to be at Low Risk of non-compliance with the EU Air Quality Directive.

Based on this Low Risk outcome, an SAQAP should not be required. However, appropriate mitigation should be implemented at the non-compliant links associated with the Scheme to improve air quality within the area. The Southampton CAZ is aimed at providing immediate air quality improvements within these non-compliant areas.

6.8.11 Summary of Key Effects

The results from the operational air quality assessment of the two Appraisal Options indicated that Appraisal Option 1 led to some worsening at receptors that were already exceeding the AQS Objective annual mean for NO_2. This occurred at less than five worst-case receptors on the A33 Millbrook West Redbridge Road, located within the Millbrook Road and Redbridge Road AQMA (on the A33). These changes only account for a maximum of 1.5% of the AQS objective, which is a small change in the overall pollutant concentrations.

The evaluation of air quality significance based on key criteria highlighted in IAN174/13 indicated that neither Appraisal Option assessed are likely to lead to significant impacts on air quality. There is also a low risk regarding compliance with the EU Limit Values, as indicated by the PCM modelled link concentrations (paragraph 5.4.20).

It is recommended that further detailed investigations including more detailed dispersion modelling is undertaken during PCF Stage 3 to confirm these conclusions, and that best practice mitigation measures be incorporated into the final design of the Scheme to ensure impacts are kept to a minimum where possible.

6.9 References

1. The Air Quality Standards Regulations (2010). Statutory Instrument No. 1001. The Stationary Office.
2. Council of European Communities (1996). Framework Directive on ambient air quality assessment and management, European Council, 96/62/EC.
3. Council of European Communities (1997). Council Decision 97/1010/EC on exchange of information and data from as amended by Commission Decision, 2001/752/EC.
4. Council of European Communities (1999). First Daughter Directive on limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air, 1999/30/EC.
5. Council of European Communities (2000). Second Daughter Directive on limit values for benzene and carbon monoxide in ambient air, 2000/69/EC.
6. Council of European Communities (2002). Third Daughter Directive on ozone in ambient air, 2002/3/EC.
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9. Highways Agency (2007). DMRB, Volume 11, Section 3, Part 1 ‘Air Quality’ (HA 207/07).
10. Highways Agency (2012). Interim Advice Note 170/12 v3, Updated air quality advice on the assessment of future NOx and NO2 projections for users of DMRB Volume 11, Section 3, Part 1 ‘Air Quality’ (HA 207/07).
11. Highways Agency (2013a). Interim Advice Note 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 ‘Air Quality’ (HA 207/07).
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14. Southampton Air Quality Annual Status Report (2016).
15. Eastleigh Borough Council Air Quality Updating and Screening Assessment (2012).
16. Test Valley Air Quality Annual Status Report (2017).
17. Department for Environment Food and Rural Affairs (Defra) Website (https://uk-air.defra.gov.uk/aqma/list).
18. Air Pollution Information System (APIS) Website (http://www.apis.ac.uk).

19. Southampton City Council Website (https://www.southampton.gov.uk/planning/air-quality-planning).
20. Eastleigh Borough Council Website (https://www.eastleigh.gov.uk/waste,-recycling-environment/environmental-health/pollution/air/air-quality).
21. Test Valley Borough Council Website (https://www.testvalley.gov.uk/housingandenvironmentalhealth/environmentalprotection/air-quality).

7. Cultural Heritage

7.1 Legislative and policy framework

7.1.1 Legislation

There are several pieces of legislation relevant to the Scheme:

- The Ancient Monuments and Archaeological Areas Act (AMAAA) defines sites that warrant protection due to their being of national importance as 'ancient monuments' and ‘monuments’.
- The Planning (Listed Buildings and Conservation Areas) (P(LBCA)) Act 1990 highlights the desirability of preserving Listed Buildings and/or their settings, which should be considered when designing a scheme and in determining the planning application. Section 72 of the Act requires that schemes undertaken within conservation areas are designed to preserve or enhancing the character or appearance of that area.
- The Enterprise and Regulatory Reform Act 2013. This deregulatory legislation allows greater authority to local authorities in respect of Listed Building Consent. It also allows greater definition of a Listed Building by allowing the exclusion of attached buildings and structures and those within the curtilage of the principal Listed Building from protection. It states that a certificate of immunity from listing may be applied for at any time. The Act also removed the requirement for Conservation Area Consent; instead planning permission will be required for "relevant demolition", which includes unlisted buildings in conservation areas.
- The Treasure Act 1996 states that any finds of treasure and objects found in association with treasure must be reported to the local coroner.
- The Burial Act 1857 requires an appropriate license to be issued prior to removing human remains from any place of burial. At the current time, the Ministry of Justice is responsible for issuing these licenses.

7.1.2 National Policy

7.1.3 National Policy Statement for National Networks

The National Policy Statement for National Networks (NPSNN)[13] advises that the Secretary of State should also take into account the desirability of new development making a positive contribution to the character and local distinctiveness of the historic environment when considering the development application. The consideration of design should include scale, height, massing, alignment, materials, use and landscaping (for example, screen planting).

When considering the impact of a proposed development on the significance of a designated heritage asset, the Secretary of State should give great weight to the conservation of the asset. The more important the asset, the greater the weight should be placed on the conservation of the asset.

[13] National Policy Statement for National Networks (DfT, 2014); [online] available at: https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

The applicant will seek to minimise the loss of historic assets, through consideration of alignments and mitigation of the scheme, where required. They will also seek to minimise adverse effects on the setting of historic assets and where feasible, obtain improvement through high quality design, materials and landscaping.

7.1.4 National Planning Policy Framework

Section 12 of the National Planning Policy Framework (NPPF) covers cultural heritage, it states that development should conserve heritage assets*" in a manner appropriate to their significance"* so that they may be enjoyed for their contribution to the quality of life for this and future generations[14].

It also states that when determining applications for proposed schemes, the Local Planning Authority should consider heritage assets and that the applicant must outline *". . .the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance."* [15]

All Sub-schemes, require land take in varying amounts either on a permanent or in the case of construction compounds, temporary basis. Where there is land take, of previously undeveloped land there is the potential to affect buried and surface archaeological remains (earthworks) within the footprint the Sub-scheme. According to the NPPF, these locations will need to be investigated further to determine the significance of any heritage assets that may be present. It is unlikely that there will be archaeological remains buried beneath the existing carriageway as the construction of the road is likely to have removed any archaeology, but this will be considered in future assessment stages.

There is also a risk that development of the scheme will impact on the setting of designated and non-designated heritage assets, contrary to NPPF and the SCC Local Plan[16]. The assessment will consider the location of each sub-scheme in relation to the heritage assets identified. Additional measures will be identified as the scheme design is developed at PCF Stage 3.

7.1.5 Local Policy

Southampton City Council Local Plan

Policy CS14 *Historic Environment* of the SCC Local Plan is particularly relevant to cultural heritage. The Policy advises that the Council safeguard important historical assets and their settings alongside the character of areas of acknowledge importance including listed buildings, conservation areas, sites of archaeological importance and their setting and parks and gardens of special historic interest. The Council will promote the retention of buildings and structures of local architectural or historical importance identified on the Local List.

[14] Department for Communities and Local Government; *National Planning Policy Framework* p.30; [online] available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2. Accessed 02/11/2017
[15] Department for Communities and Local Government; *National Planning Policy Framework* p.30; [online] available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2. Accessed 02/11/2017
[16] Southampton City Council; Local Plan: [online] available at: http://www.southampton.gov.uk/planning/planning-policy/default.aspx

Furthermore, the policy requires that the promoters of any proposed developments within the city centre pay particular attention to the medieval walled town and the Saxon town (Hamwic) remains, these are nationally important assets. If necessary proposals should reinstate the historic street pattern: and

Any new development should reflect and respect the underlying archaeology of the area. Damage of archaeological deposits should be avoided, if feasible, and where damage is unavoidable appropriate mitigation measures should be in place. Historic assets (such as buildings) should be re-used if feasible.

City of Southampton Core Strategy

The City of Southampton Core Strategy 2010 identifies several Local Areas of Archaeological Potential (LAAPs), which replace Local Areas of Archaeological Importance (LAAI) defined in the Local Plan 2006. Some 16 LAAPs are identified in Southampton, archaeological evaluation and possible mitigation work are likely to be required in these areas in advance of building commencing.

7.2 Study area

Two study areas were utilised for the proposed scheme, one for non-designated assets and another wider study area for designated assets.

Data have been collected to determine the presence of non-designated assets within a study area of 200 m from the likely construction footprint of the sub-schemes. This is considered sufficient to provide essential historic and archaeological contextual background for the Scheme.

A 500 m study area was applied for consideration of impacts upon the setting for designated heritage assets; comprising World Heritage Sites, Scheduled Monuments, Listed Buildings, and Registered Historic Parks and Gardens. This study area is considered to be sufficient due to the low-lying nature of the scheme and the urban and built up character of the environment in which it is set.

7.3 Baseline conditions (including value/sensitivity of resources and receptors)

There are no World Heritage Sites or sites included on the Tentative List of Future Nominations for World Heritage Sites (July 2014), Registered Historic Parks and Gardens, Registered Battlefields or Conservation Areas within 500m of any of the scheme.

For ease of reference the baseline condition and value/sensitivity of receptors are described below for each of the sub scheme, Tables 6.1 to 6.5 detail the historic environment receptors within the study area and their respective sensitivity for each sub scheme.

7.3.1 Sub Scheme 1

Heritage Assets

Table 6.1 summarises the heritage assets within 500 m of Sub-scheme 1. These assets are presented in Appendix 6.1, **Error! Reference source not found.** Drawing Reference HE551514 - WSP - GEN - M27 - FI - GIS – 0009).

While there are no listed buildings within the footprint of Sub-scheme 1, there are three listed buildings within the 500 m of Sub-scheme 1.

Table 7.1: Key Heritage Asset Receptors for Sub-Scheme 1

Heritage Asset Type	Asset Name	Value of Receptor[17]	Distance from centre point of Sub scheme 1 (NRG SU 4811 2209)
Grade II* Listed Buildings and their settings	Bursledon Windmill (1281479)	High	275m south
Grade II Listed Buildings and their settings	Dodwell Cottage (1111965),	Medium	491m west
	Granary adjacent to Burseldon Windmill[18] (111940)	High (categorised as high value giving regards to its proximity to the Grade II* listed structure of Burseldon Windmill	308m south
Potential below-ground/surface archaeological remains	Potential archaeological remains from the Prehistoric (500,000 – AD 43), Romano-British (AD 43 – AD 410) and Early Medieval (AD 410 – AD 1066) Periods.	Unknown	

Potential for Previously Unrecorded archaeology to be present

There are no known below-ground heritage assets within 200 m of Sub-scheme 1. There are known assets in the wider study area. Prehistoric activity has been identified in the form of a Bronze Age barrow cemetery located 1 km to the northwest of Sub-scheme 1.

Romano-British occupation and activity is indicated by the site of Bitterne (Clausentum) Roman station approximately 4km to the west of the Sub-scheme and the Roman road between Bitterne and Chichester lies approximately 1km to the north of the Sub-scheme.

Anglo-Saxon activity is evidenced by the site of the Anglo-Saxon settlement of *Hamwic* 5km to the west of the Scheme, and the site of an Anglo-Saxon cemetery at Bitterne Manor which is located 5 km to the north-west of the Sub-scheme**.**

[17] Refer to Table 6.8
[18] Formerly known as 'Granary to south of Hiltonbury Farmhouse, Hurseley Road'

7.3.2 Sub Scheme 2

Heritage Assets

Table 6.2 summarises the heritage assets within 500 m of Sub-scheme 2. These assets are presented in Appendix 6.2, **Error! Reference source not found.**.

Table 7.2: Key Heritage Asset Receptors for Sub-scheme 2

Heritage Asset Type	Asset name	Value[19]	Distance from Sub-scheme 2 (A3024)
Scheduled Monuments and their settings	Bitterne (Clausentum) Roman station (SM1005538)	High	Adjacent to the A3024 at Bitterne (west of the railway line)
	Roman piers and revetment in the River Itchen (SM1425731)		296m north-north-west from SU 4313 4833
Grade II Listed Buildings and their settings	Church of St Augustine (1339987)	Medium	26m west from SU 4312 0654
	Bitterne Manor (117845)		102m north-west from SU 4313 4430
	Church of the Holy Saviour (1339965)		102m south-west from SU 4512 2996
	1 Vespasian Road (1091984)		208m north from SU 4313 7036
Locally Listed Buildings and their settings	90 Northam Road (DSH435)	Low	413m south-west from SU 4312 0245;
	92 Northam Road (DSH436),		407m south-west from SU 4312 0245;
	Cobbett Road Library (DSH483),		Adjacent to A3024 at SU 4413 1330
	88 Northam Road (DSH434)		416m south-west from SU 4312 0245;
	Gasholder Station (DSH408)		198m south from SU 4312 0245;
	86 Northam Road (DSH526),		422m south-west from SU 4312 0245;
	216 to 238 and 238A Northam Road (DSH437),		40m south from SU 4312 1780;
	51 and 53 Northam Road (DSH427),		464m south-west from SU 4312 0245;
	84 Northam Road (DSH433),		430m south-west from SU 4312 0245;
	82 Northam Road (DSH432),		440m south-west from SU 4312 0245;
	80 Northam Road (DSH431),		448m south-east from SU 4312 0245;
	78 Northam Road (DSH430),		450m south-west from SU 4312 0245
	74 to 76 Northam Road (DSH429),		458m south-west from SU 4312 0245
	72 Northam Road (DSH428),		466m south-west from SU 4312 0245
	Northam Primary School Community Centre and "House by the School", (DSH416),		100m east from SU 4312 0243;
	Britannia Court, Flats 1 to 18, Britannia Road (DSH407),		418m south from SU 4312 0245
Non-designated	Anderson air raid shelter (MSH5682)	Low	Unknown

[19] Refer to Table 6.8

Heritage Asset Type	Asset name	Value[19]	Distance from Sub-scheme 2 (A3024)
historical buildings	A late 19th century public house, previously known as the Glebe Hotel (MSH3492)		Unknown
	The Prince of Wales Public House (MSH5045)		Unknown
	216 to 238 and 238A Northam Road (MSH3502; also, locally listed)		40m south from SU 4312 1780;
	60, 62 and 64 West End Road (MSH3872)		175m north from SU 4513 1612
	208a to 214 Northam Road (MSH3811)		Unknown
	Southampton Gas Holder Station in Britannia Road - Gas Holder No.9 (MSH459; also, locally listed)		198m south from SU 4312 1780;
	Bitterne Station (MSH5711).		37m south from SU 4313 9134
Known and potential buried/surface archaeological remains	Known and potential archaeological remains, particularly from the Prehistoric (500,000 – AD 43), Romano-British (AD 43 – AD 410), Early Medieval (AD 410 – AD 1066), Late Medieval (AD 1066-1750) and Industrial (c.1750 – 1901) Periods LAAP 8, 11, 12 and 16	Low-High	LAAP 11, 12 and 16 are within the red line boundary and LAAP 8 is 8m from the western end of Sub-scheme 2.

Scheduled Monuments

There are no Scheduled Monuments within the Sub-scheme boundary. There are two Scheduled Monuments within the 500m study area (Bitterne (Clausentum) Roman station, located either side of the A3204; and Roman piers and revetment in the River Itchen located to the 29m north of the Sub-scheme 2 corridor.

Historic Buildings

There are no listed or locally listed historic buildings within the Sub-scheme boundary. However, there are four Grade II listed buildings and 16 Locally listed buildings within 500m of the sub-scheme corridor.

There are eight non-designated historic buildings within the study area which have been highlighted by SCC as holding local historical value; two of which are also locally listed.

Known below-ground/surface archaeological remains

There are five heritage assets extending into the maximum likely physical extent of Sub-scheme 2. These are detailed below in

Table 7.3 and comprise the route of the Roman road between Clausentum and Chichester (MSH550), the site of Northam Marsh (MSH5699), the site of the Netley Branch Railway (MSH5710), the suggested route of Roman Aqueducts (MSH394), and the site of an Anglo-Saxon route-way (MSH2063).

Table 7.3: Known Below-ground/Surface Archaeological Remains within the Footprint of Sub-Scheme 2

HER Number	Name / Description	Value[20]	Historic Period
MSH5699	Site of Northam Marsh	Negligible to Medium	Prehistoric (500,000BC to 43 AD onwards
MSH5710	Site of Netley Branch Railway		Industrial (1750 to 1901 AD)
MSH394	Bitterne - Suggested Routes of Roman Aqueducts		Romano-British (43 to 410 AD)
MSH2063	Derby Road - site of Saxon route and later country lane		Early Medieval (410 to 1066 AD)
MSH550	Route of the Roman Road between Clausentum and Chichester		Romano-British (43 to 410 AD)

[20] Refer to Table 6.8

A number of below-ground heritage assets have also been identified in the 200m study area, these are largely associated with the settlement of Southampton in the Romano-British and Anglo-Saxon periods. There are eleven assets dating to the Industrial Period which relate to transport, industry and habitation. These assets are presented in Appendix B1 of the ESR prepared for PCF Stage 1 (WSP, December 2016).

Potential for Previously Unrecorded archaeology to be present

The Sub-scheme extends through four LAAPs. These are described below:

- "City Centre and Itchen Ferry (LAAP 8)

  This area includes the peninsula of land defined by the River Itchen and River Test, the adjacent estuarine areas and Itchen Ferry on the east bank of the Itchen.

  In the area between the Test and Itchen, the main interest lies in the historic towns established from the 8th century onwards (and their complex developments up to the present day), the common fields immediately adjacent to these places, the medieval ribbon suburbs to the north and east, the sites of two medieval chapels (St Andrews and Holy Trinity), a large number of mills (variously driven by wind, horses, or water), public buildings around the stream of Houndwell, the Leper Hospital and its fields, and the different shorelines and quays. Also of interest are the places where there were later industries, an example of which is the 19th century cannon foundry in Chapel Road. Evidence of Prehistoric and Roman settlement has also been found in this area.

  The ferry crossing on the River Itchen was in existence by the end of the Middle Ages, and probably existed much earlier. On the west bank, Cross House was built in the medieval period as a ferry passenger shelter. On the east bank the crossing point was the village of 'Itchyng' (now Itchen Ferry), which is medieval.

  The area includes the Old Docks, built on reclaimed land from the mid-19th century onwards, and the New Docks, reclaimed and constructed in the early 20th century.

  The drowned lower valleys of the River Itchen and River Test preserve river terrace and peat deposits - the remains of prehistoric landscapes. These deposits and the overlying estuarine muds may contain the remains of maritime vessels of all periods. . .

- Bitterne Manor and Southern St Denys (LAAP 11)

  This includes the Bitterne Manor peninsula on the east shore of the River Itchen, the south part of St Denys on the west shore, together with the adjacent river between.

  At Bitterne Manor, there is evidence of prehistoric occupation, including a Bronze Age cremation burial.

  Bitterne Manor was the site of a Roman town, with defences and quaysides. A possible Roman cremation cemetery has been found to the east of the defences. The Roman road from Chichester terminates here, and a possible route from Winchester. A Roman settlement has been found across the river at St Denys, including evidence of waterfront structures in the intertidal zone. This was perhaps at the end of another road from Winchester.

There is a Saxon inhumation cemetery at Bitterne Manor, and it was probably a Late Saxon fort. It was the site of a medieval bishop's palace.

The hulks of 19th and 20th century maritime craft can be seen in the intertidal mud of the Itchen Estuary. The remains of vessels from prehistoric, Roman and later times may be present.

- Northam (LAAP 12)

  This area includes the shores of the Northam peninsular and adjacent parts of the River Itchen. Prehistoric finds discovered in the area include a Bronze Age rapier. Roman finds have also been made. There may have been a river crossing here. The area is referred to in 842 AD as North Hamwic. The Hegestone was a medieval boundary stone. Burials were found near the stone in the 19th century. From the 17th century onwards, the waterfront was developed for shipbuilding and other industries. The River Itchen deposits preserve the remains of prehistoric landscapes and may contain the remains of maritime vessels of all periods. . .

- The Rest of Southampton - Area of Potential Archaeological Importance (LAAP 16)

  Area 16 has not been formally marked on the map, but it encompasses the parts of the city not marked as areas 1 to 15. Anywhere within the city boundary is an area of potential archaeological importance, about which little is known at the moment. An example is any stretch of land between two designated areas. Other, more specific, examples are the many small sites that are too small to show on the accompanying maps: industrial works such as brick manufacturies, isolated buildings such as farms and country houses, and the immediate surroundings of such places." [21]

  The areas have been classified by SCC as likely to require archaeological evaluation and possible mitigation work in advance of building commencing.

7.3.3 Sub scheme 3 – Northam Road Rail Bridge Replacement

Heritage Assets

Table 6.4 summarises the heritage assets within 500 m of Sub-scheme 3. These assets are presented in Appendix 6.1, **Error! Reference source not found.**3.

Table 7.4: Key Heritage Asset Receptors for Sub-Scheme 3

Heritage Asset Type	Asset Name	Value[22]	Distance from centre point of Northam Road Rail Bridge (NRG SU421 933)
Grade II Listed Buildings and their settings	Church of St Augustine (1339987)	Medium	358m north-east;
	St Mary's Hall 76 St Mary's Street (1393939)		459m south-west;
	Lamp standard in centre of paved area at western end of Bevois Street (1178432)		451m south-west;
	No 33 Palmerston Road (1179004)		655m west

[21] http://www.southampton.gov.uk/images/laaps%20descriptions_tcm63-360361.pdf
[22] Refer to Table 6.8

Heritage Asset Type	Asset Name	Value[22]	Distance from centre point of Northam Road Rail Bridge (NRG SU421 933)
	No 32 Palmerston Road (1339991)		655m west
	Nos 30 and 31 Palmerston Road (1092031)		655m west
	No 2 New Road (1092025)		653m west
Locally Listed Buildings and their settings	92 Northam Road (DSH436),	Low	107m south-west;
	90 Northam Road (DSH435),		112m south-west;
	88 Northam Road (DSH434),		115 m south-west
	Gasholder Station (DSH408),		Within scheme boundary
	86 Northam Road (DSH526),		117m south-west;
	51 and 53 Northam Road (DSH427),		123m south-west;
	84 Northam Road (DSH433),		136m south-west
	82 Northam Road DSH432),		141m south-west
	80 Northam Road (DSH431),		146m south-west;
	78 Northam Road (DSH430),		154m south-west
	74 to 76 Northam Road (DSH429),		162m south-west
	72 Northam Road (DSH428),		167m south-west
	2 Northam Road (DSH426)		330m north-east
	Northam Primary School Community Centre and "House by the School", Peel Street (DSH416),		392m west
	St Matthews Church, St Marys Road (DSH449),		294m south
	St Mary's School, Ascupart Street (DSH370),		410m south-west
	120 St Mary Street (DSH455),		420m north-west
	Argyle Centre (DSH369),		282m south-east
	Britannia Court (DSH407),		410m south-east
	128 St Mary's Road (DSH450),		442m south-west
	James Street Evangelical Church (DSH494),		485 south-west
	Plumes of Feathers Public House, 73 St Mary Street (DSH453),		470m south-west
	135 St Mary Street (DSH456),		500m south-west
	141 St Mary Street (DSH457),		638m south-west
	Eve of "Adam and Eve" sculptures, Kingsland Estate, Cossack Green (DSH485)		597m north-east;
	216 to 238 and 238A (evens) Northam Road (DSH437)		107m south-west;
Non-designated historical	Southampton Gas Holder Station in Britannia Road - Gas Holder No.9 (MSH459l; also, locally	Low	Within scheme boundary

Heritage Asset Type	Asset Name	Value[22]	Distance from centre point of Northam Road Rail Bridge (NRG SU421 933)
buildings	listed) and Gas Holder No.1 (MSH244; also, locally listed).		
	St Matthew's Church (MSH3513: also, locally listed),		294m south
	129 and 131 Northam Road (MSH3924).		11m west
Known and potential buried/surface archaeological remains	Particularly from the Prehistoric (500,000 – AD 43), Romano-British (AD 43 – AD 410), Early Medieval (AD 410 – AD 1066) and (*C.*1750 – 1901) Periods. LAAP 8[23]	Low-High	LAAP 8 is within the scheme boundary and the wider vicinity

Scheduled Monuments

There are no Scheduled Monuments within the maximum extent Sub-scheme 3 or the 500m study area.

Historic Buildings

There are no listed buildings within the footprint of the Sub-scheme 3. However, the Southampton Gasholder Station (MSH459), a locally listed structure, has been identified as the potential location for the construction compound, for Sub-scheme 3.

There are seven Grade II listed buildings and 26 Locally listed buildings within the 500m study area.

There are four non-designated historic buildings within the study area which have been highlighted by SCC as holding local historical value, three of these are also locally listed. These assets are presented in **Heritage Assets**

Table 6.4 summarises the heritage assets within 500 m of Sub-scheme 3. These assets are presented in Appendix 6.1, **Error! Reference source not found.**3.

Table 7.4**.**

Known below-ground/surface archaeological remains

There are three heritage assets which extend into the Sub-scheme boundary. These are detailed below in **Table 7.** and comprise the site of Former Northam Marsh (MSH5699), the Netley Branch Railway (MSH5710) and the site of a Saxon route and later country lane (MSH2063).

Table 7.5: Known Below-ground/Surface Archaeological Remains within the Footprint of Sub-Scheme 3

HER Number	Name / Description	Value[24]	Historic Period
MSH5699	Site of Northam Marsh	Negligible - Low	Industrial (1750 to 1901)

[23] Local Areas of Archaeological Potential
[24] Refer to Table 6.8

HER Number	Name / Description	Value[24]	Historic Period
MSH2063	Derby Road - site of Saxon route and later country lane		Early Medieval (410 to 1066)
MSH5710	Site of Netley Branch Railway		Industrial (1750 to 1901)

Four of below-ground heritage assets present in the 200m study area and are largely associated with the settlement of Southampton in the Anglo-Saxon period. There are nine assets dating to the Industrial period which relate to transport, industry and habitation. These assets are shown in Appendix B1 of the ESR prepared for PCF Stage 1 (WSP, December 2016).

Potential for Previously Unrecorded buried archaeology to be present

The Sub-scheme is located within the City Centre and Itchen Ferry (LAAP8). LAAP8 includes the peninsula of land defined by the River Itchen and River Test and adjacent estuarine areas for details of this LAAP please refer to Section 6.3.2.

7.3.4 Sub Scheme 5

Table 6.6 summarises the heritage assets within 500 m of Sub-scheme 5. These assets are presented in Appendix 6.1, **Error! Reference source not found.**4.

Heritage Assets

Table 7.6: Key Heritage Asset Receptors for Sub-Scheme 5

Heritage Asset Type	Asset name	Value[25]	Distance from centre point of Bitterne Road Bridge (NRG SU431 923)
Scheduled Monuments and their settings	Bitterne (Clausentum) Roman station (SM1005538)	High	163m west; and approximately 55m to the south - adjacent to either side of the A3024
	Roman piers and revetment in the River Itchen (SM1425731)		560m north west.
Grade II Listed Buildings and their settings	Bitterne Manor (117845)	Medium	550m west
	1 Vespasian Road (1091984),		334m north-west
Locally Listed Buildings and their settings	Cobbett Road Library (DSH483)	Low	220m east
Known and potential buried/surface archaeological remains	Particularly from the Roman, Medieval and Industrial Periods. LAAP 11 and LAAP 16	Low-Medium	LAAP 11 and LAAP 16 are in the red line boundary and extend into the wider vicinity.

Scheduled Monuments

There are no Scheduled Monuments within the footprint of Sub-scheme 5. There are two Scheduled Monuments within the 500m study area.

Historic buildings

There are no listed or locally listed buildings within the footprint of the Sub-scheme. There are two Grade II listed buildings and one Locally listed building within the 500m study area which are presented above in

[25] Refer to Table 6.8

Table 7.7. Neither of the Grade II listed buildings have any inter visibility with the Sub-scheme, Bitterne Manor House is set back in the grounds and 1 Vespasian Road is separated from the Sub-scheme by residential development.

Known below-ground/surface archaeological remains

There are two heritage assets within the maximum extent of the Sub-scheme which are presented below in Table 6.7 and comprise the route of the Roman road between Clausentum and Chichester (MSH550); and the suggested routes of Roman Aqueducts (MSH394).

Table 7.7: Known Below-ground/Surface Archaeological Remains within the Footprint of Sub-Scheme 5

HER Number	Name / Description	Value[26]	Historic Period
MSH550	Roman road between Clausentum and Chichester	Low-Medium	Romano-British (43AD to 410)
MSH394	Bitterne - Suggested Routes of Roman Aqueducts		Romano-British (43AD to 410)

[26] Refer to Table 6.8

A number of below-ground heritage assets have been identified in the 200m study area. Three are associated with the settlement of Southampton in the Romano-British Period and five are associated with the Industrial Period; in particular transport, industry and habitation related.

Potential for Previously Unrecorded buried archaeology to be present

The Sub-scheme boundary extends through LAAP 11 *Bitterne Manor and Southern St Denys* and LAAP 16 *The Rest of Southampton*. For descriptions of the LAAPs please refer to Section 6.3.2.

7.4 Potential impacts

- The CIfA 'Standard and Guidance for Historic Environment Desk-based Assessment' (2014) considers that an assessment of the significance of heritage assets should identify the potential impact of proposed or predicted changes on the significance of the asset and the opportunities for reducing that impact. Impacts associated with the proposed Scheme are: potential disturbance to known and unknown buried archaeology (both designated and non-designated). Any groundworks involved (including topsoil stripping and excavations for drainage) have the potential to disturb or cause the loss of potential remains especially within areas of previously undeveloped land, e.g. on the construction compounds at Junction 8 of the M27 and Windhover Roundabout.
- Changes to setting of designated assets as a result of lighting and acoustic intrusion due to the activities and plant; and as a result of increased traffic, both during construction and operational phases.

Under the 2017 EIA Regulations there is a requirement to consider the expected effects arising from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the proposed Scheme. Major accidents and/or disasters will not result in any likely significant effects in the context of cultural heritage.

7.5 Assessment methodology

7.5.1 Terminology

The technical terminology applied to the assessment process in this document is based Historic England guidance The Setting of Heritage Assets, Good Practice Advice in Planning:3 (2015) and the Cultural Heritage Section (Volume 11, Section 3, Part 2) of the DMRB (Highways Agency, 2007).

7.5.2 Standards and guidance

This assessment has also been written in compliance with the NPPF and in accordance with the following relevant professional guidelines: Chartered Institute for Archaeologists (CIfA) Standard and Guidance for Historic Environment Desk-based Assessment (2014); CIfA Code of Conduct (2014); and Historic England (2015) Management of Research Projects in the Historic Environment (MoRPHE).

7.5.3 Sensitivity or importance of the asset

For the two-relevant cultural heritage sub-topics (Archaeological Remains and Historic Buildings), an assessment of the value of the heritage assets within the study areas has been undertaken on a five-point scale of Very High, High, Medium Low, Negligible and Unknown according to the criteria provided in Table 6.8.

Table 6.8: Assessing the value of cultural heritage receptors

Resource value	Criteria
Very High	World Heritage Sites (including buildings and those inscribed for their historic landscape qualities) Assets of acknowledged international importance Assets that can contribute significantly to acknowledged international research objectives Extremely well-preserved historic landscapes with exceptional coherence, time-depth or other critical factors
High	Scheduled Monuments (including standing remains) Designated historic landscapes of outstanding interest Undesignated assets of schedulable quality and importance Assets that can contribute significantly to national research objectives Grade I and II* Listed Buildings Other Listed Buildings that can be shown to have exceptional qualities in their fabric or historical associations Conservation Areas containing very important buildings Undesignated structures of clear national importance Undesignated landscapes of outstanding interest, high quality or importance and of demonstrable national value Well-preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factors.
Medium	Designated or undesignated assets that contribute to regional research objectives Undesignated historic landscapes that would justify special historic landscape designations, or landscapes of regional value Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor Grade II Listed Buildings Conservation Areas containing buildings that contribute significantly to its historic character Historic Townscape or built-up areas with important historic integrity in their buildings, settings or built settings.
Low	Designated and undesignated assets of local importance Robust undesignated historic landscapes and historic landscapes with importance to local interest groups Historic landscapes whose value is limited by poor preservation and / or poor survival of contextual associations 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 '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. Locally Listed Buildings
Negligible	Assets with very little or no surviving archaeological interest Buildings of no archaeological or historical note, or buildings of an intrusive character Landscapes with little or no significant historical interest.

Unknown	The importance of the resource has not been ascertained, or buildings with some (hidden) potential for historical significance.

7.6 Assessment assumptions and limitations

Baseline data gathered at PCF Stage 1 have been used to inform the assessment. Other than a review of readily available information from the on-line Southampton Historic Environment Record (HER), no additional data collection has been undertaken as it was not deemed necessary due to the limited time period elapsed since completion of PCF Stage 1 (12 months).

No site visit has been undertaken by an archaeologist to inform the EAR; therefore, comments relating to the impact of the Sub-schemes on the setting of the heritage assets is based upon readily available desk based information (including Google Earth) and must therefore be seen as provisional.

At PCF Stage 1, there was no consideration of urban environment, this EAR provides and update of the stage 1 assessment and having given regards to the urban setting of the proposals it is considered that the exclusion of historic environment is reasonable at this stage of design. At PCF Stage 3, it is recommended a formal Scoping exercise be undertaken with the relevant statutory consultees to confirm the 'Scoping out' of historic environment.

To inform PCF Stage 3 assessment, baseline data should be reviewed and updated and a site visit by an appropriately qualified archaeologist should be undertaken to inform the assessment of setting of the historical built environment.

No intrusive investigations have been undertaken to inform the assessment, therefore worst-case scenario has been assumed in the assessment of significance. At PCF Stage 3 focused intrusive investigations should be considered to refine the assessment.

7.7 Design, mitigation and enhancement measures

Historic England (2015) guidelines for mitigation of the impact of a development on the setting of a heritage asset advise that in the first instance impacts should be mitigated for either by relocation of the development or changes to its design. Where relocation of the development is not feasible, good design alone may be capable of reducing any harm. High quality design will be particularly important for the junction options that may have an adverse effect on the setting of heritage assets. Throughout the development and refinement of options at PCF Stage 2 consideration has been given to minimising the land take required beyond the existing highway boundary. During PCF Stage 3, further refinements to alignment and works will be made

Northam Road Rail Bridge and the gas holders on the Britannia Road Gas Works site (Sub-scheme 3) are to be subject to an Historic England standard building investigation prior to demolition or structural alterations.

Sub-schemes 2 and 5 lie close to Bitterne (Clausentum) Roman station (Scheduled Monument 1005538). Construction activities within any areas of land take close to this designation have the potential to directly or indirectly physically harm this nationally importance asset. The AMAAA advises avoidance of

Scheduled Monuments. Any impact on this asset, either physical or upon its setting will be discussed with Historic England.

For all Sub-schemes, there is considered to be potential for undisturbed below-ground archaeological remains to be present. The value of these assets is unknown therefore taking a worst-case scenario and giving regards to table 4.4, the significance of the effect is assumed to be 'moderate/large' adverse. However, through undertaking of a detailed desk based assessment and if required intrusive investigations, any impacts to this heritage asset can likely be mitigated and resultant impacts thus might be considered likely to not be significant. (Requirement for intrusive investigations will depend upon the extent of physical works).

7.8 Assessment of effects

7.8.1 Appraisal Option 1

Sub-scheme 1

Construction

The majority of construction works will take place within the highway boundary, which has limited potential for undisturbed below-ground archaeological remains as a result of previous road works. The potential for undisturbed below-ground archaeological remains to be present is considered to be low.

In areas where carriageway widening is proposed and on the site of the proposed compounds, the ground has previously been undisturbed. Works in these areas have the potential to disturb below-ground remains that survive within undisturbed ground. Any groundworks involved in creating the compounds and widening (including topsoil stripping and excavations for drainage) have the potential to disturb or cause the loss of potential remains. The value of these assets is unknown therefore taking a worst-case scenario and giving regards to table 4.4, the significance of the effect is assumed to be 'moderate/large' adverse.

The Bursledon Windmill should not undergo a setting impact as it is removed from both roundabouts and the works proposed on them. Furthermore, it is screened from view by mature vegetation surrounding it. The magnitude of impact on the setting of this listed building, will not be noticeably greater than that which the Windmill is subject to at present, the magnitude of any impact during construction phase is therefore considered to be 'no change' The resultant significance is (refer to Table 4.4) is therefore 'neutral'.

The impacts to the Granary adjacent to Bursledon Windmill are considered to be similar to those experienced by the Windmill.

Dowell Cottage is situated adjacent to Junction 8. During construction, there is potential for visual impact to this listed building, as a result of lighting and acoustic intrusion due to the activities and plant likely to be in proximity of the asset during works. The magnitude of impact is a minor setting impact during the course of works as the disruption will only be moderately more noticeable than that presented by the current road layout and only for a short duration. The resultant significance to Dowell Cottage during the construction phase is therefore slight adverse effect.

Operation

During operation, it is considered that the new road layout will not generate any significantly greater impact than which the current Junction 8 and Windhover Roundabout layout already present. As the impact is considered to be similar to that already present (i.e. 'no change'), it is considered there will no significant effect upon the setting of designated assets during the operational phase. The resultant significance during the operational phase is therefore 'neutral'.

Sub scheme 2

Construction

The majority of construction works will take place within the highway boundary, which has limited potential for undisturbed below-ground archaeological remains as a result of previous road works. The potential for undisturbed below-ground archaeological remains to be present is considered to be low.

In areas where carriageway widening is proposed and on the site of the proposed compounds, the ground has previously been undisturbed. Works in these areas have the potential to disturb below-ground remains that survive within undisturbed ground. Any groundworks involved in creating the compounds and widening (including topsoil stripping and excavations for drainage) have the potential to disturb or cause the loss of potential remains. The value of these assets is unknown therefore taking a worst-case scenario and giving regards to table 4.4, the significance of the effect is assumed to be 'moderate/large' adverse construction effects on any archaeological remains.

The scheduled moment, Bitterne (Clausentum) Roman Station lies to adjacent to the Sub-scheme boundary, although no works are currently proposed adjacent to the boundaries. Given the proximity of the asset to the works areas, there is considered to be limited potential for the disturbance of known and potential non-designated buried/surface archaeological remains. The asset is designated for below ground features, there are no works proposed in its immediate proximity and as it is a below ground feature, its setting does not contribute toward its significance, therefore, the magnitude of impact to this feature is considered to be 'negligible'. The resultant significance is therefore 'slight adverse'.

There are four listed buildings within the study area, during construction there is limited potential for visual impact to these structures, as a result of lighting and acoustic intrusion due to the activities and plant as slight lines are limited. For those structures which do experience an impact, it is not likely to be noticeably greater than that which they are subject to at present, the magnitude of any impact during construction phase is therefore considered to be 'no change' The resultant significance is therefore 'neutral'.

Operation

During operation, due to the proposed scale of the Sub-scheme, its proximity to the existing highway boundary and the location of designated heritage assets in relation to works, it is considered there will 'no change' to impacts on designated assets. The resultant significance is therefore neutral.

The scheduled moment, Bitterne (Clausentum) Roman Station which lies to adjacent to the Sub-scheme, is designated for below ground features, therefore it is considered it will not be impacted during the operational phase (despite its

proximity) as it is a below ground feature, and thus its setting does not contribute toward its significance. The resultant significance is therefore neutral.

Sub-scheme 3

Construction

There are no scheduled monuments or listed buildings in the immediate vicinity of Northam Road Rail Bridge. There is one locally listed structure within the scheme boundary, this is the gas holder site at Britannia Road. This heritage asset is considered to be of low importance. Site preparation of the proposed construction site will involve the removal of one or both of the gas holders, resulting in a permanent moderate/large adverse effect. Furthermore, any groundworks in this area, including excavations for drainage, has the potential to disturb; or cause the loss of, unknown archaeological remains which there is considered to be potential for within the site. Giving regards to Table 4.4, the significance of the effect is 'minor' adverse impact.

The majority of construction works will take place within the highway boundary, which has limited potential for undisturbed below-ground archaeological remains as a result of previous road works. The potential for undisturbed below-ground archaeological remains to be present is considered to be low.

To the north of Northam Road Rail Bridge, the proposals require land take of mainly vegetated areas. Any earthmoving activity within areas of land that has not been subject to any previous disturbance has potential to cause the loss and disturbance of known and unknown buried/surface archaeological remains, the impact of which is considered to be potentially moderate to large adverse. Giving regards to Table 4.4, the significance of the effect is assumed to be 'moderate/large' adverse effect on any archaeological remains.

Operation

During operation, other than allowing a great volume of traffic to pass over, the operation of the newly construction Northam Road Rail Bridges, will not differ to how it currently operates. Therefore, it is considered there will no significant effects upon the designated assets and non-designated assets, and their settings, within 500m of the bridge. The resultant significance is therefore neutral.

Sub scheme 5

Construction

The majority of works associated with Sub-scheme 5 are within the existing highway boundary, which has previously been disturbed by prior works related to the A3042. Therefore, giving regards to the type of and scale of the works, there is considered limited potential for impacts upon cultural heritage assets.

The scheduled moment, Bitterne (Clausentum) Roman Station lies approximately 55m to the south of the Sub-scheme at its closest point. Given the proximity of the asset to the works areas, there is considered to be limited potential for the disturbance of known and potential non-designated buried/surface archaeological remains. The asset is designated for below ground features, there are no works proposed in its immediate proximity and as it is a below ground feature, its setting does not contribute toward its significance, therefore, the magnitude of impact to

this feature is considered to be ‘negligible’. The resultant significance is therefore slight adverse.

Operation

During operation, due to the proposed scale of the Scheme, its proximity to the existing highways boundary and the location of designated heritage assets in relation to it, it is considered there will no significant effects upon designated assets during the operational phase. The resultant significance is therefore neutral.

Table 6.8 summarises the construction and operational effects of the sub-schemes described above.

Sub-scheme	Summary of works	Significance of Effect	
		Construction	Operation
Sub-scheme 1: M27 Junction 8 and Windhover Roundabout Upgrades	Capacity upgrades to M27 Junction 8 and the Windhover Roundabout (A27/A3024/A3025)	Archaeology – moderate/large adverse for undisturbed below-ground archaeological remains (potential presence is considered to be low). Setting of Built Heritage – neutral, slight adverse for Dodwell Cottage	Archaeology – neutral Setting of Built Heritage -neutral
Sub-scheme 2: A3024 Eastern Access Corridor (west of Windhover Roundabout to east of Six Dials)	Highway network improvements aimed at enhancing traffic movements and capacity for all travel modes along the A3024 Eastern Access Corridor	Archaeology – – moderate/large adverse for undisturbed below-ground archaeological remains (potential presence is considered to be low). Slight adverse impact to known and potential non-designated buried/surface archaeological remains associated with Bitterne (Clausentum) Roman Station Setting of Built Heritage - neutral	Archaeology – neutral Setting of Built Heritage - neutral
Sub-scheme 3: Northam Road Rail Bridge	Capacity upgrades to allow two full lanes of traffic in each direction over the railway at Northam Bridge. Improvements also include a new 5m wide NMU bridge to the south of the new vehicle bridges.	Archaeology - – moderate/large adverse for undisturbed below-ground archaeological remains. Minor adverse impact to gas holder. Setting of Built Heritage– neutral	Archaeology – neutral Setting of Built Heritage - neutral
Sub-scheme 5: Bitterne Bridge	Improved NMU facilities and movements over the bridge, minor works to junction layout	Archaeology – – moderate/large adverse for undisturbed below-ground archaeological remains (potential presence is considered to be low). Slight adverse impact to known and potential non-designated buried/surface archaeological remains associated with Bitterne (Clausentum) Roman Station Setting of Built Heritage - neutral	Archaeology - neutral Setting of Built Heritage - neutral

7.8.2 Appraisal Option 2

Construction

The majority of construction works will take place within the highway boundary, which has limited potential for undisturbed below-ground archaeological remains as a result of previous road works. The potential for undisturbed below-ground archaeological remains to be present is considered to be low.

In areas where carriageway widening is proposed and on the site of the proposed compounds, the ground has previously been undisturbed. Works in these areas have the potential to disturb below-ground remains that survive within undisturbed ground. Any groundworks involved in creating the compounds and widening (including topsoil stripping and excavations for drainage) have the potential to disturb or cause the loss of potential remains. The value of these assets is unknown, taking a worst-case scenario and giving regards to table 4.4, the significance of the effect is assumed to be 'moderate/large' adverse construction effects on any archaeological remains. However, based upon the information available at the time of undertaking the EAR; and giving regards to total area of proposed works in areas of undisturbed ground, it considered likely any impacts can be reduced to slight adverse.

The Bursledon Windmill should not undergo a setting impact as it is removed from both roundabouts and the works proposed on them. Furthermore, it is screened from view by mature vegetation surrounding it. The magnitude of impact on the setting of this listed building, will not be noticeably greater than that which the Windmill is subject to at present, the magnitude of any impact during construction phase is therefore considered to be 'no change' The resultant significance is (refer to Table 4.4) is therefore 'neutral'.

The impacts to the Granary adjacent to Bursledon Windmill are considered to be similar to those experienced by the Windmill.

Dowell Cottage is situated adjacent to Junction 8. During construction, there is potential for visual impact to this listed building, as a result of lighting and acoustic intrusion due to the activities and plant likely to be in proximity of the asset during works. The magnitude of impact is considered to be a minor setting impact during works as the disruption will only be moderately more noticeable than that presented by the current road layout and only for a short duration. The resultant significance to Dowell Cottage during the construction phase is therefore slight adverse effect.

Operation

During operation, due to the proposed scale of the works their proximity to the existing highways boundary and the location of designated heritage assets in relation to works, it is considered there will no significant effects upon the setting of designated assets during the operational phase.

8. Landscape, Townscape and Visual Assessment

8.1 Legislative and policy framework

8.1.1 National legislation and policy

The legislation and national policy governing the protection of landscape and townscape, views, good design and the setting of importance features is summarised below.

Ancient Monuments and Archaeological Areas Act 1979 - Establishes the legal protection of Scheduled Monuments, including the 'setting' of these as material considerations in planning decisions, and nonpermitted damage to the monuments themselves as a criminal act.

- **Planning (Listed Buildings and Conservation Areas) Act 1990** – Establishes the framework behind the listing of buildings and the ability of local planning authorities to establish Conservation Areas, which have specific planning controls to maintain and enhance a valued landscape character.
- **Countryside and Rights of Way Act 2000** – Establishes the legal framework that oversees publicly accessible land (Open Access Land) and Public Rights of Way.
- **Commons Act 2006** – Details controls and allowances for the protection and management of Commons and Village Greens.
- **The Enterprise and Regulatory Reform Act 2013** – Introduces amendments to various Acts regarding heritage planning controls, including Conservation Areas and Listed Buildings.

National Planning Policy Framework 2012 - This document is the primary guidance for local planning authorities when producing local policy documents and is a material consideration in determining planning decisions. The Framework makes a 'presumption in favour of sustainable development' and begins with the three 'dimensions' of sustainable development (Para. 7), number three being 'an environmental role' of *"…protecting and enhancing our natural, built and historic environment …"*

Design issues are further detailed in 'Chapter 7: Requiring Good Design'. Paragraph 58 provides several points of guidance, including that policies should:

"… Ensure that developments establish a strong sense of place, using streetscapes and buildings to create attractive and comfortable places …

… Respond to local character and history, and reflect the identity of local surroundings and materials …

… Ensure that developments are visually attractive as a result of good architecture and appropriate landscaping …"

8.1.2 Local Policy

Southampton City Council

City Centre Action Plan (2015), Southampton City Council – Sets out the overall vision for future development within Southampton and identifies St Mary Street and Old Northam Road as Opportunity Sites for development as well as St Marys Church of England School as Protected Open Space. Strategic Views are also described, though none are expected to be effected by the proposed works.

City Centre Area Adopted Policies Map (2015), Southampton City Council – Sets out the spatial framework of the City Centre Action Plan, notably identifying the Protected Open Space of St Marys CofE School and the Industrial Site of Britannia Road.

Southampton City Centre: The Masterplan (2013), Southampton City Council – Sets out the masterplanning and design framework for Southampton and identifies St Mary's as 'City Quarter' within that framework.

Local Development Framework Core Strategy Development Plan Document (2015), Southampton City Council – Sets out local planning policies, including those for design quality and historic environments.

A Characterisation Appraisal to Inform the City Centre Action Plan for The City of Southampton (2009), Southampton City Council – Analyses the existing landscape character of Southampton City Centre by dividing it into numerous landscape character areas, including St Mary's Stadium and Northam.

City Centre Urban Design Strategy Supplementary Planning Document (2001), Southampton City Council - Analyses the existing landscape character of Southampton City Centre by dividing it into seven landscape character areas.

The Development Design Guide Supplementary Planning Document (2004), Southampton City Council – A guide for developments in the city centre, including designing within character and context.

Streets + Spaces Framework Supplementary Planning Document (2015), Southampton City Council – Sets out the public realm strategy for the city centre.

Streetscape Tool Kit: Design Guidance for the Public Realm Supplementary Planning Document (2013), Southampton City Council – Describes the material palette for public realm works in the city.

Eastleigh Borough District Council

Eastleigh Borough Local Plan: Review (2001-2011) (2006), Eastleigh Borough Council – Sets out the overall vison and specific planning policies for the borough.

Bursledon Windmill Conservation Area Appraisal and Management Proposals Supplementary Planning Document (2011), Eastleigh Borough Council – Describes the landscape character of the Conservation Area.

Character Area Appraisals Supplementary Planning Document (2007), Eastleigh Borough Council – Sets out a detailed analysis of the individual character areas within the borough.

Hampshire County Council

Hampshire Integrated Character Assessment (2012), Hampshire County Council – An interactive GIS web-based map that illustrates the broad character areas outside of Southampton City, notably around Junction 8 and Windhover Roundabout.

8.2 Study area

The study area for both the landscape character and visual amenity assessment was established as a 1km offset from the proposed works. This was tested during the site survey and found to adequately encompass all likely effects. The 1km distance is based on previous experience of assessing the addition of typical highway elements to an existing highway corridor.

8.3 Baseline conditions (including value/sensitivity of resources and receptors)

8.3.1 Landscape Designations within the study area

The following designations were identified within the study area and are considered relevant to further assessment:

- Donkey Common (Registered Common Land) lies adjacent to Bursledon Road (A3024), beside Springwell School in the Thornhill area.
- Peartree Green (Registered Village Green) lies across the River Itchen from St Marys Stadium, approximately 1km south-east of Northam Road Rail Bridge.
- The Church of St Augustine Grade II Listed Building lies on Northam Road (A3024), approximately 0.4km north-east of Northam Road Rail Bridge.
- Dodwell Cottage Grade II Listed Building lies approximately 0.1km to the east of Junction 8, on Dodwell Lane.
- St Mary Street and Old Northam Road are designated as an ‘Opportunity Site’ within the City Centre Action Plan (Southampton City Council, March 2015).
- The Britannia Road Gas Holders site is safeguarded for ‘Industrial Use’ or use appropriate to the function of the St Mary’s Stadium, within the City Centre Action Plan (Southampton City Council, March 2015). The gas holders themselves are Locally listed within the Southampton City Centre Masterplan (Southampton City Council, Sept 2013).
- The playing fields of St Mary’s Church of England Primary School are ‘Protected Open Space’ within the City Centre Action Plan (Southampton City Council, March 2015).

- The following designations were identified within the study area but are not expected to experience landscape or visual effects due to the proposed development. These designations are not considered further in this assessment.

Table 7.1: Designated areas excluded from the assessment

Designation	Reason for exclusion
Bitterne (Clausentum) Roman Station Scheduled Monument and Bitterne Manor Grade II Listed Building	The results of the ZTV analysis suggested that outward views from the designation were constrained by a block of woodland to the south and residential properties to the east and west. This was confirmed during the site survey.
Bursledon Windmill Grade II* Listed Building and Bursledon Windmill Conservation Area	The review of mapping and aerial photography during the desk study revealed that views towards both Windhover Roundabout and Junction 7 are constrained by multiple layers of residential buildings, woodland blocks and field boundaries. This was confirmed during the site survey.
Central Parks Grade II* Registered Park and Registered Common Land	The results of the ZTV analysis demonstrated that views to the east from the Central Parks are well constrained by multiple large buildings within Southampton City Centre.
Asylum Green Registered Common Land	The results of the ZTV analysis demonstrated that views to the east and south-east from Asylum Green are well constrained by multiple large buildings within Southampton City Centre.
The Church of The Holy Saviour Grade II Listed Building	The ZTV analysis and site survey demonstrated that the visibility of the A3024 did not extend beyond the immediate adjacent properties; therefore, the church was not included in the assessment.
Freemantle Common	The ZTV analysis and site survey demonstrated that the visibility of the A3024 did not extend beyond the immediate adjacent properties; therefore, the Common was not included in the assessment.

8.3.2 Landscape Character

The application site is situated within the city of Southampton, Hampshire, centred along the A3024 from the St Mary's area of the city centre in the west, over the River Itchen, to Junction 8 of the M27 at Bursledon, approximately 5.7km to the east-south-east. The application site lies within National Character Area (NCA) 128: Hampshire Lowlands (Natural England, 2014), a low lying plain dominated by the port city of Southampton and its adjoining towns and suburbs. Rural areas mostly consist of woodland and pasture, though these areas are under pressure from continuing development and are fragmented by major transport links, namely the M3 to London and the M27 along the South Coast. It is important to note that there is very little to no inter-visibility between the proposed development and the surrounding rural landscape. The chalk rivers, estuaries and Southampton Water are major visitor attractions and are well used for recreational activities, a use that is equally matched by industrial activity associated with the port. Aims for the area include: creating woodland buffers to shield major transport routes and improve tranquillity; use street trees to soften the urban to rural transition; create corridors for non-motorised travel; and, reduce the pressure of road traffic.

The following landscape character areas (CA) were identified within the study area, and constitute the landscape receptors for this assessment. These CAs were defined for this assessment and do not directly reflect any planning designation or ownership boundary.

CA1: Windhover Roundabout and Junction 8 – This area is dominated by green elements, though with diverse patterns. To the north, open patches of pasture are divided by large blocks of woodland that stretch to Thornhill. To the south-west large open fields, including the Bursledon Market site, are divided by wooded field boundaries. To the south-east the landscape is built-up, with the large supermarket site adjacent to Windhover Roundabout, and the suburban village of Bursledon

beyond. To the east, small patches of woodland are spread amongst a small-scale field network that stretches east from Bursledon Windmill around Junction 8 and north, to Dodwell Lane in Hedge End. Major roads are a significant characteristic of the area, with the A3024 and A27 converging at Windhover Roundabout. These roads are well screened by vegetation which, combined with the blocks of woodland and field boundaries, results in little inter-visibility throughout CA3.

The CA has few detractors in terms of quality due to the effective screening of the major roads. The proposed development is consistent with the current characteristic of those roads; therefore, the character area is considered to have **Low Sensitivity**.

CA2: Bitterne and Thornhill – This CA is characterised by its widespread suburban residential landscape, consisting of large blocks of post-war semi-detached housing that follows the dramatically rolling contours of the land. The blocks are connected by long, wide and often straight, residential streets. Houses have small front gardens, setting them back only slightly, meaning views are often constrained to these long highway corridors, but open out significantly where the street is steeply sloping. There is a large proportion of green elements within the area, but these are mostly confined to rear gardens, allotments and other private space. Bitterne Road West and Bursledon Road have developed into a wide highway (A3024), often with multiple lanes, that is heavily trafficked. It is not a pedestrian friendly environment and effectively severs the area, north from south; it is a significant detractor to the landscape. The main road is punctuated by small commercial and civic centres, such as at Bitterne Railway Station, Bitterne Village and Antelope Park. Antelope Park is a large scale out-of-town type commercial estate, and marks the eastern point where the medium grain of the suburbs gives way to the coarser grain of large tower blocks separated by large areas of lawn between, and large commercial units, up to the A3024/Botley Road junction.

Bitterne and Thornhill have consistent characteristics that form a locally distinct sense of place. The A3024 is a major detractor, though its influence is limited to its immediate surroundings. The proposed development is consistent with the nature of that existing corridor and, as such, the character area is considered to have **Low Sensitivity** to change.

CA3: City Centre (St Mary's, Itchen Riverside, Newtown and Northam) – The character of these areas is described in Southampton City Council's (SCC) Characterisation Appraisal (2009) and City Centre Action Plan (2015). It consists of a working industrial riverfront on the western bank of the River Itchen, with residential areas behind, and severed north-south by a railway line. The industrial riverfront is very coarse grained, with large structures forming distinct visual landmarks. The gas holders on Britannia Road dominate views from the residential areas and are a '*relic of the area's successful industrial past*'; removal of these should be '*carefully considered*' (SCC, 2009). St Mary's Stadium is a large modern building that makes a '*very positive contribution*' to the city skyline, its form echoing the wharf cranes along the river (SCC, 2009). In contrast to the industrial riverfront, the residential areas behind are fine grained, arranged predominantly into 19th century residential terraced streets. These streets are mostly in poor to fair condition and in need of regeneration (Southampton City Council, 2015), though some higher quality architectural details remain, such as at the Church of St Augustine on Northam Road, and the historic school buildings on Peel Street.

Despite some visual and cultural landmark features that could be enhanced to create a strong sense of place, this character area has an overriding amount low quality elements and is not susceptible to the proposed development. It is therefore considered to have **Low Sensitivity**.

8.3.3 Visual Amenity

The study area for both the landscape character and visual amenity assessment was established as a 1km offset from the proposed works during the desk study. This distance is based on previous experience of assessing the addition of typical highway elements to an existing highway corridor. The study area was further analysed using open source Geospatial software that accounted for topography and included 3-D data of structures and vegetation (Google Earth). View-sheds were set up for various points along the application site to form a broad Zone of Theoretical Visibility (ZTV) for the proposed development. The results of this analysis are as follows:

- Visual effects outside the 1km study area are not likely.
- The main exception to this could be where the proposed development changes the Britannia Road Gas holders, as these structures are likely to have view-sheds beyond 1km when at full height (one of the holders appeared to be a full height on the day of the site visit). Initial analysis indicates these longer views are predominantly taken in from upper storeys of tall buildings at West Quay and Ocean Village.
- Views of the Britannia Road Gas Holders are also taken in (within the study area) from the upper storeys of tall buildings at Southampton Civic Centre (around the Central Parks), throughout the residential areas of St Mary's and Northam, and along the River Itchen.
- Views of the A3024 are highly constrained by vegetation and buildings, so that the highway corridor, and its associated elements, are commonly not visible beyond its immediate surroundings.
- Inter-visibility between the sub-schemes is highly unlikely.
- Due to their elevation, viewpoints from the upper storeys of two tower blocks, on Golden Grove and Graham Street, may experience visual effects not observed from their neighbouring low-rise properties. These tower blocks are within the 1km study area. To the south and north-east of Northam Bridge.

These results were confirmed by the site survey.

The following views were recorded during the site survey (14/06/2017) as part of a high level visual baseline assessment.

View 01 Windhover Manor – Visual Receptor: Visitors to Windhover Manor

Reason for view: Representative view toward Windhover Roundabout for visitors to Windhover Manor

Description: The view towards the Windhover Roundabout and A27 from Windhover Manor is broadly made up of the two components of the car park and the trees surrounding it. The treeline is a complete element that stretches from the far left to the far right of the view, though is notable for its varied textures and shades. The car park has a number of elements (the paved surface, the cars and the planting) that have fairly equal significance in the view. The nature of the view is wholly contained, with the A27 and Windhover Roundabout in the mid-ground filtered by the tree stems, and long views wholly screened. The roads would be unnoticeable if not for the movement of traffic along them.

Receptor Type: Recreational Facility

Receptor Sensitivity: Medium.

View 02 West End Road – Visual Receptor: Residents on West End Road

Reason for view: Representative view of Windhover Roundabout from West End residents

Description: The view is notably open to the sides, with little vegetation to contain it. In contrast, the centre of the view is contained at the mid-ground by the treeline that follows the A3024 on the left of the view, and sits on the central island of Windhover Roundabout in the centre of the view. The island is framed by the large trees either side of West End Road.

Receptor Type: Residential

Receptor Sensitivity: High

View 03 Hamble Motors – Visual Receptor: Residents on A3024

Reason for view: Representative view of the Botley Road junction from the residential side.

Description: The road and associated moving traffic dominates the view in the foreground and stretching out into the distance off to the sides. The view is wholly contained by the highway corridor, with street trees, boundary hedgerows and housing screening longer views.

Receptor Type: Residential

Receptor Sensitivity: High

View 04 Hinkler Road/Kathleen Road Junction – Visual Receptor: Residents on A3024

Reason for view: Representative view of the Hinkler Road/Kathleen Road junction

Description: The wide road (which has opened out to accommodate two lanes toward the lighted junction) dominates the view due to occupying a large amount of space, and is accompanied by the moving and stationary traffic at the junction.. The tall evergreen street trees are a dominant element of the view which curtail views beyond the highway.

Receptor Type: Residential

Receptor Sensitivity: High

View 05 Donkey Common – Visual Receptor: Residents on A3024

Reason for view: Representative view for Ruby Road to Sedgewick Road

Description: The view is dominated by the trees and grassland of Donkey Common; the trees extending along the road into the distance in the right of the view. The road in the foreground has little influence, but is greatly more noticeable when occupied by moving traffic.

Receptor Type: Residential

Receptor Sensitivity: High

View 06 Ruby Road/Bath Road Junction – Visual Receptor: Residents on A3024

Reason for view: Typical view of the Ruby Road/Bath Road junction

Description: The houses across the road are the major visual elements within the view and curtain longer views either side of the road. The road itself occupies a large space, but offers little visual stimulation. However, the scattered street furniture intrudes on the view enough to be a noticeable component.

Receptor Type: Residential

Receptor Sensitivity: High

View 07 Hampshire Constabulary – Visual Receptor: Residents on Maybray King Way

Reason for view: Typical view of the Maybray King Way/White's Road junction

Description: The wide road occupies the majority of the view but offers little visual interest in comparison to the houses on the other side (centre-right). The linear pattern of the road and the containment of the view, by the houses opposite, leads the eye to where the road meets the horizon on the centre-left.

Receptor Type: Residential

Receptor Sensitivity: High

View 08 Bitterne Library – Visual Receptor: Visitors to Bitterne Library and Christ The King and St Colman Roman Catholic Church

Reason for view: Representative view for works outside Bitterne Library

Description: The view is made up of multiple elements that are collected into a linear pattern along the road, leading to the right of the view. The hard surface of the road and footpath and street trees take up the large proportion of the view and are the primary elements. Restricted views.

Receptor Type: Visitor to public realm

Receptor Sensitivity: Medium

View 09 Chessel Crescent – Visual Receptor: Residents on Chessel Crescent

Reason for view: Typical view of a minor road crossing along Bitterne Road West, from a residential receptor.

Description: The movement of traffic on the A3024 makes it the focal point of the view, though this is a temporal aspect that is not consistent. Otherwise, the minor road and footpaths in the foreground dominate the view. This is mostly due to the lack of mid to long views, which are screened by the tree planting (and by surrounding houses in other similar views). The view is framed by properties along the minor road on either side.

Receptor Type: Residential

Receptor Sensitivity: High

View 10 Bitterne Centre – Visual Receptor: Residents on Bitterne Road West

Reason for view: Typical view of the Bitterne Road West/Bullar Road/Athelstan Road Junction

Description: The view is dominated by the road and the moving traffic along it. The built form around the junction offers little visual interest, and as such, the eye is drawn to the repetitive pattern of the semi-detached homes further along the road, and the wooded hills above.

Receptor Type: Residential

Receptor Sensitivity: High

View 11 Northam Road – Visual Receptor: Residents on Northam Road

Reason for view: Typical view of the A3024/Union Road/Princes Street/Summers Street Junction.

Description: The view is dominated by the carriageway of the A3024 and its associated street furniture, as well as the trees of the park beyond. These elements occupy approximately three quarters of the view and create a linear pattern running towards the distance on the left. This pattern is interrupted by the highway junction, where the park ends and is replaced with inconsistent commercial buildings. Rising into the skyline on the centre-left of the view is the Church of St Augustine, the large building and small spire being a prominent landmark within the view.

Receptor Type: Residential

Receptor Sensitivity: High

View 12 Peartree Green– Visual Receptor: Visitors to Peartree Green (Village Green)

Reason for view: Representative long view toward Northam Road Rail Bridge

Description: This view has a distinctly balanced composition, with the vegetated foreground, the sky above, and the narrow city skyline between completing the scene in broad strokes. In the centre of the view, St Mary's Stadium is a prominent landmark, easily distinguished from the surrounding skyline. The Britannia Road gas holders are visible to the right of the stadium, though are less prominent. Northam Road Rail Bridge lies behind the gas holders and is not visible in the view.

Receptor Type: Recreational vantage point

Receptor Sensitivity: High

View 13 Northumberland Road – Visual Receptor: Residents on Northumberland Road

Reason for view: Representative view for residents of Newtown

Description: Though the top and bottom of the view are divided by Northam Road Rail Bridge and the A3024, running across the centre of the view, the bridge itself is not particularly dominant. This is mostly due to the green elements of the foreground, which are visually stimulating and screen much of the bridge; though

this may not be the case during winter. The focal point of the view is the Britannia Road gas holder, which rises dramatically into the skyline.

Receptor Type: Residential

Receptor Sensitivity: High

View 14 Old Northam Road – Visual Receptor: Pedestrians on Old Northam Road and Visitors to St Mary's Stadium

Reason for view: Representative view of Northam Road Rail Bridge from road level

Description: The foreground is largely featureless and is significantly less stimulating to the eye than the Northam Road Rail Bridge parapet and the Britannia Road gas holder beyond, which are the true focal points of the view. Long views are contained by the bridge, with only the tower block on Graham Street and a small section of the wooded hills at Bitterne visible between the two parapets.

Receptor Type: Visitor to public realm

Receptor Sensitivity: Medium

View 15 St Mary's Stadium - Visual Receptor: Visitors to St Mary's Stadium and Cyclists on National Cycle Network Route 23

Reason for view: Representative view for visitors to the stadium.

Description: Northam Road Rail Bridge is the focal point of the view, its elevation giving it prominence in the mid-ground skyline. A very large proportion of the view is taken up by the grey steel security fencing, either side of the path. Though the fencing directs the eye to Northam Road Rail Bridge, the repetitive pattern of the fencing is distracting and, in this way, particularly dominant. The steel structure of the green pedestrian bridge segments the view in the foreground, and provides the third primary element of the view.

Receptor Type: Visitor to public realm

Receptor Sensitivity: Medium

8.4 Potential impacts

The PCF Stage 1 assessment made the following conclusions regarding likely impacts.

- Sub-scheme 1 (M27 Junction 8 and Windhover Roundabout) could be accommodated within the Hampshire County Council highway boundary. Landscape and visual effects associated with this sub-scheme would vary according to the extent of the new infrastructure and loss of mature woodland planting within the highway boundary.
- Sub-scheme 2 (A3024) has the potential for permanent landscape and visual effects, though these effects depend fully on the extent that existing trees, planting and residential properties themselves are lost to the scheme. Without these losses, the sub-scheme would be barely distinguishable during operation.
- Sub-scheme 3 (Northam Road Rail Bridge) lies within an urban area and would not be visible from the surrounding rural landscape. Sub-scheme 3 would result in potential adverse visual impacts for a small number of residential properties, due to the bridge having increased prominence in the view. However, it is also concluded that options proposing new structures could have an overall beneficial effect by introducing new visual landmarks with higher design quality.
- Sub-scheme 5 (Bitterne Bridge) lies within an urban area and would not be visible from the surrounding rural landscape. There would be no impacts on landscape character or elements.

The two crucial factors that will determine the scale of impact for this project are:

1. The proposed works are typical of an existing highway corridor and therefore the nature of change is limited, and
2. The effects are predominantly limited to the highway corridor and those receptors situated immediately along it.

Due to this, the majority of impacts are likely to be slight adverse to no change, with the potential for slight beneficial impacts where good design leads to environmental enhancements. The exception to this is at Windhover Roundabout, where the scale of the proposals could lead to more dramatic changes in the landscape if large scale options, such as a new tunnel are pursued, or large areas of vegetation are cleared.

Under the 2017 EIA Regulations (published since the completion of PCF Stage 1) there is a requirement to consider the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the proposed Scheme. Major accidents and/or disasters will not result in any likely significant effects in the context of landscape and visual impacts.

8.5 Assessment methodology

The assessment was carried out in accordance with IAN 135/10 (Highways England, 2010) and informed by 'Guidelines for Landscape and Visual Impact Assessment, Third Edition' (Landscape Institute and Institute of Environmental Management and Assessment, 2013). The key steps of the assessment process are described below:

- A desk study was carried out during March 2017 and a site survey performed (by a Chartered Landscape Architect) on 14th June 2017. The weather conditions were bright sunshine with good light. A winter survey (commonly carried out between December and February) was not carried out due to the period of the assessment programme at PCF Stage 2.
- The study area was divided into its component landscape character areas, and these were assessed to determine their overall sensitivity to change as a receptor. As landscape character is not expected to be impacted upon significantly, and due to the stage of the design, the character areas were described at a broad level of detail, with the baseline describing areas of several kilometres in length.
- Appropriate viewpoints were identified within the study area, and representative existing views and the visual receptor were recorded for each during the site survey. As the options extend over a study area of approximately 7km in length, representative views were selected to represent groups of similar views and/or viewpoints, to keep the overall assessment concise.
- Likely landscape and visual effects were identified and assessed to determine their magnitude of impact and significance of effect. The method for determining significance is set out in the table below. Any moderate or major result is considered a significant effect. Where both Minor and Moderate, or Moderate and Major are both indicated within the matrix set out below, professional judgement determines the result and is specific to circumstance.

Table 7.2: Criteria for assessing the significance of effects.

Magnitude of impact	**Sensitivity of receptor**		
	Low	**Medium**	**High**
High Beneficial	Minor/Moderate	Moderate/Major	Major

Medium Beneficial	Minor	Moderate	Moderate/Major
Low Beneficial	Minor	Minor	Minor/Moderate
Negligible Beneficial	Minor	Minor	Minor
No Change	Neutral	Neutral	Neutral
Negligible Adverse	Minor	Minor	Minor
Low Adverse	Minor	Minor	Minor/Moderate
Medium Adverse	Minor	Moderate	Moderate/Major
High Adverse	Minor/Moderate	Moderate/Major	Major

8.6 Assessment assumptions and limitations

The Zone of Theoretical Visibility (ZTV), which informed the selection of viewpoints for the site survey, was based on opensource data (Google Earth), and included surface modelling of buildings, structures, vegetation and landform. The limits of these data will have a coinciding limit on the accuracy of the ZTV.

During the desk study, the Britannia Road gas holders were found to be approximately 25m in height. This value was used for the purposes of the visual assessment.

The survey was carried out during the summer, when foliage was fully established. A winter site survey has not been carried out as part of this assessment as this did not align with the PCF Stage 2 study programme. A winter survey (between December and February) should be undertaken to inform the next stage of assessment.

The majority of views surveyed for PCF Stage 2 will not be affected by this limitation, either because the proposed works lie in the foreground, or because screening vegetation is otherwise absent. The exception to this is at View 01 – Windhover Manor, where the moving traffic of the A27 and Windhover Roundabout are likely to be more apparent during peak winter months. This winter baseline is not taken into account during the assessment, however, as the proposals are of a similar nature to the current baseline, the effects are likely to be similar to those described in the assessment against the summer baseline.

The potential locations for site compounds were not established until after the site survey. As a result, these locations were not fully explored during the site survey.

The view into the Old Fairground Site from Botley Road (Sub-scheme 2, Option 2, representing residential receptors thereon) was not recorded during the site survey due to the timing of the site survey in relation to design progress. The assessment of the view is therefore based on a baseline view determined through online street mapping and 360° street view.

Views from the two tower blocks, on Golden Grove and Graham Street, were not recorded during the site survey, due to restrictions upon access. These views could be included in further assessment stages if access was gained.

8.7 Design, mitigation and enhancement measures

Table 7.3 presents a summary of Visual receptors and potential mitigation and enhancement measures relevant to the respective receptor.

Table 7.3: Mitigation and enhancement measures identified for landscape and visual receptors.

Location	Mitigation and enhancement measures identified
• View 04: Hinkler Road/Kathleen Road Junction	There are lawn areas between Carey Road and the residential properties to the north that could receive new tree planting, to help mitigate the loss of the large existing trees in this location. The scale of these trees would likely be smaller than the tall pines that are currently there, but a lower canopy could improve the screening of the highway from the residential properties.
• View 10: Bitterne Centre	Felled trees at Bitterne Railway Bridge should be replaced once construction is complete. These trees should be subject to a 5-year maintenance period that includes formative pruning to ensure the trees reach a full and balanced

Location	Mitigation and enhancement measures identified
	shape. This may include the management of adjacent retained trees.
• View 03: Hamble Motors • View 04: Hinkler Road/Kathleen Road Junction • View 05: Donkey Common • View 06: Ruby Road/Bath Road Junction • View 07: Hampshire Constabulary • View 08: Bitterne Library • View 09: Chessel Crescent • View 10: Bitterne Centre • View 11: Northam Road • View 14: Old Northam Road	The proposed NMU route and bus laybys provide an opportunity to use a consistent material and furniture palette along the Eastern Access Corridor. The NMU priority crossings create the opportunity to make small environmental improvements, using visually interesting materials. However, it is important that the materials used for these crossings is suitably durable for the vehicle movements occurring at these locations. If the condition of these materials is reduced due to wear, their beneficial impact will be removed.
• View 10: Bitterne Centre • View 11: Northam Road • View 14: Old Northam Road	The refurbishment and decluttering of the highway will improve the landscape in certain locations that are currently in poor condition, but also provides an opportunity to use higher quality materials for paving and street furniture in district centres – particularly at the Northam Road Rail Bridge, the Princes Street/Northam Road junction, and the Bitterne Road/Athelstan Road junction.
• Character Area 3: City Centre • View 13: Northumberland Road • View 14: Old Northam Road • View 15: St Marys Stadium	The Northam Road Rail Bridge will replace the Britannia Road gas holder (gas works site) in many views. The new bridges should therefore be designed as a visually interesting landmark feature to fulfil that role in the landscape. Local policy indicates that landmark developments in the locality should echo the design of St Mary's Stadium, which in turn echoes the large crane shapes along the industrial riverside.
• All landscape and visual receptors	Retained trees should be protected during construction in accordance with BS5837 (2012): Trees in Relation to Design, Demolition and Construction. All planting as part of the proposed scheme should be subject to a 5-year maintenance period that includes weed removal, watering and replacement of failed individual plants. The planting scheme should be locally appropriate, using only native species in areas of natural regeneration, of an appropriate mix. Ornamental species in urban areas should be suitable to the conditions and comply with Southampton planning policy.

8.8 Assessment of effects

8.8.1 Appraisal Option 1

Sub-scheme 1

The construction of Sub-scheme 1 will introduce heavy plant and construction activity/noise into the existing highway corridor. As this corridor is already dominated by busy traffic, including heavy vehicles, the overall perception of character in Character Area 1 is unlikely to be noticeably altered. The proposed site compound off the A27, West End Road will present a drastic change in visual amenity for this locality, causing a noticeable degradation of view for residential properties opposite (along the A27, West End Road). No significant residual effects are expected due to the construction of Sub-scheme 1.

In general, during operation the highway widenings and the addition of NMU routes and highway apparatus will not alter the overall landscape character of the area, which will remain a large highway corridor enclosed by woodland planting. However, there is likely to be localised visual impacts. The widening of Junction 8 Southbound Off-Slip as it meets Dodwell Lane is likely to remove some screen planting, exposing the slip-road to views from properties on Dodwell Lane. Moving traffic on the elevated M27 is already a feature of these views, as is a filtered view of the existing slip-road, so the increased visibility of the slip-road will not be entirely incongruous. At Windhover Manor, the addition of a new lane and NMU route along the southern edge of Windhover Roundabout will present little change to the existing view, providing trees and planting outside the highway boundary are not removed during construction. The site compound off West End Road will not have permanent visual effects providing it is reinstated appropriately and hedgerows are retained or replaced. Oblique views from the residential properties opposite will take in the widened highway leading into Windhover Roundabout, though this change will not be easily noticeable. It will also take in the new NMU route joining West End Road from the north of the roundabout. This may be a noticeable change, due to the clearance of vegetated verge to widen the existing footpath, and simply close proximity, but should not alter the balance of the overall view.

Impact on CA1: Low Sensitivity; Negligible Adverse Impact; Minor Significance.

Impact on View 01: Medium Sensitivity; Negligible Adverse Impact; Minor Significance.

Impact on View 02: High Sensitivity; Low Adverse Impact; Minor Significance.

Sub-scheme 2

The construction of Sub-scheme 2 will introduce heavy plant and construction activity/noise into the existing highway corridor. As this corridor is already dominated by busy traffic, including heavy vehicles, the overall perception of character in Character Area 2 is unlikely to be noticeably altered. Localised changes in view will occur for adjacent residential properties throughout the sub-scheme. These will be noticeable adverse effects on views for sensitive receptors. Significant residual effects due to the construction of Sub-scheme 2 are not expected except where vegetation loss is permanent; This is discussed as part of the operation assessment below.

During operation, the proposed development will introduce elements that are consistent in character with the existing highway corridor. In particular, junction improvements are proposed at locations where the highway is already formed by multiple lanes with multiple signals, all of which dominate the character of the locality. However, the highway widening is large enough in places to be noticeable in views. The addition of the NMU route and bus laybys may directly and indirectly make improvements to the public realm, due to a likely use of a higher quality and consistent palette of materials and street furniture. Similarly, in places a negligible benefit will arise simply from the refurbishment of the highway corridor. However, the installation of the new 4m wide NMU route will result in the loss of some existing trees and planting. In most instances, this will be a partial loss, with trees remaining to maintain the existing character of the tree lined highway corridor. However, an entire line of trees could be lost along Carey Road, opposite the Kathleen Road/Bursledon Road Junction. This will open out the highway and remove a valued characteristic in this location, resulting in an adverse, but localised, landscape and visual effect.

Effect: Highway widening, Junction improvements and addition of NMU route and new bus laybys

Impact on CA2: Low Sensitivity; Low Beneficial Impact; Minor Significance

Impact on View 04/05/06: High Sensitivity; Low Adverse Impact; Minor Significance

Impact on View 03/07; High Sensitivity; Negligible Adverse Impact; Minor Significance

Impact on View 08: Medium Sensitivity; Negligible Adverse Impact; Minor Significance

Impact on View 09: High Sensitivity; Low Beneficial Impact; Minor Significance

Impact on View 10/11: High Sensitivity; Negligible Beneficial Impact; Minor Significance

Effect: Loss of trees at Carey Road

Impact on CA2: Low Sensitivity; Low Adverse Impact; Minor Significance

Impact on View 04: High Sensitivity; Medium Adverse Impact; **Moderate Significance**

Sub-scheme 3

The construction of Sub-scheme 3 will introduce heavy plant, including tall cranes, into the Northam Road Rail Bridge area. There is also likely to be a wide area of clearance, hoarded or fenced-off site boundaries, footpath diversions and temporary traffic measures, including lights, signage and amended traffic flows. The proposed site compound within the gas holder site will also replace an empty urban brown-field site with active and built-up elements such as welfare facilities and temporary offices, parking and material storage. Despite these noticeable changes to the landscape, there is some commonality with the baseline – the presence of industry and the railway, security fencing, the stadium car park and the dominance of the highway. Due to this, the quality of Character Area 3 is unlikely to be greatly reduced. Visual receptors along National Cycle Route 23 and Northumberland Road will take in the works at close proximity, and will therefore experience noticeable changes in views.

The most immediate effect during operation will be the removal of the northern gas holder on Britannia Road (to make way for the site compound during construction). Views of the gas holder are a significant characteristic of the local area, and it is the most dominant component of many views towards Northam Road Rail Bridge. During Operation, the prominence of the gas holder will be replaced by the new Northam Road Rail Bridge, which will be considerably wider (extending 20 m further to the north) and constructed of new materials that will attract the eye. The impact of this change will be notably focussed on the residential visual receptors along Northumberland Road (View 13). The whole nature of the view from here is likely to change– not only through the noticeable removal of the gas holder from the centre of the view, but also as the trees that screen the A3024 (south of Northumberland Road) are removed and the carriageway and bridge are extended towards the receptor, replacing existing green space. The nature of View 13 will be changed to one dominated by carriageway, and this change cannot be mitigated by the aesthetics of the new bridge. However, the new bridge does provide an opportunity to increase the visual interest of the bridge and establish it as a new landmark in other surrounding views, in place of the lost gas holder. The site of the compound itself will be left noticeably different to the baseline, as the clearance of the gas holder, as well as general clearance and ground levelling, will remove the cover of wildflowers, grasses, shrubs and trees that have naturally colonised the site. Until the site is recolonised or redeveloped, it will be left with a reduced sense of place, with its character as an industrial relic much removed.

Effect: Loss of gas holder and vegetation to the north and within the site compound location

Impact on CA3: Low Sensitivity; Medium Adverse Impact; Minor Significance

Impact on View 12: High Sensitivity; Negligible Adverse Impact; Minor Significance

Impact on View 13: High Sensitivity; High Adverse Impact; **Major Significance**

Impact on View 14/15: Medium Sensitivity; Medium Adverse Impact; **Moderate Significance**

Effect: Replacement Northam Road Rail Bridge

Impact on CA3: Low Sensitivity; Medium Beneficial Impact; Minor Significance

Impact on View 12: High Sensitivity; Low Beneficial Impact; **Moderate Significance**

Impact on View 13: High Sensitivity; High Beneficial Impact; **Major Significance**

Impact on View 14/15: Medium Sensitivity; High Beneficial Impact; **Moderate Significance**

Sub-scheme 5

During construction, views of the construction activity and tall pant will be taken in by visual receptors on Macnaghten Road and Bitterne Railway Station. This will be a noticeable adverse change from the existing view through the removal of vegetation and an increase in activity.

There may be some loss of mature trees during the construction of the bridge. This could expose the existing bridge and the A3024 to views from properties on Chafen Road to the north. There should be scope to replant these trees and mitigate the impact in the long term. Views of the new NMU bridge will be a permanent change to views, though this may improve the overall scene, as Bitterne Railway Bridge is in fairly poor condition. The new NMU bridge would be an additional distracting and screening element to this. Junction improvements would have some benefit, through decluttering the street scene. However, the overall nature of the view will remain consistent.

Effect: New NMU bridge north of Bitterne Railway Bridge

Impact on CA2: Low Sensitivity; Low Beneficial Impact; Minor Significance

Whole Scheme

The majority of views assessed throughout Option 1 do not result in significant effects, with most resulting in effects of Minor Significance. Where significant effects do occur, these are due to isolated circumstances that do not reflect the option as a whole – for example, the loss of the tree lines at Carey Road or the widening of Northam Road Rail Bridge are not typical across the scheme.

As discussed within the sub-schemes, the impact of the proposed development on landscape character is limited, as there is no substantial change to the highway corridor's defining characteristics.

Effect: Impact of whole scheme

Impact on CA1; Low Sensitivity; Negligible Adverse Impact; Minor Significance

Impact on CA2: Low Sensitivity; Low Beneficial Impact; Minor Significance

Impact on CA3: Low Sensitivity; Medium Adverse Impact; Minor Significance

8.8.2 Appraisal Option 2

Sub-scheme 1

The construction of Sub-scheme 1 will introduce heavy plant and construction activity and noise into the existing highway corridor. As this corridor is already dominated by busy traffic, including heavy vehicles, the overall perception of Character Area 1 is unlikely to be noticeably altered. The proposed site compound

off West End Road will present a change in visual quality for this locality, causing a noticeable degradation of view for residential properties opposite (along West End Road). No significant residual effects are expected due to the construction of Sub-scheme 1.

In general, during operation the highway widenings and the addition of NMU routes and highway apparatus will not alter the overall landscape character of the area, which will remain a large highway corridor enclosed by woodland planting. However, there is likely to be localised visual impacts. The widening of Junction 8 Southbound Off-Slip as it meets Dodwell Lane is likely to remove some screen planting, exposing the slip-road to views from properties on Dodwell Lane. Moving traffic on the elevated M27 is already a feature of these views, as is a filtered view of the existing slip-road, so the increased visibility of the slip-road will not be entirely incongruous. At Windhover Manor, the addition of a new lane and NMU route along the southern edge of Windhover Roundabout will present little change to the existing view, providing trees and planting outside the highway boundary are not removed during construction. The site compound off West End Road will not have permanent visual effects providing it is reinstated appropriately and hedgerows are retained. Oblique views from the residential properties opposite will take in the widened highway leading into Windhover Roundabout, though this change will not be easily noticeable. It will also take in the new NMU route joining West End Road from the north of the roundabout. This may be a noticeable change, due to the clearance of vegetated verge to widen the existing footpath, and simply close proximity, but should not alter the balance of the overall view.

Effect: Highway widening and added NMU routes, with removal of some verge vegetation

Impact on CA1: Low Sensitivity; Negligible Adverse Impact; Minor Significance

Impact on View 01: Medium Sensitivity; Negligible Adverse Impact; Minor Significance

Impact on View 02: High Sensitivity; Low Adverse Impact; Minor Significance.

Botley Road (Sub-scheme 2)

The construction of Sub-scheme 2 will introduce heavy plant and construction activity and noise into the existing highway corridor. As this corridor is already dominated by busy traffic, including heavy vehicles, the overall perception of Character Area 2 is unlikely to be noticeably altered. Localised changes in view will occur for adjacent residential properties throughout the sub-scheme. These will be noticeable adverse effects on views for sensitive receptors. Significant residual effects due to the construction of Sub-scheme 2 are not expected except for where vegetation loss is permanent; This is discussed as part of the operation assessment below.

The Botley Road/Bursledon Road junction will be noticeably wider, due to the extra lanes formed in all but the north-eastern arm of the junction. The junction is already very open and dominates the locality. As the proposed widening occurs mostly within the highway boundary, the character of the locality is unlikely to change significantly. However, widening will result in the loss of trees/overgrown hedge along Botley Road to the south-west of the junction. This will wholly alter views from the adjacent properties, changing the view from one filtered and screened by

vegetation in the foreground, to an exposed view of the fields of The Old Fair Ground site. These fields are of low landscape quality and are typically used as an informal compound to store events equipment and caravans. A view was not recorded for these properties during the site survey.

Effect: Highway widening and junction improvements, and addition of NMU route

Impact on CA2: Low Sensitivity; Low Adverse Impact; Minor Significance

Impact on View 03; High Sensitivity; Negligible Adverse Impact; Minor Significance

Impact on residents of properties on Botley Road; High Sensitivity; Medium Adverse Impact; **Moderate Significance**

Whole Scheme

Option 2 maintains the current balance of characteristics throughout the Character Areas it passes through and does not significantly alter the overall visual amenity for receptors along the corridor. As described above, there is a localised significant visual effect at Botley Road, but this is not typical to the entire option.

Effect: Impact of whole scheme

Impact on CA1: Low Sensitivity; Negligible Adverse Impact; Minor Significance

Impact on CA2: Low Sensitivity; Low Adverse Impact; Minor Significance

9. Biodiversity

9.1 Legislative and policy framework

9.1.1 National Legislation and Policy

The regulatory and policy framework of relevance for this ecological assessment is as follows:

- Wildlife and Countryside Act (1981) (as amended);
- The Conservation of Habitats and Species Regulations (2010) (as amended) (Habitat Regulations);
- The Countryside and Rights of Way Act (2000);
- The Natural Environment and Rural Communities (NERC) Act (2006);
- The Protection of Badgers Act (1992);
- The Hedgerow Regulations (1997);
- National Planning Policy Framework (NPPF) (2012)[27];

9.1.2 Local Policy

The Southampton Local Plan[28]; Policies SDP12 (Landscape and biodiversity) and NE5 (Intertidal mudflats) in the Southampton Local Plan, and Policy CS22 (Promoting biodiversity and protecting habitats) in the City of Southampton Core Strategy 2010, relate to nature conservation.

Policy CS22 describes protection afforded to designated sites and protected species and states that the Council will ensure development: retains and protects features of biological interest; does not adversely affect the integrity of international sites; and is unlikely to have an unacceptable impact on national or local designations. It also states that the Green Grid will be safeguarded to provide a network of wildlife corridors between areas of green space.

Policy NE5 states that development will not be permitted which would result in disturbance to intertidal mudflat habitat and land along the River Itchen unless there is no adverse effect on nature conservation interest and no net loss of mudflat habitat.

The UK Post-2010 Biodiversity Framework (2012)[29] – The Hampshire Biodiversity Action Plan[30] lists all the Habitats of Principle Importance (HPIs) and Species of Principle Importance (SPIs) in Hampshire and includes action plans for specific species and habitats.

[27] National Planning Policy Framework (Department of Communities and Local Government); (2012): [online] available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[28] Southampton Local Plan: [online] available at: http://www.southampton.gov.uk/planning/planning-policy/adopted-plans/default.aspx
[29] UK Post-2010 Biodiversity Framework (2012): [online] available at: http://jncc.defra.gov.uk/page-6189
[30] Hampshire Biodiversity Partnership (no date) 'Biodiversity Action Plan for Hampshire' [online] available at: http://www.hampshirebiodiversity.org.uk/vol-one.html

Our Plan to Protect and Increase Biodiversity (2015) [31] – This Highways England strategy document sets out the Highways England's biodiversity plan. The Plan, as one component part of Highways England's Environment Strategy, will "*enable funds to be effectively used to halt the decline in the vitality of habitats and plant and animal populations on and around our network. Ultimately, this will move us forward to a time when our roads positively support the health of our wildlife."* The strategy contains Five 'Outcomes' each with a series of 'Actions' required to meet the outcomes many of which are considered relevant to the Scheme. It aims to achieve 'no net loss' of biodiversity.

9.2 Study area

A desk study was conducted to collate information on designated sites and species for an area of 2km radius for internationally and nationally designated sites, extended to 30 km radius for Special Areas for Conservation (SACs) designated for bats and reduced to 1km for non-statutory and locally designated sites and protected species records.

This study area is considered to be sufficient to cover the likely zone of influence of the Scheme with respect to habitats and protected/notable species; and is based on guidance on undertaking ecological assessment provided in the DMRB.

The information was sought from MAGIC and a bespoke data search undertaken by Hampshire Biodiversity Information Centre (HBIC) as reported in the PCF Stage 1 ESR (WSP | Parsons Brinckerhoff, 2016) [32].

9.3 Baseline conditions (including value/sensitivity of resources and receptors)

A Phase 1 Habitat Survey of the proposed Scheme was undertaken in 2016 and a Phase 2 Ecological walkover was performed in 2017, the results of these surveys are used to inform the baseline environment.

9.3.1 Statutory Designated Sites

Four internationally designated sites are located within the study area:

- River Itchen Special Area of Conservation (SAC);
- Solent Maritime SAC;
- Solent and Southampton Water Special Protect Area (SPA); and
- Solent and Southampton Water Ramsar site.

(Please refer to Appendix 8.1, Drawings: HE551514-CH2M-EGN-PCF2-SW ZZZZ-DR-LX-001 and HE551514-CH2M-EGN-PCF2-SW ZZZZ-DR-LX-002 for the location of statutory designated sites)

[31] Highways England (2015) 'Our plan to protect and increase biodiversity' [online] available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/441300/N150146_-_Highways_England_Biodiversity_Plan3lo.pdf

[32] PCF Stage 1 Environmental Study Report (Document Number HE55154-WSP-GEN-PCF1-RP-EN-00002-S3-P01)

At their closest point, the Solent and Southampton Water SPA and Ramsar sites are located adjacent to the A3024 where the Northam River Bridge crosses over the River Itchen, and are approximately 150 m to the south of the nearest construction location at Sub-scheme 5. This area also forms the Lee-on-the-Solent to Itchen Estuary Site of Special Scientific Interest (SSSI). The Ramsar site is designated as an internationally important wetland characteristic of the region and, as it supports an important assemblage of rare plants and invertebrates. It is also designated as it supports a peak winter waterfowl count of international importance and populations of the following bird species occurring at levels of international importance:

- ringed plover (Charadrius hiaticula);
- dark-bellied brent goose (*Branta bernicla bernicla*);
- Eurasian teal (*Anas crecca*); and
- black-tailed godwit (*Limosa limosa islandica*).

The SPA is designated for supporting a waterfowl assemblage of international importance and for supporting populations of European importance including breeding:

- Mediterranean gull (*Larus melanocephalus*);
- little tern (*Sterna albifrons*);
- roseate tern (*Sterna dougallii*);
- common tern (*Sterna hirundo*); and
- sandwich tern (Sterna sandvicensis);
- and overwintering:
- ringed plover
- dark-bellied brent goose
- Eurasian teal; and
- black-tailed godwit.

The River Itchen SAC (which also forms the River Itchen SSSI) is crossed by the M27 between Junctions 5 and 7, and is approximately 2.4 km to the north of Sub-scheme 5. The SAC is designated for the presence of Annex I habitat: *"water course of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation";* and Annex II species: bullhead fish (*Cottus gobio*) and southern damselfly (*Coenagrion mercuriale*).

The closest point of the Solent Maritime SAC is situated approximately 1.2 km to the south east of Sub-scheme 1, and is crossed by the M27 at the River Hamble between Junctions 8 and 9. It is designated for the presence of Annex I habitats:

- estuaries;
- Spartina swards; and
- Atlantic salt meadows.

The eastern part of the Upper Hamble Estuary and Woods SSSI lies within the SAC, and the western part of the SSSI is approximately. 580 m to the east of Sub-scheme 1. The SSSI is designated as saltmarsh, reedswamp and semi-natural ancient woodland. The southern part of the SAC, is approximately 1.9 km to the south east of Sub-scheme 1 and also forms Lincegrove and Hackett's Marshes SSSI, designated as a mature saltmarsh.

Two SACs designated for bats were identified within 30 km of the scheme. Mottisfont Bats SAC, designated for its population of barbastelle bat (*Barbastella barbastellus*), is located approximately 18 km to the north west of Sub-scheme 3 and separated from it by the peripheries of the City of Southampton, the town of Romsey and several major roads. Briddlesford Copses SAC, designated for its population of Bechstein's bat (*Myotis bechsteini*), is located on the Isle of Wight is approximately 20 km to the south east of Sub-scheme 1 and separated from it by The Solent.

Southampton Common SSSI is the only additional nationally designated site (not also forming part of an internationally designated site). It is situated is approximately 2 km to the north west of Sub-scheme 3 and is designated as it supports large amphibian populations, including one of the largest known populations of great crested newt in the UK.

Four Local Nature Reserves (LNRs) are located within the study area as follows:

- Chessel Bay LNR is situated is approximately 150 m to the south of Sub-scheme 5 and forms part of the Solent and Southampton Water SPA and Ramsar site. It is described as the only remaining long stretch of natural undeveloped shoreline in the lower Itchen River, including mudflats which provide a feeding ground for wading birds and wildfowl (in particular oystercatcher), a strip of shingle and saltmarsh, and a parallel narrow strip of woodland which runs along the railway line at the north-eastern boundary of the site.
- Netley Common LNR is situated approximately 350 m to the north east of Sub-scheme 2 and forms an open heathland surrounded by a woodland fringe, and including Netley Common Hound Site of Importance for Nature Conservation (SINC) and Netley Common Southampton SINC.
- Manor Farm LNR is situated approximately .350 m to the east of Sub-scheme 1, described as supporting roe deer, curlews, skylarks and an array of wildflowers, insects and reptiles.
- Millers Pond LNR is situated is approximately 600 m to the south west of Sub-scheme 2, described as semi-natural woodland and wildlife areas including a pond and acid grassland, forming an important green open space.

9.3.2 Non- Statutory Designated Sites

There are 30 non-statutory designated Sites of Importance for Nature Conservation (SINCs) within 1 km of the sub-schemes, as listed in Table 8.1 and shown on Drawing: HE551514-CH2M-EGN-PCF2-SW ZZZZ-DR-LX-001 and HE551514-WSP-GEN-M27-FI-GIS-0014 in Appendix 8.2. Of these, seven are located within 10 m of the scheme:

- Windhover (Nettley Common South) on the northern boundary of Sub-scheme 2 near Windhover roundabout
- Shoreburs Greenway on the southern boundary of Sub-scheme 2
- Sholing Common on the northern boundary of Sub-scheme 2
- Oakleigh Meadow on the southern boundary of Sub-scheme 2
- Hum Hole on the northern boundary of Sub-scheme 2;
- Bitterne Manor 2m to the north of Sub-scheme 2; and
- River Itchen Mudland directly under Sub-scheme 2 at Northam River Bridge.

Table 9.1: SINCs within 1km area of the Scheme

Site Name	Description	Distance from Sub-scheme (SS) (to nearest 10 m, or to nearest 1 m if within 10 m)
Sholing Common SINC	Semi-improved grassland with significant element of unimproved grassland and of high social value to local communities.	0 m to SS2 (southern approximately m of SINC is within study area of SS2)
Windhover (Netley Common South) SINC	Areas of heathland vegetation; and areas of afforested heathland which retain significant remnants of heathland vegetation which would enable their recovery.	0 m to SS2 (southern approximately 5 m of SINC is within study area of SS2)
Oakleigh Meadow SINC	Semi-improved grassland with significant element of unimproved grassland.	0 m to SS1 (bounds south eastern corner of SS1)
Shoreburs Greenway SINC	Woodland with significant element of ancient semi-natural woodland; and other semi-natural woodland of restricted distribution in the county; semi-improved grassland with significant element of unimproved grassland; supports one or more notable species; and of high social value to local communities.	1 m to south of SS2 in northern part of SINC, and 6 m to south west of SS2 in southern part of SINC
Hum Hole SINC	Woodland with significant element of ancient semi-natural woodland; supports one or more notable species; and of high social value to local communities.	2 m to north of SS2
Bitterne Manor SINC	Semi-natural coastal and estuarine habitats; and of high social value to local communities.	2 m to north of SS2
River Itchen Mudland SINC	Semi-natural coastal and estuarine habitats.	Directly under SS2 at Northam Road River Bridge
Peewit Hill SINC	Areas of heathland vegetation; areas of afforested heathland which retain significant remnants of heathland vegetation which would enable their recovery; and supports one or more notable	180 m to north of SS1

Site Name	Description	Distance from Sub-scheme (SS) (to nearest 10 m, or to nearest 1 m if within 10 m)
	species.	
Durncomb's Copse Meadow SINC	Semi-improved grassland with significant element of unimproved grassland.	180 m to east of SS1
Montgomery Way SINC	Site of high social value to local communities.	200 m to north of SS2
Freemantle Common SINC	Semi-improved grassland with significant element of unimproved grassland; and of high social value to local communities.	250 m to south of SS2
Piland's Copse SINC	Ancient semi-natural woodland.	300 m to north east of SS1
Netley Common, Southampton SINC	Areas of heathland vegetation; areas of afforested heathland which are contiguous with or form an integral part of an open area of heathland; semi-improved grassland with significant element of unimproved grassland; and fens, flushes, seepages, springs, inundation grasslands etc. that support a flora and fauna characteristic of unimproved and waterlogged conditions.	350 m to north east of SS2
Durncomb's Copse SINC	Woodland with significant element of ancient semi-natural woodland.	370 m to east of SS1
Windmill Fields Wood SINC	Woodland with significant element of ancient semi-natural woodland.	390 m to south of SS1
Dumbleton's Copse SINC	Areas of afforested heathland which are contiguous with or form an integral part of an open area of heathland.	420 m to north east of SS2
Netley Common, Hound SINC	Semi-improved grassland with significant element of unimproved grassland; areas of heathland vegetation; areas of afforested heathland which are contiguous with or form an integral part of an open area of heathland; and fens, flushes, seepages, springs, inundation grasslands etc. that support a flora and fauna characteristic of unimproved and waterlogged conditions.	430 m to north east of SS2
Weston Greenway SINC	Ancient semi-natural woodland; woodland with significant element of ancient semi-natural woodland; and other semi-natural woodland of restricted distribution in the county.	520 m to south west of SS2
Sandpit Copse SINC	Ancient semi-natural woodland.	580 m to east of SS1
Saxon Wharf/Shamrock Quay SINC	Semi-natural coastal and estuarine habitats.	590 m to south of SS5
Thornhill Park Plantation SINC	Woodland with significant element of ancient semi-natural woodland; and of high social value to local communities.	600 m to north east of SS2
Riverside Park SINC	Other semi-natural woodland of restricted distribution in the county; semi-natural coastal and estuarine habitats; and of high social value to local communities.	730 m to north of SS5

Site Name	Description	Distance from Sub-scheme (SS) (to nearest 10 m, or to nearest 1 m if within 10 m)
Land North of Bridge Road SINC	Semi-improved grassland with significant element of unimproved grassland.	740 m to south of SS1
Harefield Copse SINC	Woodland with significant element of ancient semi-natural woodland	780 m to north east of SS2
Piland's Wood (Upper) SINC	Ancient semi-natural woodland; and other semi-natural woodland of restricted distribution in the county.	800 m to south of SS1
Netley Hill Heath SINC	Areas of heathland vegetation; areas of afforested heathland which retain significant remnants of heathland vegetation which would enable their recovery.	800 m to north east of SS2
Peartree Green SINC	Semi-improved grassland with significant element of unimproved grassland or sufficient relicts to enable recovery; supports one or more notable species; and of high social value to local communities.	850 m to south east of SS3
Itchen Bridge Mudflat SINC	Semi-natural coastal and estuarine habitats.	860 m to south of SS3
Braeside Road Woodland SINC	Ancient semi-natural woodland; and of high social value to local communities.	910 m to south of SS2
South West of Exeter Close SINC	Site of high social value to local communities.	780 m to north of SS2

9.3.3 Protected and notable species

Species recorded in the biological records for the Study Area, and with potential to be present within the Scheme extents and affected by the proposals include:

- Breeding birds including SPIs such as house sparrow (*Passer domesticus*), dunnock (*Prunella modularis*), linnet (*Carduelis cannabina*), song thrush (*Turdus* philomelos), spotted flycatcher (Muscicapa striata), and starling (*Sturnus vulgaris*);
- Schedule 1 birds including kingfisher (*Alcedo atthis*), redwing (*Turdis ilacus*), firecrest (*Regulus ignicapilla*) and nightjar (*Caprimulgus europaeus*);
- Reptiles including adder (*Vipera berus*), common lizard (*Zootoca vivipara*) and slow worm (*Anguis fragilis*);
- Bat species including brown long-eared (*Plecotus auritus*), noctule (*Nyctalus noctula*) and pipistrelle (*pipistrellus sp.*);
- Badger (Meles meles);
- Hazel dormouse (Muscardinus avellanarius);
- West European hedgehog (*Erinaceus europaeus*); and
- Invertebrates – numerous species including SPIs such as stag beetle (*Lucanus cervus*), cinnabar moth (*Tyria jacobaeae*) and small heath butterfly (*Coenonympha pamphilus*).

9.3.4 Habitats of Principal Importance

Two HPIs were included in the records provided by HBIC within the Survey Area. Lowland mixed deciduous woodland was recorded within Sub-scheme 1 and Sub-scheme 2 at various points, and a small area of dry heathland was recorded within the edge of approximately 10 m length of Sub-scheme 2, in the south west corner of Windhover (Netley Common South) SINC.

Other HPIs were recorded immediately adjacent to the Survey Area including: lowland meadows adjacent to Sub-scheme 1; wet woodland adjacent to Sub-scheme 2; and intertidal mudflats adjacent to Sub-scheme 2.

Within a 1km radius of the scheme area, there are two sites designated as Ancient Woodland:

- Catland/Fosteres/Bottom Copses - starting approximately 400 m to the north east of Junction 8 (Sub-scheme 1)
- An unnamed area of Ancient Woodland - starting approximately 900 m to the south of Windhover Roundabout (Sub-scheme 1).

9.3.5 Phase 1 Habitat Survey 2016

The Survey Area supported eleven habitat types. Table 8.2 lists the habitats present in each sub-scheme Survey Area. All sub-scheme Survey Areas consisted mostly of hard standing (tarmac/concrete) forming the existing A3024, with narrow strips of habitat either side.

Table 9.2: Habitats present in each sub-scheme Survey Area

Habitat Type	Sub-Scheme (✓ = habitat present)			
	1	2	3	5
Semi-natural broadleaved and mixed woodland	✓	✓		✓
Plantation broadleaved woodland	✓			
Scattered trees/tree line (including Tree Preservation Order (TPO) trees)	✓ (TPO)	✓ (TPO)	✓	✓ (TPO)
Dense/continuous scrub/scattered scrub	✓	✓	✓	✓
Ornamental shrubs	✓	✓	✓	
Poor semi-improved grassland		✓		
Improved grassland		✓	✓	✓
Arable (allotments)		✓		
Amenity grassland	✓	✓	✓	✓
Species-poor hedgerow	✓	✓		
Buildings		✓		

9.3.6 Ecological Walkover Survey 2017

The Phase 2 Ecological Walkover survey of the Study Area during 2017 identified more than 20 trees with low to moderate bat roosting potential within Sub-schemes

1 and 2, and several buildings / bridge structures within Sub-schemes 1, 3, and 5 with low roosting potential.

A single dormouse nest tube was identified to the north east of the M27 junction 8 roundabout (at approximately grid reference SU 48583 11285) indicating the possibility of dormice being present within the footprint of Sub-scheme 1.

Five ponds close to Sub-scheme 1 were identified as having potential for great crested newt (*Triturus cristatus*). The terrestrial habitat around these waterbodies was recognised as high suitability for this species and encroaches onto the carriageway verges of Sub-scheme 1.

Reptile habitat is present throughout all sub-schemes, particularly at the woodlands, grasslands, hedgerows, allotments and scrub thickets of Sub-schemes 1 and 2, but more localised at Sub-schemes 3 and 5 due to increased fragmentation and urbanisation.

9.3.7 Ecological Value

Of the recorded habitats, two are HPIs and are therefore considered as Important Ecological Features (IEFs): semi-natural broad-leaved woodland; and hedgerows. As the hedgerows are species poor and gappy in places, they are considered to be of local importance due to their relatively poor quality. The woodlands were also considered to be of local importance in Sub-schemes 1 and 2 where they mostly formed small parts of larger wooded areas and SINC. In Sub-scheme 5 the wooded habitat was classed as of site importance only as it formed a fairly small and isolated patch of recently developed woodland, including non-native species such as sycamore, within an urban area.

With regard to the two areas of ancient woodland detailed above there is considered to be no potential for impacts to these habitats as a result of the proposed scheme.

Other habitats were assessed for importance only in relation to their potential function in supporting protected and notable IEF species as listed below.

9.3.8 Potential Protected and Notable Species

The Survey Area and adjacent habitats have the potential to support various protected and notable species. The species records collated during the desk study and habitat assessments undertaken during the Extended Phase 1 Habitat Survey and Phase 2 Ecology Walkover were used to create Table 8.3**,** summarising the potential for the presence of protected and notable species in or immediately adjacent to the Survey Area.

No targeted species surveys have been undertaken, and these surveys would be required to confirm presence or likely absence of species in each area.

Table 8.3: Summary of the potential for presence of protected and notable species in or immediately adjacent to the Survey Area

Species	Sub-Scheme (☐ = potential for			
	1	2	3	5
Badger	✓	✓	✓	x
Bats - roosting	✓	✓	✓	✓
Bats - foraging	✓	✓	✓	✓
Breeding birds	✓	✓	✓	✓
Dormouse	✓	✓	x	x
Great crested newt – terrestrial	✓	✓	x	x
Hedgehog	✓	✓	✓	✓
Invertebrates	✓	✓	✓	✓
Reptiles	✓	✓	✓	✓
Non-native invasive plants	✓	✓	✓	✓

9.4 Potential impacts

Impacts on IEFs, non-native species and TPOs are considered for the construction phase in the absence of mitigation in Table 8.4.

Operation phase impacts are not expected to result in significant effects on IEFs as the M27 and A3024 are already heavily used roads: the 2014 Annual Average Daily Traffic (AADT) over 24 hours reported around 34,800 on the A3024 Northam River Bridge over the River Itchen; and approximately. 155,900 vehicles on the M27 between Junctions 5 and 8. Therefore, protected species, habitats and sites in the vicinity of the Scheme are already subject to impacts associated with these roads such as fragmentation of habitat, disturbance from traffic noise and lights, air pollution and mortality from collision with vehicles. It is therefore unlikely that increases in traffic would have a significant effect on IEFs in the vicinity of the Scheme.

Reasonably foreseeable effects associated with the risks of major accidents and/or disasters relevant to biodiversity are likely to relate to road traffic accidents on either the proposed Scheme or the surrounding road network (in particular the M27 motorway and A3024). For example, an accident resulting in a major fuel or oil spillage could reach the River Itchen (or any other watercourse) thus could adversely impact aquatic ecosystems.

Table 9.3: Potential construction phase impacts on IEFs in the absence of mitigation

Sub-schemes	Options	Designated Sites - Value	Habitats - Value	Protected and notable species, invasive weeds to be treated (Japanese knotweed) and TPO trees - Value
Sub-scheme 1: M27 Junction 8 and Windhover Roundabout Upgrades	Localised Junction Widening and Signalisation	Oakleigh Meadow SINC: Possible minor temporary damage of edge of installation of Vehicle Restraint System (VRS) on southbound entry slip road - Local	Semi-natural broadleaved woodland: Permanent loss of woodland edges- Local Intact species poor hedgerow: Permanent loss of hedgerows - Site Grassland: Permanent and temporary loss of grassland/ruderal along carriageway edges. A large area of grassland approximately 1.5 ha will also be temporarily disturbed to the north east of the M27 Junction 8 roundabout to provide a construction compound. - Local Scattered trees; Permanent loss of carriageway trees - Local	Badger: Possible damage to setts, harm to individuals and permanent loss of foraging habitat - Site Dormouse: Loss of potential low quality connecting habitat and harm to individuals – Local Bats: Loss of trees which have potential to support roosting bats – Local. Loss of foraging/commuting bat habitat - Local Breeding birds and Schedule 1 birds[33]: Minor permanent loss of habitat and potential to kill/injure and disturb birds - Site Great crested newt: Minor permanent loss of terrestrial habitat and risk of killing/injuring - Local Reptiles: Minor permanent loss of potential habitat with risk of killing/injuring – Site Hedgehog: Minor permanent loss of habitat and risk of killing/injuring – Site TPO trees: Potential damage to and loss of trees - n/a Japanese knotweed: Potential to spread invasive species – n/a
Sub-scheme 2: A3024 Eastern Access Corridor	Localised Junction Widening and Signalisation	Sholing Common SINC: Potential for minor permanent loss of improved grassland and semi-improved grassland - Local Windhover (Netley Common South) SINC: Potential for minor permanent loss of woodland and heathland - Local	Semi-natural broadleaved woodland: Moderate permanent loss of woodland edges - Local Intact species poor hedgerow: Minor permanent loss of hedgerows - Site Scattered trees: Permanent loss of carriageway and residential trees - Local.	Badger: Possible damage to setts, harm to individuals and permanent loss of foraging habitat - Site Dormouse: Loss of potential low-quality woodland edge habitat and harm to individuals - Local Bats: Loss of trees which have potential to support roosting bats - Local. Loss of foraging/commuting bat habitat - Local Breeding bird and Schedule 1 birds: Minor permanent loss of habitat and potential to kill/injure and disturb birds - Site Great crested newt: Minor permanent loss of minimal potential terrestrial habitat and risk of killing/injuring - Site.

[33] Wildlife Countryside Act 1981

		Shoreburs Greenway SINC - Potential for minor potential temporary damage to edge of woodland and potential loss of some trees in northern part of SINC – Local		Reptiles: Minor permanent loss of potential habitat with risk killing/injuring – Site Hedgehog: Minor permanent loss of habitat and risk of killing/injuring – Site TPO trees: Potential damage to and loss of trees
Sub-scheme 3: Replacement of the A3024 Northam Road Rail Bridge	Replacement of the A3024 Northam Road Rail Bridge	Solent and Southampton Water Ramsar: Potential construction associated disturbance to estuarine fauna, particularly water birds.	Semi natural broad-leaved woodland: temporary loss of on area of land to the north west of Northam Road Rail Bridge and on Gas works site– Site. Scrub: temporary loss of scrub on area of land to the north west of Northam Road Rail Bridge and on Gas works site– Site. Scrub: Permanent loss of carriageway scrub thickets– Site.	Bats: Loss of bridge structure which has low potential to support roosting bats – Local. Temporary loss of foraging/commuting features - Local. Breeding birds, Schedule 1 birds, and waterbirds: Minor permanent loss of habitat and potential to kill/injure birds – Site. Potential for temporary disturbance to water birds along River Itchen (including Annex II species[34]) - Local Reptiles: Minor permanent loss of potential habitat and risk of killing/injuring – Site Hedgehog: Minor permanent loss of habitat and risk of killing/injuring – Site Terrestrial invertebrates: Possible impacts to 'brownfield' invertebrate species related to use of Gas works site for construction compound for Sub-scheme 3. - Site
Sub-scheme 5: Bitterne Bridge Widening	Installation of new bridge for pedestrians and cycles.	None	None	None

[34] EC Birds Directive

9.5 Assessment methodology

Assessment of impacts was carried out using the guidelines for Ecological Impact Assessment (EcIA) produced by the Chartered Institute of Ecology and Environmental Management (CIEEM)[35] and DMRB guidelines for nature conservation[36].

IEFs with potential to be affected by the scheme were categorised by geographical level of importance (or sensitivity). The importance of the feature was determined within a geographical context on the following basis:

- International;
- National (England);
- Regional (South East);
- County (Hampshire County);
- Local (Southampton); and
- Site (i.e. within the Survey Area).

Given the preliminary nature of design information, the fact that this assessment is not based on detailed species and habitat survey work, and that access could not be obtained to parts of the Survey Area, precautionary assumptions have been applied to the presence and value of the baseline information. Features have been classified on a 'reasonable worst case' basis. Where a precautionary classification has been undertaken this is fully justified in the Southampton Junctions Preliminary Ecological Appraisal (WSP, 2016)[37].

The characteristics and scale of potential impacts of the options on each IEF were then assessed, and the geographic level at which the effect is significant is stated. It should be noted that in line with the guidance issued by CIEEM, an impact which has been considered as significant in ecological terms is the same as significant in terms of the EIA Regulations. The assessment of effect takes into consideration the following parameters: positive/negative effect, magnitude, extent, duration, reversibility, and timing/frequency. The impact assessment was made assuming that design, embedded mitigation and standard construction practice measures are implemented.

Further mitigation recommendations are made to avoid, mitigate or compensate for the potential impacts. The significance of any residual impacts was then assessed to determine whether the impacts would result in a significant effect on the IEF once recommended mitigation was implemented.

At PCF Stage 3, potential impacts of major accidents and/or disasters will be qualitatively considered and where appropriate mitigation measures considered.

9.6 Assessment assumptions and limitations

[35] CIEEM (2016) 'Guidelines for ecological impact assessment in the UK and Ireland: terrestrial, freshwater and coastal'. Second Edition. January 2016.
[36] DMRB (2003). Ecology and Nature Conservation. Volume 11, Section 3, Part 4. http://www.standardsforhighways.co.uk/dmrb/vol11/section3.htm
[37] WSP|PB (2016) 'M27 Southampton Junctions: Preliminary Ecological Appraisal'

No further specialist species surveys have been undertaken following the preliminary Phase 1 Habitat Survey undertaken at PCF Stage 1; and the ecology walkover undertaken at PCF Stage 2. Therefore, the assessment of effects and mitigation/compensation recommendations are based on assumptions regarding potential presence of protected species. Presence or likely absence of these species would need to be assessed through further species-specific surveys before the effect and required mitigation measures can be confirmed. In addition, no detailed information was available regarding the routes for construction traffic, therefore the potential impacts of these aspects will need to be considered once available (at PCF Stage 3.

For the 2016 Phase 1 Habitat Survey, access was not possible to parts of the scheme where there was no public right of way or pavement adjacent to the road. This prevented access to the M27 Junction 8 roundabout, parts of the Windhover Roundabout, the A3024 between the two roundabouts, and parts of the A3024 between Windhover roundabout and Botley Road to the west. Habitats were assessed based on visibility from the nearest footpath/pavement on Windhover Roundabout and the road to the west, and using biological records and information from publicly available sources, including aerial photography, and Google Street View for inaccessible areas to the east of Windhover Roundabout and Junction 8. There were no access restrictions for the 2017 Phase 2 ecological walkover, with the exception of the potential construction site locations, and the entirety of the scheme footprint was visited.

The final design of the scheme has yet to be confirmed. This assessment has been undertaken with reference to the most up to date drawings available as referenced in Section 1.4 of this EAR. The mitigation measures described are recommendations and are not yet confirmed as included within the final scheme design, they should be refined and confirmed at PCF Stage 3.

9.7 Design, mitigation and enhancement measures

9.7.1 Design and Embedded Mitigation

The impact assessment is undertaken in the absence of any bespoke mitigation measures for specific/ individual ecological features, but assumes that the following standard design, embedded mitigation and construction practice measures are implemented:

- The road alignment and any widening is designed to affect the minimum necessary area of habitat outside the existing kerb lines.
- Habitat protection measures such as fencing and signage are used to prevent accidental direct adverse impacts to nearby habitats.
- Surface water run-off attenuation and treatment features are installed to avoid increase in discharge to watercourses, and to ensure that any discharge would not compromise the conservation value of any nearby waterbody or the species that live within it.
- General construction environmental best practice and pollution prevention measures (similar to the now redacted Environment Agency (EA) Pollution Prevention Guidelines) are implemented. This could include, but is not limited to, the damping of haul routes to minimise the spread of dust, the use of drip trays and spill kits when refuelling vehicles.

Following the finalisation of preferred scheme option, specialist species and habitat surveys would be required to confirm presence or likely absence of IEFs. These surveys are likely to be required to inform the PCF Stage 3 environmental assessment and ideally should be implemented at least a year in advance of construction to allow the subsequent necessary mitigation and compensation to be identified, as well as opportunities for enhancement. At this stage, the following general mitigation and compensation measures are recommended based on assumptions regarding likelihood of presence of species following the Phase 1 Habitat Survey undertaken in 2016 and the Ecological Walkover undertaken in 2017.

In broad terms, the following hierarchical approach to mitigation should be adopted – this approach is strongly supported by guidance in the DMRB and national planning policy:

- Firstly, measures to avoid adverse ecological impacts (for example the re-siting of construction compounds, or adjustments in road alignment, etc.) should be exhausted.
- Where an adverse impact cannot be avoided, options to ameliorate or reduce an adverse impact should be implemented (e.g. these options might include: erection of barriers or bunds to reduce noise and vibration; use of Sustainable Drainage Systems (SuDS) to regulate water flows).
- As a last resort, measures that compensate for the loss of the particular ecological resource that is affected should be considered. For example, like-for-like replacement of lost habitats. Compensation approaches may include enhancement of existing habitats by improved management and long-term monitoring.

- Recommended mitigation measures to avoid adverse ecological impacts during construction could include the following
- Construction practices are modified to minimise working width, and habitat protection measures including protective fences around tree root protection areas and important habitats are implemented to protect immediately adjacent trees and habitats of importance.
- Any woody vegetation clearance is undertaken outside of the nesting season or following a check by a qualified ecologist that nesting birds are not present (where nesting birds were present, their nests would be left intact until completion of the nesting attempt).
- Clearance of dense scrub and hedgerows is undertaken in a directional manner, outside of the hedgehog hibernation period, or following a check that hedgehogs are not present.
- Open trenches are not left open over night without a safe means of egress (i.e. secure Heras fencing around open trenches; and or planks from the bottom of trenches to ground level) for animals that may fall into them, such as small mammals.

Recommended mitigation and compensation measures could include the following (depending on the finding of specialist surveys and the scheme options selected):

- Habitat creation/enhancement to compensate for loss of habitat as a result of the scheme either through: the translocation of existing habitats or seed banks (applicable for rare/niche flora); the enhancement of existing retained habitat; and/or the planting of new habitat.
- If avoidance of protected species cannot be achieved, translocation and/or exclusion (under appropriate licences/agreements) is to be implemented with protected species relocated to one or more to pre-prepared receptor sites to minimise impacts of habitat loss and species mortality.
- Appropriate design and use of lighting to minimise impacts on bats and other light sensitive species.
- Re-establishing/maintaining connectivity between habitats affected by road construction and incorporation of features within the detailed design which would restore connectivity for protected species.
- The use of screening during construction to minimise the spread of noise, dust, lighting, etc. and the use of fencing to temporarily exclude species by restricting access into particular areas where necessary (such as reptile exclusion fencing).
- Appropriate landscaping and re-landscaping of all new roadside verges and disturbed habitat specifically for species known to be present in the area, and replacement of any TPO and other mature trees (where suitable for network and safety priorities).
- Implementation of a Japanese knotweed management plan to prevent spread and eradicate the existing stands.

If, following assessment at PCF Stage 3 it is deemed there is a significant environmental effect in terms of the EIA Regulations, consideration should be given to using a biodiversity offsetting approach which employs a metric to quantify

the area of required compensatory habitat creation. A biodiversity offsetting approach may also be used to provide early and effective engagement of offset providers and statutory consultees so that compensatory habitat creation measures contribute to existing biodiversity strategies. It may be that compensatory habitat creation (if required) is best undertaken away from the scheme to achieve the best overall nature conservation outcomes locally. Thorough engagement with local biodiversity stakeholders is recommended to facilitate appropriate offsetting, and to reduce the risk of objection from these stakeholders.

The measures to mitigate impacts on ecology during construction will be incorporated into the Construction Environmental Management Plan (CEMP) and implemented by the contractor.

9.7.2 Monitoring and Management Post Construction

Implementation of a post-construction monitoring programme is also recommended during the initial maintenance period, to assess establishment of the ecological mitigation measures, help inform future management and, if necessary, allow for the implementation of remedial measures.

A Handover Environmental Management Plan (HEMP) would be developed based on the mitigation provided during the construction stage and the long-term objectives of the mitigation. This plan would be developed during the detailed design stage and finalised the end of either the defects period or the aftercare period specified in the construction contract. It would provide an auditable record of the various mitigation commitments identified, and the requirements for regular maintenance of the mitigation features to ensure that their goals are achieved. An Environmental Masterplan for the scheme, would be developed in accordance with DMRB Volume 10 to show all existing and proposed environmental aspects of the scheme including environmental barriers, proposed planting/seeding and its functions, biodiversity and nature conservation, noise attenuation, heritage conservation and enhancement, flood attenuation, water courses and quality controls. This information would be fed into the Highways England Environmental Database (EnvIS).

9.8 Assessment of effects

9.8.1 Appraisal Options 1 and 2

This section characterises the potential ecological impacts that are likely to arise in the absence of mitigation (excluding standard ‘embedded’ mitigation) during construction and operation of all sub-schemes.

Sub-scheme 1

Works associated with construction (primarily loss of habitats via carriageway widening outside Windhover Roundabout and along M27 Junction 8 Slip Road) would result, in the absence of mitigation, in a potential significant effect at the local level for: semi-natural woodland, scattered trees, great crested newt, dormouse and bats; and at the site level only for: grassland, hedgerow, reptiles, birds, badger, and hedgehog. The total number of trees that will need to be removed will depend on the final alignment works in particular the final alignment of any NMU route that crosses the centre of Windhover Roundabout.

With implementation of the recommended mitigation measures, the residual effect would be negligible for reptiles, dormouse, bats, great crested newt, badger, breeding birds and hedgehog. The residual effect would be significant in the short-term at the site level for grassland, semi-natural woodland, scattered trees and hedgerows, until created/enhanced compensatory habitat had reached maturity. However, in the long-term the residual effect would be negligible for all IEFs.

Sub-scheme 2

Construction impacts, in the absence of mitigation, would result in a potential significant effect at local level for: semi-natural woodland, great crested newt, bats, dormouse and; and at a site level only for: hedgerow, reptiles, breeding birds, badger, and hedgehog. The total number of trees that will need to be removed will depend on the final alignment of the route; and will need to be considered in PCF Stage 3

Potential operational impacts for Sub-scheme 2 are the air quality effects on the wetland habitats and the effect of traffic noise on the waterfowl and wading birds for which the Solent and Southampton Water SPA was designated, as a result of an increase in traffic.

The wetland habitats in the locality are mudflats, which are not considered to be sensitive to the predicted small changes in air quality[38], even when considered cumulatively with the predicted increase in traffic in the absence of the scheme. Data from the Wetland Bird Survey (WeBS) annual report presented on online maps on the British Trust for Ornithology (BTO) website shows that none of the four important over-wintering species for the SPA was recorded in the vicinity of the Northam Road River Bridge in 2014/15. The closest record for these species was dark-bellied brent goose, recorded approximately 500 m to the south of the bridge. The location in which they were recorded is beyond a meander in the river to the south of the bridge, separated from it by the Millbank Industrial area, and therefore would not be visible from the bridge. As a result, it is unlikely that the features for which the Solent and Southampton Water SPA was designated would be disturbed by an increase in traffic along the A3024.

The A3024 adjacent to the Solent and Southampton Water SPA and Ramsar site is already a heavily used road, therefore, as any birds in the area (such as oystercatcher, redshank and dunlin recorded on The Wetland Bird Survey (WeBS)[39]) would already be habituated to the loud noise of the existing road, it is unlikely they would be significantly disturbed by any increase in noise levels (see Habitats Regulations Assessment (HRA), CH2M 2017 for further assessment).

The Solent Maritime SAC and River Itchen SAC are also unlikely to be significantly affected by the scheme due to their distance from construction areas, and as no significant changes are predicted in nearby traffic flows or air quality on the M27 as a result of the proposed Scheme (as reported in the HRA, CH2M 2017).

No operational impacts resulting Sub-scheme 2 are identified for other protected and notable species. The M27 and A3024 are already heavily used roads, therefore, protected species in the vicinity are already subject to impacts

[38] Guide to habitats used in APIS. http://www.apis.ac.uk/habitat_table.html; accessed 20th September 2016
[39] British Trust for Ornithology Wetland Bird Survey: [online] available at https://www.bto.org/volunteer-surveys/webs

associated with roads and it is unlikely that the road improvements and the consequential, increase in traffic on the A3024 would have a significant effect on protected/notable species populations.

Therefore, operational impacts on IEFs are expected to be negligible as a result of the scheme.

With implementation of the recommended mitigation measures, the residual effect would be negligible for reptiles, dormouse, bats, great crested newt, badger, breeding birds and hedgehog. The residual effect would be significant in the short-term at the site level for semi-natural woodland and hedgerows, until created/enhanced compensatory habitat had reached maturity. However, in the long-term the residual effect would be negligible for all IEFs.

Sub scheme 3

Works associated with replacement of the A3024 Northam Road Rail Bridge, including preparation of the construction compound would in the absence of mitigation, likely result in an adverse effect at local level for: bats and birds; and at a site level for: scrub, hedgehog, terrestrial invertebrates and reptiles.

With implementation of the recommended mitigation measures, the residual effect would be negligible for scrub, reptiles, bats, birds, terrestrial invertebrates and hedgehog. There would be no significant residual effect significant in the short-term at Sub-scheme 3.

Sub scheme 5

With implementation of the recommended mitigation measures, works associated with the junction improvements at Bitterne Bridge and the installation of a new footbridge, including preparation of the construction compoundhood are likely have no significant effect on ecological receptors. This is the only location where there is potential for notable aquatic invertebrates/ invertebrate assemblages, but as major re-construction of road bridge no longer considered, there is considered to be no potential for adverse impacts, and this ecological receptor is thus scoped out from further consideration.

10. Geology and Soils

10.1 Legislative and policy framework

Policy and regulations of relevance to the assessment of geology and soils are as follows:

- National Planning Policy Framework (NPPF), Department for Communities and Local Government, March 2012[40];
- National Policy Statement for National Networks (NPSNN) (DfT, 2014);
- The Contaminated Land (England) (Amendment) Regulations (2012);
- Contaminated Land Statutory Guidance (2012)[41];
- Technical Guidance to the National Planning Policy Framework[42];
- Model Procedures for the Management of Land Contamination (CLR11) (2004)[43];
- Environmental Protection Act (EPA) (1990) part IIA provides powers in relation to the identification, remediation and apportionment of liability for contaminated land. Local Authorities are required to identify contaminated land and serve on every person who is an appropriate person a remediation notice setting out what is to be done by way of remediation and the period within which it must be done.
- The EPA also contains a number of legal provisions concerning “controlled waste”. This legislation creates offences regarding the deposit, treating, keeping or disposing of controlled waste without a permit. A registered waste carrier and an authorised landfill site or suitable disposal site will need to be used to dispose of any material containing this species off site. If soil has been treated and is free from Japanese knotweed contamination and suitable for use, it can be reused on site.
- Water Environment (Water Framework Directive (WFD)) (England and Wales) Regulations 2015 (SI 2011/1043);
- Water Resources Act 1991 (SI 57) (as amended by the Water Act (2003); and
- Highways Act (1980) Section 105A.

[40] National Planning Policy Framework (Department of Communities and Local Government); (2012): [online] available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2
[41] Contaminated Land Statutory Guidance: Department for Environment, Food and Rural Affairs, (Defra) (2012); [online] available at: https://www.gov.uk/government/publications/contaminated-land-statutory-guidance
[42] Technical Guidance to the National Planning Policy Framework, Department for Communities and Local Government, (2012).
[43] CLR11: Model Procedures for the Management of Land Contamination; Department for Environment, Food and Rural Affairs (2004): [online] available at]http://www.claire.co.uk/index.php?option=com_content&view=article&id=187&catid=45&Itemid=256

10.2 Study area

A study area for the assessment of effects on geology and soils is not specified in the DMRB. The study area specified in the Research and Development Publication 66[44] states that off-site features within an area up to 250 m from the site boundary should typically be considered within the hazard identification stage of site assessment.

For the purposes of this section, the study area is defined as the land within 250 m of the maximum extent of the Scheme.

10.3 Baseline conditions (including value/sensitivity of resources and receptors)

10.3.1 Ground Conditions

Made ground

The land within the study area is predominantly urban in use. Due to the majority of this land having a residential, commercial or infrastructural land use, it is expected that a veneer (≤ 5 m) of Made Ground is present throughout the study area. The British Geological Survey (BGS) maps a swathe of Made Ground in coastal regions of Southampton. The coastal location and angular morphology of water frontages suggest these are likely to be reclaimed estuarine land. Parts of this reclaimed land fall within the 250 m study area surrounding Sub-schemes 2, 3 and 5. There are also sections of made ground at key road junctions including the M27 Junction 8 (Sub-scheme 1), which are likely to have been excavated and built up to attain stability and aid road developments.

Superficial geology

The predominant drift geologies in the area are tidal flat deposits consisting of clay and silt underlying Sub-scheme 3. The alluvium and tidal flat deposits associated with the River Itchen have moderate compressibility and a low to moderate risk of running sands. Running sands are considered as a permeable and rapid pathway for contamination transferal.

The river terrace deposits underlying Sub-scheme 5, Sub-scheme 1 and areas of Sub-scheme 2 are layered and consist of interbedded gravels and sands. River Terrace Deposits within the study area are related to the progression of the main river, the River Itchen, and its tributaries.

[44] Research and Development Publication 66: Guidance for the Safe Development of Housing on Land Affected by Contamination (EA/NHBC, 2008)

Solid geology

The bedrock beneath the study area is gently folded and this results in a variation in rock type across the scheme.

Sub-scheme 3 and parts of Sub-schemes 1 and 2 cross the Wittering Formation which is Eocene in age and composed of laminated clay with some sandy interbeds.

Sub-scheme 5 and parts of Sub-schemes 1 and 2 cross London Clay which is also Eocene in age and composed of laminated silty and sandy clay with calcareous and pyritic beds. A characteristic of the London Clay which should be noted is its' moderate shrink-swell capacity. The Portsmouth Sand Member which is a high permeability sand layer, is present within the London Clay along with other more granular layers.

The London Clay Formation is typically between 53 m and 114 m thick, and it is therefore unlikely that the underlying Reading Formation would be encountered during excavations.

Published stratigraphy describes the clay of the Wittering Formation to be firm with compact sands. The London Clay Formation is also described as firm but with a higher frequency of gravel clasts (flint and other) and fissuring.

10.3.2 Designated sites

There are several sites of high nature conservation sensitivity near the scheme. These include sections along the Itchen estuary which are designated as a Ramsar site and Special Protection Area (SPA), a designated Site of Special Scientific Interest (SSSI). The potential impacts on these sites in ecological terms are assessed in **Section** Error! Reference source not found.. There are no identified Regionally Important Geological and Geomorphological Sites (RIGS) in the study area.

10.3.3 Soils

The study area is generally urban or non-agricultural in use. However, land use around Sub-scheme 1 is rural and the Agricultural Land Classification (ALC) system maps classify the area as Grade 4 (poor) agricultural land. The study area does not contain any 'best and most versatile' (BMV) agricultural land taken to be ALC Grades 1-3 as defined in Annex 2 of NPPF.

Department for Environment, Food and Rural Affairs (Defra) identifies the whole of Southampton, and thus all of the Sub-schemes, as a eutrophic nitrate vulnerable zone (NVZ). However, given the area of the Scheme is predominantly urban land the underlying soils are considered to be of low value. Legal requirements which apply to NVZs relate to use of nitrogen fertilisers and storing of organic manures these are not considered relevant to the Scheme which is road improvement works.

10.3.4 Groundwater

Groundsure report GS-3280716 confirms the high to very high permeability of the superficial deposits (intergranular River Terrace Deposits) in parts of the Sub-schemes 1, 2 and 5, classified by the Environment Agency (EA) as Secondary A Aquifers. These characteristics result in a high leaching potential and a rapid

pathway for contamination transferal. The Wittering Formation is a Secondary A bedrock aquifer: the upper clay member of the London Clay is of very low permeability and acts as an aquiclude i.e. it provides and impermeable layer which acts as a barrier to the flow of groundwater.

There are no groundwater Source Protection Zones (SPZs) or groundwater extraction points within the 250m radial study area surrounding the maximum extent of the four sub-schemes.

10.3.5 Surface water

The most notable surface water feature within the study area is the River Itchen and its tributaries. The River Itchen flows southwards to converge with the River Test and form Southampton Water.

There is one surface water abstraction licence (Licence No. 11/42/23/3), 250m east from Sub-scheme 3. It is associated with Cemex UK Material and is for mineral washing.

10.3.6 Historical land use

The western section of scheme, including Sub-scheme 3 and parts of Sub-scheme 2, traverse sites historically used by heavy industries such as ship builders and foundries, also containing gasworks, railway land and rope walks.

The central and eastern sections of the Scheme, including Sub-schemes 1 and 2 were, historically, much less developed, though brick works, gravel, sand and clay pits were common. These areas saw a progressive increase in the development of residential properties, associated with the expansion of the city of Southampton.

Selected historical land uses of interest within the study area of all Sub-schemes are summarised in Error! Reference source not found..

Table 10.1: Summary of Historical Land Use along the A3024 Corridor

Aspect	Map Dates	Comments
Open pit mine workings – gravels, sands and clays	1869 - 1942	There are numerous examples of mining of the superficial and bedrock geology adjacent and proximal to the road course over the specified times.
Rural / agricultural land use	Prior to 1869 - Present	The mid and eastern sections of the corridor travel through areas historically mapped as fields, farmland, parklands and woodland. These have gradually been in-filled with residential dwellings until only small pockets (such as Hum Hole) remain.
Residential land	Prior to 1869 - present	Terraced residential properties have been present in the western parts of the entire study area since prior to 1869. As the residential properties have increased areas in between have been infilled with allotments and parklands from 1895 onwards.
Industrial land	1869 - Present	Gas Works have existed to the south of Northam Road within the 250m area of consideration surrounding Sub-scheme 3 since 1908. In 1978/79 the *Gas Works*, south of Northam Road Railway Bridge, is no longer shown. the site has been redeveloped with *Warehouses*. In 2002, The *Gas Distribution Centre* to the south of Northam Railway Bridge is no longer shown. Timber yards, wharves, numerous types of mills works and depots have existed along the Itchen estuary since before the first available County Series map in 1869. These facilities were expanded through the 1800s and 1900s, with development of

Aspect	Map Dates	Comments
		jetties for more leisure purposes from 1990 onwards. In 2002, brownfield land in the Bitterne and Northam areas near Sub-schemes 3 and 5 were developed into industrial parks. Some small mining pits were present in the 1800s, later either infilled to allow residential development or turned into parks.
London to Southampton Railway	1838 - Present	Records from the Hampshire cultural trust (http://hampshireculturaltrust.org.uk/content/railways-hampshire) show that the London to Southampton Railway line has been operational since 1838. The earliest available County Series map (1869) shows the railway in the same situation as the present day, but with the railway depot north of Sub-scheme 3 falling out of use soon after 1990.
M27	1976 - Present	The M27 (including Junction 8) and Windhover roundabout within Sub-scheme 1 were built in 1976 on farmland and have not been noticeably developed since.

10.3.7 Current land use

The majority of transport links within the entire study area are located within residential or commercial urban land. Sub-scheme 1 is surrounded by agricultural land. The River Itchen and its tributaries are present within the study area, flowing south towards Southampton Water. The Bitterne and Northam Road Rail Bridges in Sub-schemes 3 and 5 cross over the Southampton to Portsmouth coastal railway line.

There is a complex network of residential streets within the whole of the study area, connecting to the A3024. Numerous commercial (shops, hotels, public houses etc.), residential and industrial properties (railway stations, scrap yards, manufacturing plants, garages etc.) are located within the immediate vicinity of the scheme.

Data from the EA shows two landfill sites containing household waste directly west of the Windhover Roundabout within Sub-scheme 1. The contents at the landfill sites should be treated as of unknown composition and potential sources of contamination.

There are three locations to the east of the Sub-scheme 3 which are active points of extraction for marine sands and gravels along with crushed rock.

10.3.8 Potential for land contamination

Where land has been contaminated as a result of former industrial processes, for example at the former Gas Works site located in south of Sub -scheme 3, this has the potential to be a constraint on the sub-scheme options. Consideration is also given to the potential for any post-construction impacts, due to the potential for remobilisation of contamination within ground disturbed by the construction processes.

Sources

The multitude of industrial processes which historically operated in the docklands area provide innumerable potential contaminants of concern, as detailed in Error! Reference source not found.**2.** These include gasworks, railways, wharves, rope walks, engine sheds, brickfields, foundries, shipbuilding yards, cement works, iron

works, saw mills, linseed mills, pottery workshops, timber yards and sewerage works.

The risk of contaminated land being encountered during the site work period is considered highly likely and in the absence of Phase 2 ground investigation data and characterisation, the Made Ground underlying the entire study area is assumed to be a potential source of contaminative substances.

The four fuel stations situated along the A3024 corridor (Sub-scheme 2 as illustrated on Figure 9.1, drawing reference HE551514 - WSP - GEN - M27 - FI - GIS – 0017, included in Appendix 9.1) and in the land surrounding to the south of Sub-scheme 3 also represent potential sources of contamination. There is a potential for polluting discharges to have occurred from vehicles and trains using the road and rail network respectively. Discharges are likely to be hydrocarbon based and include diesel fuels and lubricants. The contamination has the potential to pollute drainage channels.

The Former North Allotment Gardens, Radcliffe Road were determined as Contaminated land (under Part 2A of the EPA 1990) in 2002. The significant contaminant linkage was associated with elevated concentrations of lead in the soil (location indicated on Figure 9.1 in Appendix 9.1). In February 2007, a remediation strategy for the site was prepared by Soils Limited on behalf of Keir Homes[45]. Given the proximity of this site to the Scheme, located approximately 400m to the north of Sub-scheme 3; and the fact that groundwater at the site is understood to flow towards the north/ north east it is considered unlikely this site provides a potential source of contaminative substances for

Radon

The entire study area is situated within a Radon Affected Area, as defined by the Health Protection Agency, with 1-3% of properties above the Action Level (200 Bq/m^3). The control strategy recommended by the National Radiological Protection Board (NRPB) and accepted by the Government includes the following provisions:

- Radon concentrations at or above the Action Level of 200 Bq/m^3 should be reduced to as low as reasonably practicable; and,
- New homes built within localities delimited by the appropriate Government authorities should be constructed with precautions against radon.

The Scheme is unlikely to be impacted by radon risks which are typically associated with the accumulation of radon in enclosed spaces such as basements. Radon is therefore not considered further in this assessment.

Invasive Species

Japanese knotweed (*Fallopia japonica*) is a non-native Invasive Plant listed under Schedule 9 of the Wildlife & Countryside Act 1981, as amended. This has been identified during Ecological Phase 1 Habitat survey undertaken in 2016 within the maximum extent of Sub-schemes 1 and 5. Any soil or plant material contaminated

[45] Remediation Strategy on the Former North Allotment Gardens, Radcliffe Road, Southampton, Hampshire Report J9619 Rev 1.02 (Soils Limited, February 2007) – Available at: https://www.southampton.gov.uk/Images/Radcliffe%20(N)%20Completed%20Remediation%20Strategy%20Report%201_tcm63-366329.pdf

with Japanese knotweed that the scheme discards, intends to discard or are required to discard is likely to be classified as controlled waste.

10.3.9 Conceptual site model

Contamination sources impact different receptors through different pathways as detailed below:

1. Ingestion and inhalation of, and dermal contact with, contaminated soil, dust or particulates, potentially impacting **Construction Workers** and **End Users**.
2. Lateral migration of aqueous and dissolved contaminants via groundwater flow or preferential pathways to **Surface Waters**.
3. Vertical migration of aqueous and dissolved contaminants through Made Ground or via preferential pathways (e.g. piling) to **Groundwater**.
4. Chemical attack and degradation of contaminants on **Buildings and Buried Concrete Structures**.

On the basis of the Phase 1 Preliminary Risk Assessment (PRA), a preliminary Conceptual Site Model (CSM) has been developed. Due to the number of potential historical and current areas of concern identified within the study area, a high level CSM has been prepared, which focusses on the principal areas of concern.

The CSM is presented as **Error! Reference source not found.**.

Table 10.2: Conceptual Site Model (Reference: WSP, December 2016[46])

Source	Potential Contaminants	Receptor	Consequence	Probability	Risk
Made Ground (associated with existing highways) and fuel stations.	Fuel and oil discharges.	Construction workers and End Users	Minor	Unlikely	Very Low Risk
		Surface water	Medium	Unlikely	Low Risk
		Groundwater	Mild	Unlikely	Very Low Risk
		Buildings	Minor	Unlikely	Very Low Risk
Brick Works and Pottery Workshops	Transition metal compounds, hexavalent chromium, various inorganic compounds.	Construction workers and End Users	Minor	Unlikely	Very Low Risk
		Surface water	Medium	Unlikely	Low Risk
		Groundwater	Minor	Unlikely	Very Low Risk
		Buildings	Minor	Unlikely	Very Low Risk
Clay, Sand and gravel Pits	Likely infill of ground with unknown waste material (releasing	Construction workers and End Users	Minor	Likely	Low Risk

[46] PCF Stage 1 Environmental Study Report (Document Number HE55154-WSP-GEN-PCF1-RP-EN-00002-S3-P01)

Source	Potential Contaminants	Receptor	Consequence	Probability	Risk
	CH_4, CO_2).	Surface water	Medium	Unlikely	Low Risk
		Groundwater	Mild	Unlikely	Very Low Risk
		Buildings	Minor	Unlikely	Very Low Risk
Gas Works	Ammoniacal liquor (hydrocarbons, cyanides, coal tar etc), 'spent' oxide from processing. Various organic and inorganic compounds (fuels, acids, alkalis, metals etc.).	Construction workers and End Users	Medium	Likely	Moderate Risk
		Surface water	Medium	Likely	Moderate Risk
		Groundwater	Mild	Likely	Moderate / Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Railway Lines	Hydrocarbons, solvents, creosote, metals, asbestos, ash, sulphates.	Construction workers and End Users	Medium	Likely	Moderate Risk
		Surface water	Mild	Low Likelihood	Low Risk
		Groundwater	Mild	Low Likelihood	Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Shipbuilding Yards	Metals and metal compounds, organic compounds used in paint solvents, fuels and oils, pickling acids, Cyanides, Coal, PCB's, Asbestos, Radioactive materials.	Construction workers and End Users	Medium	Likely	Moderate Risk
		Surface water	Medium	Low Likelihood	Moderate Risk
		Groundwater	Mild	Low Likelihood	Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Sewerage Works	Various metals, metal compounds, inorganic ions, treatment chemicals (including strong acids and alkalis), hydrocarbon gas, asbestos.	Construction workers and End Users	Medium	Low Likelihood	Moderate Risk
		Surface water	Medium	Low Likelihood	Moderate Risk
		Groundwater	Medium	Low Likelihood	Moderate/ Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Foundries and Iron Works.	Various metals and inorganic compounds, acids	Construction workers and End Users	Medium	Likely	Moderate Risk

Source	Potential Contaminants	Receptor	Consequence	Probability	Risk
	and alkalis, oils and hydrocarbons related to the production of coke, asbestos and solvents.	Surface water	Medium	Low Likelihood	Moderate Risk
		Groundwater	Medium	Low Likelihood	Moderate/ Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Cement Works	Various inorganic compounds, blast furnace slag, pulverised fuel ash, hydrocarbons, plasticisers, cement and flue gas dusts.	Construction workers and End Users	Medium	Low Likelihood	Low Risk
		Surface water	Medium	Low Likelihood	Moderate/ Low Risk
		Groundwater	Mild	Low Likelihood	Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Landfill containing household waste.	Leachate and landfill gas released by decomposition of waste.	Construction workers and End Users	Medium	Likely	Moderate Risk
		Surface water	Medium	Low Likelihood	Moderate/ Low Risk
		Groundwater	Mild	Low Likelihood	Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Wharves and docklands.	Likely construction on top of natural organic material releasing gasses (CH_4, CO_2). Likely infill of ground with unknown waste material. Dredgings containing metals. Release of contaminants from cargo passing through.	Construction workers and End Users	Medium	Likely	Moderate Risk
		Surface water	Medium	Low Likelihood	Moderate/ Low Risk
		Groundwater	Mild	Low Likelihood	Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Metal scrap yards and automobile construction.	Various metals, organic and inorganic compounds, acids and alkalis, hydrocarbons and oils, solvents, asbestos.	Construction workers and End Users	Medium	Low Likelihood	Moderate/ Low Risk
		Surface water	Medium	Low Likelihood	Moderate/ Low Risk
		Groundwater	Mild	Low Likelihood	Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Timber yards	Resins and resin hardeners, dyes and	Construction workers and	Medium	Likely	Moderate

Source	Potential Contaminants	Receptor	Consequence	Probability	Risk
and saw mills.	surface coatings, organic solvents and pigments, preservative treatments.	End Users			Risk
		Surface water	Medium	Low Likelihood	Moderate/ Low Risk
		Groundwater	Mild	Low Likelihood	Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Farmland	Buried waste from animal, household and machinery sources.	Construction workers and End Users	Medium	Low Likelihood	Moderate/ Low Risk
		Surface water	Medium	Low Likelihood	Moderate/ Low Risk
		Groundwater	Mild	Low Likelihood	Low Risk
		Buildings	Mild	Low Likelihood	Low Risk
Japanese Knotweed	Invasive plant species with strong, aggressive growth.	Buildings	Mild	Likely	Moderate/Low Risk

10.3.10 Attribute Importance (Sensitivity)

The attribute importance (sensitivity) assigned to the identified environmental attributes and contaminated land receptors are shown in Table 9.3.

Table 10.3: Attribute Importance

Attribute / Contaminated Land Receptor	Justification	Attribute Importance (Sensitivity)
Geology and Geomorphology	Sections of the Sub-schemes 2, 3 and 5 around the River Itchen estuary directly interact with designated SSSIs of biological importance. However, the entire study area does not lie within an area where nationally important geological or geomorphological features have been recorded (geological SSSIs) and there are no Regionally Important Geological Sites (RIGS) within the study area.	Low
Soil	The area in which the development options are situated is primarily of urban use, with parts of Grade 4 (poor quality) agricultural land near Sub-scheme 1.	Low
Groundwater	The superficial deposits, where present, are classified as Secondary 'A' Aquifers. The Wittering Formation bedrock, which underlies much of the study area, is also a Secondary 'A' Aquifer. There are no licensed groundwater abstractions in the study area.	Medium
Surface Water	There is a Primary River within the study area (The River Itchen). There is a surface water abstraction licence within the study area, associated with Cemex UK Material mineral washing (Licence No. 11/42/23/3).	High
Built Environment	The study area includes the existing M27, A3024, and Old Gas works site, interaction with railway lines and a multitude of residential and commercial properties in the city of Southampton. Several Grade II listed structures lie within the study area - largely churches.	Medium to High

Attribute / Contaminated Land Receptor	Justification	Attribute Importance (Sensitivity)
	The presence of Japanese Knotweed in the 250 m zone of consideration surrounding Sub-schemes 1 and 5 could cause damage to foundations of the bridge and road through its forceful growth.	
Construction Workers	It is assumed that best practice will be adhered to throughout construction. Moderate to extensive earthworks, and demolition of structures including the Northam Road Rail Bridge.	Medium to High
End Users	The proposed future land use (i.e. a highway) is considered unlikely to expose end users to soil or groundwater contamination.	Low

10.4 Potential impacts

Appraisal option 1 and Appraisal Option 2 as well as individual sub-scheme options are expected to have similar impacts on geology, geomorphology and soil.

Major accidents and/or disasters will not result in any likely significant effects in the context of geology and soils.

10.4.1 Sub-scheme 1:

This sub-scheme would involve a small amount of topsoil stripping with no substantial land take. There is likely to be a requirement to reuse or dispose of topsoil and there is potential for run off from exposed soils. Therefore, this Sub-scheme is expected to have a Neutral or Slight Adverse effect on shallow soil, groundwater and surface waters during the construction phase and a Neutral effect on geology and geomorphology, the built environment, construction workers and end users.

10.4.2 Sub-scheme 2

Improvements comprise junction improvements and traffic signal controller reconfiguration at signalised junctions to eliminate running side roads for longer green times than required. Minor changes are proposed to kerblines at junctions (introducing flares and turning pockets) to improve localised stop-line capacity.

This sub scheme involves minimal construction work. Land take is negligible and it is currently intended all land would be within Highways England; or Southampton City Council ownership (although land ownership details are to be confirmed during development of options). These works are predicted to have the potential for Neutral to slight adverse impacts on all receptors.

10.4.3 Sub-scheme 3:

Sub scheme 3 involves both demolition and construction works including citing of the construction compound on the former gas works site to the south of the Northam Road Rail Bridge. Excavations within potentially contaminated soils, especially those previously covered by hard standing, could allow contaminants to be mobilised due to surface run-off and due to infiltration of rainwater. These works are predicted to have the potential to result in Neutral or Slight Adverse effects on groundwater and surface waters during the construction phase, and Neutral effects to all remaining attributes.

10.4.4 Sub-scheme 5

This sub scheme predominantly involves works within the exiting highway, with surface water run-off; and is considered likely to have potential for a Neutral or Slight Adverse effects on groundwater and surface waters during the construction phase, and Neutral effects to all remaining attributes a Neutral effect on receptors.

10.5 Assessment methodology

This assessment has been undertaken in accordance with the principles of:

- DMRB Volume 11, Section 2, Part 5: Assessment and Management of Environmental Effects, (2008); and,
- DMRB Volume 11, Section 3, Part 11: Geology and Soils (1993).

This section comprises Stage 1 of the assessment methodology as set out in DMRB Volume 11, Section 3, Part 11. This approach has been used to identify attributes of importance (e.g. geology, geomorphology and soils), the magnitude of potential impacts, and the significance of potential effects upon the resources, to be taken into account when refining the sub-scheme options.

A Phase 1 Preliminary Risk Assessment (PRA) was undertaken at PCF Stage 1[47]; and a Preliminary Sources Study Report was prepared at PCF Stage 2[48] to establish baseline conditions in the study area. The PRA assessed potential interactions with geology, geomorphology and soils (including the potential for land contamination) during the construction and operational phases of the sub-scheme options.

The potential for land contamination within the study area has been assessed in accordance with the principles of the EA report CLR11: Model Procedures for the Management of Land Contamination[49].

In accordance with current UK Government guidance, qualitative risks on land contamination are assessed using a 'Source-Pathway-Receptor' approach, where the following definitions apply:

- Source/ hazard: a substance or situation which has the potential to cause harm or pollution;
- Pathway: means by which a source/ hazard can reach and impact upon a receptor; and,
- Receptor: that which may be adversely affected by the presence of the source or hazard.

Such an approach recognises that risks from site-based contaminants can only exist where all three components are present, constituting a complete contaminant linkage.

The level of risk is evaluated in accordance with CIRIA C552[50]. This involves qualitative classification of the consequence and probability of each potential contaminant linkage. The classifications are compared to determine the corresponding risk category.

The framework for determining the classification of consequence, presented in full in CIRIA C552, is summarised in

[47] WSP, no reference found
[48] Preliminary Sources Study Report for Southampton Junctions, Ref: HE55154-CH2-PCF2-XX-ZZZZ-SW-TE-ZZ-002 (CH2M, 2017)
[49] CLR11: Model Procedures for the Management of Land Contamination [online] available at http://www.claire.co.uk/index.php?option=com_content&view=article&id=187&catid=45&Itemid=256
[50] CIRIA C552; (2001): Contaminated Land Risk Assessment – A Guide to Good Practice.

Table 10.4**.** The classification does not account for the probability of the consequence being realised.

Table 10.4: Qualitative Risk Assessment – Classification of Consequence

Classification	Definition
Severe	Short term (acute) risks to human health, likely to result in significant harm. Short-term risk of polluting sensitive water resources. Short-term risk to a particular ecosystem or organism forming part of such ecosystem.
Medium	Chronic damage to human health (significant harm). Pollution of sensitive water resources. A significant change in a particular ecosystem, or organism forming part of such ecosystem.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or to the environment.
Minor	Harm, not necessarily significant, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health. Easily repairable effects of damage to buildings, structures and services.

The framework for determining the classification of probability, presented in full in CIRIA C552[51], is summarised in **Table 10.55.**

Table 10.5: Qualitative Risk Assessment – Classification of Probability

Classification	Definition
High Likelihood	There is a contaminant linkage and an event that appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	It is probable that an event will occur. Whilst not inevitable, it is possible in the short term and likely over the long term.
Low Likelihood	Circumstances are possible under which an event could occur, but it is not certain that (even over a long time period) such an event would occur.
Unlikely	It is improbable that an event would occur even in the very long term.

Once the consequence and probability have been determined for a potential contaminant linkage, these have been compared using the matrix shown in

[51] CIRIA C552; (2001): Contaminated Land Risk Assessment – A Guide to Good Practice.

Table 10.6**6** to produce a risk category ranging from 'very high risk' to 'very low risk'.

Table 10.6: Qualitative Risk Assessment – Risk Category

		Consequence			
Probability		**Severe**	**Medium**	**Mild**	**Minor**
	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/ Low Risk
	Likely	High Risk	Moderate Risk	Moderate/ Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/ Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/ Low Risk	Low Risk	Very Low Risk	Very Low Risk

A value (or 'sensitivity') has been assigned to each attribute in accordance with the principles established in Volume 11, Section 2, Part 5 of the DMRB[52].

Following consideration of the potential for post-constructional effects, such as the remobilisation of contaminative substances following ground disturbance during the construction process, a value has also been assigned to the potential contaminated land receptors identified in the conceptual site model (CSM).

Assigning sensitivity relies on reason, professional judgement, and the advice of appropriate organisations (Volume 11, Section 2, Part 5 of the DMRB).

The values (and typical descriptors) assigned to attributes and contaminated land receptors are defined in **Table 10.77.**

[52] Design Manual for Road and Bridges; [online] available at: http://www.standardsforhighways.co.uk/dmrb/

Table 10.7: Defining the Value (Sensitivity) of Attributes and Contaminated Land Receptors

Value (Sensitivity)	Attributes		Contaminated Land Receptors			
	Geology & Geomorphology	Soils	Controlled Waters	Built Environment	Construction Workers	End Users
High	Nationally important geological or geomorphological features (SSSI) or mineral resources.	Good to excellent quality agricultural land.	Principal aquifer beneath site, and/or major surface water in close proximity.	Buildings of high historical value or other high sensitivity.	Extensive earthworks including demolition of buildings.	Residential development, allotments, plays areas.
Medium	Regionally Important Geological Sites (RIGS) or mineral resources.	Poor to moderate quality agricultural land.	Secondary aquifer beneath site and/or minor surface water in close proximity.	Buildings, including services and foundation.	Limited to moderate earthworks.	Landscaping or public open space.
Low	No geological or mineral features of importance in close proximity.	Very poor quality agricultural land. Made ground with little potential for farming use.	Aquitard or aquiclude beneath site. No surface water body in close proximity.	Not applicable.	Minimal disturbance of ground.	'Hard' end use (e.g. industrial use, road, car park).

The magnitude of impact is assigned using reason and professional judgement (typical descriptors, set out in Volume 11, Section 2, Part 5, of the DMRB, are provided in **Section** Error! Reference source not found.).

The significance of effects is determined using the matrix in DMRB Volume 11, Section 2 Part 5, detailed in

Table 5.**4**.

10.6 Assessment assumptions and limitations

The assessment of the effects of each of the sub-scheme options are based on indicative information and limited by the absence of site-specific ground investigation data.

Japanese Knotweed should be treated to prevent potential future damage to built structures.

10.7 Design, mitigation and enhancement measures

It is recommended that a site specific ground investigation be undertaken to generate such data as to confirm the anticipated ground conditions, identify and confirm potentially significant sources of land contamination and obtain the information necessary to permit detailed design, including testing to determine the appropriate concrete class to be utilised in construction.

Any future ground investigation should also aim to determine the waste classification and potential for re-use of soils.

Ground investigation work is required to characterise the existing ground conditions in relation to the CSM (to include consideration of soil, groundwater, ground gas and geotechnical parameters). The works should be completed in accordance with BS10175:2011, CLR11 and other relevant standards and guidance. The information obtained must be utilised in the design and construction phases.

A Construction Environmental Management Plan (CEMP) is also required, which will outline the mitigation, control and monitoring measures to be put in place to minimise the impact of the development options on ground conditions, land quality and water resources during the construction process.

Construction work is to proceed in accordance with industry best practice

Soils removed to carry out road improvement works could potentially be retained and re-used, either as part of the development options, landscape works or elsewhere. Soils must be demonstrated to be suitable for use, following an appropriate testing and assessment strategy. The level of damage and deterioration in soil quality during storage and transit will depend on the types of earthworks machinery used, methods of handling and storage conditions.

A management plan to eradicate the Japanese Knotweed identified south of Bitterne Rail Bridge by ‘Phase 1 Habitat Survey’ (WSP 2016) should be prepared and implemented. The weed should be treated and removed in accordance with current industry best practice.

Japanese Knotweed would be dealt with in the long term/wider context by each respective landowner as part of their current obligations; (that responsibility would fall to Area 3 Asset Support Contract (ASC) Contractor for Highways England's Strategic Road Network (SRN) or the relevant Highway Authority if not Highways England).

10.8 Assessment of effects

10.8.1 Appraisal Option 1

Designated sites

With no geological SSSIs or RIGS within the study area, there will be no change to these geological and geomorphological attributes and therefore effects from all Su-Schemes are considered to be neutral during both construction and operation.

Soils

This Scheme as a whole would involve a small amount of topsoil stripping with a small amount of land take to the south west of Junction 8 Roundabout, along the south of the A3024 between Junction 8 of the M27 and Windhover Roundabout, within the centre of Windhover Roundabout (Sub-scheme 1), localised sections of the A3024 (Sub-scheme 2, 3 and 5), to the north of Northam Road Rail Bridge (Sub-scheme 3); and temporary land take for construction compounds to the north of Windhover Roundabout and the south of Northam Road Rail Bridge.

The magnitude of impact to soils is expected to be negligible adverse (total area of land take of <20ha) during construction; and approximately 1.4hectares of permanent land take during operation. The significance of effect on soils is therefore expected to be slight adverse during the construction phase and neutral during the operational phase.

Groundwater and surface water

The multitude of industrial processes which historically operated across the Scheme extents provide innumerable potential contaminants of concern. In the absence of site specific ground investigation data and characterisation, the Made Ground underlying the entire study area is assumed to be a potential source of contaminative substances. Any works where the ground is broken (a likely occurrence for all sub-schemes), therefore provides potential for the creation of new migratory pathways for contaminants during construction.

The significance of effect on groundwater and surface water is therefore expected to be slight adverse during the construction phase and neutral during the operational phase.

Built environment/ Land Use

Chemicals that are destructive to concrete (e.g. sulphates and acids) have the potential to constrain the design of the Scheme. However, it is assumed that laboratory data (gathered following completion of intrusive investigation) will be available at PCF Stage 3 to characterise the concentrations of these substances in soil and groundwater and that suitable construction materials resistant to any such substances will be used.

As such no change to the built environment is expected and therefore the effect of the Scheme on the built environment will be neutral in both the construction and operational phases.

Construction Workers and end users

The Scheme extents has the potential to contain significant contamination sources, in particular this is the case for Sub-Scheme 3 and the western extents of Sub-scheme 2. However, with the implementation of best practice and standard mitigation, the effect of the Scheme on construction workers and end users is considered to be neutral in both the construction and operational phases.

10.8.2 Appraisal Option 2

Operation and construction phase impacts for Appraisal Option 2 are the same as for Appraisal Option 1 as detailed in Section 9.8.1. However, are limited to the impacts associated with the geographical extent of the Option, which excludes areas of high probability of contamination such as the gas works site (construction compound for Sub-scheme 3) and railway (passing directly underneath Sub-scheme 3).

11. Materials

11.1 Legislative and policy framework

The overarching policy document for waste in Europe, the Revised Waste Framework Directive, sets a target for recycling and reuse of 70% for Construction Demolition and Excavation (CDE) wastes by 2020. This requirement has been cascaded down at a national level within the Waste (England and Wales) Regulations 2011. England and the UK are already achieving an estimated 93% recovery rate of construction and demolition waste[53].

Statutory Requirements

The *EU Waste Framework Directive 2008/98/EC* provides the overarching legislative framework for the collection, transport, recovery and disposal of waste, and includes a common definition of waste. It lays down measures to protect the environment and human health by preventing or reducing the adverse effects resulting from the generation and management of waste and by improving the efficiency and reducing the overall impacts of resource use.

The Directive also mandates the Waste Hierarchy (Please refer to Error! Reference source not found.**1**), which requires that where waste is unavoidable, products and materials should, subject to regulatory controls, be used again for the same or a different purpose (re-use). Otherwise resources should be recovered from waste through recycling. Value can also be recovered by generating energy from waste but only if none of the above offer an appropriate alternative solution.

Figure 11.1 The Waste Hierarchy[54]

[53] Defra, 2013. *Waste Management Plan for England*. [online] Accessed: 12/09/2016.
[54] European Commission, 2016. *Directive 2008/98/EC on Waste (EU Waste Framework Directive)*. [online] Accessed 15/09/2016.

The *EU Landfill Directive 1999/31/EC* sets stringent requirements for the landfilling of wastes. The key requirements of the Directive are:

- Separation of wastes through a classification approach to landfills: landfill for hazardous waste; landfill for non-hazardous waste and landfill for inert waste;
- Treatment of wastes prior to landfilling;
- Banning of certain wastes from being landfilled;
- Reduction in the amount of biodegradable municipal waste going to landfill; and
- Landfill location requirements.

There are a number of primary legislative instruments in the UK on waste listed below. In turn, these enact a wide range of secondary legislation that governs the storage, collection, treatment and disposal of waste:

- The Control of Pollution Act (CoPA)1974;
- The Control of Pollution (Amendment) Act 1989;
- Environmental Protection Act 1990;
- The Environment Act 1995;
- The Finance Act 1996;
- Waste Minimisation Act 1998;
- The Waste and Emissions Trading Act 2003;
- The Clean Neighbourhoods and Environment Act 2005;
- The Waste (England and Wales) (Amendment) Regulations 2012 and 2014

National Policy Statement for National Networks (NPSNN)

The NPSNN requires that if a project is categorised as a Nationally Significant Infrastructure Project (NSIP) evidence of appropriate mitigation measures (incorporating engineering plans on configuration and layout, and use of materials) during both design and construction needs to be presented together with the arrangements for managing any wastes that are produced.

At PCF Stage 1, it was considered that Development Consent Order (DCO) would not be required for the Scheme. This situation has been reviewed and the same view is held at PCF Stage 2, therefore, the Scheme is not considered to be an NSIP, therefore the NPSNN requirements are not mandatory, however as a course of best practice due regard shall be given to the requirements.

Waste Management Plan for England (2013)

The Waste Management Plan for England is a high-level document which is non-site specific and provides an analysis of the current waste management situation in England. It provides a planning framework to enable local authorities to put forward strategies that identify sites and areas suitable for new or enhanced waste management facilities to meet growing demand. Local Planning Authorities prepare local waste management plans as part of their Development Plan. Site-specific waste management plans are also prepared by contractors to control waste during construction, although they are not a legal requirement.

National Planning Policy for Waste (October 2014)

This document sets out detailed waste planning policies and states that all local authorities should have regard to its policies when discharging their responsibilities. The document provides guidance to local authorities on the following:

- Using a proportionate evidence base when preparing waste plans;
- Identifying the need for waste management facilities;
- Identifying suitable sites and areas for facilities; and
- How to determine waste planning applications.

Hampshire Minerals and Waste Plan 2013-2030

This Local Plan contains Hampshire County Council (HCC), Portsmouth City Council, Southampton City Council (SCC), New Forest National Park Authority and the South Downs National Park Authority (the 'Hampshire Authorities') strategic vision for the management of Minerals and Waste until 2031.

The Plan contains a number of policies that the Scheme would need to comply with in order to contribute to the county's strategic goals. The Plan aims to support economic growth by ensuring that a reliable source of minerals is maintained and waste is managed effectively and efficiently, whilst protecting the environment and the county's communities.

The Plan's policies are centred around:

- Sustainable minerals and waste development;
- Protecting the Hampshire Authorities environment;
- Maintaining the Hampshire Authorities communities; and
- Supporting the Hampshire Authorities economy.

The options should be in line with the strategic goals of this document in order to be compliant with county policy.

11.2 Study area

The study area comprises the predicted maximum physical extent of the Scheme and the associated works, as well as the locations of waste management facilities and associated transportation networks within the administrative area of the Hampshire Authorities (assuming waste will remain within the Hampshire Authorities administrative area). Whilst the final locations and land take areas of construction compounds are not yet agreed it is likely there will be a dedicated construction compound associated with Sub-Scheme 1 located to the north west of Windhover roundabout and for Sub-scheme 3, this will be located to the south of Northam Road Rail Bridge on the gas works site.

Many material resources will originate off-site as described in **Section** Error! Reference source not found., but others will arise onsite during construction such as excavated soil and rock or recycled elements of existing roads. The latter are included within the scheme boundary.

11.3 Baseline conditions (including value/sensitivity of resources and receptors)

11.3.1 Materials and waste generated

The CDE sector is the largest contributing sector to the total waste generation in England and generated 77.4 million tonnes (Mt) of waste in 2010[55].

The objective in Hampshire authorities' administrative area is to reuse, recycle and recover as much as possible of the estimated 2.35 Mt of CDE waste that is generated each year[56]. This is mostly made up of inert material such as concrete, rubble or soils[57]. This CDE waste comprises about 49% of the total waste arisings (by weight) in Hampshire[58]. Other waste streams in the Hampshire authorities' administrative area include municipal solid waste (MSW), which contributes about 17% and commercial and industrial (C&I) waste, which contributes about 34% of the total waste arisings (by weight).

This is managed through a network of commercial waste transfer stations and materials recovery facilities, with the remainder going to landfill[59] (Please refer to **Figure 11-22)**. It is recognised that there is a shortage of strategic waste management facilities in the UK and an increase in waste management infrastructure is required. Overall the Hampshire authorities' administrative area currently has enough capacity to deal its waste[60].

The Scheme may result in surplus material which may need to be disposed of as waste. In the case of options being considered here, this is most likely to include arisings from existing site materials (e.g. concrete and excavation of material from

[55] Defra, 2013. *Waste Management Plan for England*. [online]. Accessed: 19/10/2017.
[56] Environment Agency, 2012. *Hampshire Mineral & Waste Plan, Assessment of Need for Waste Management Facilities in Hampshire: Waste Data Summary Report*. [online]. Accessed: 19/10/2017.
[57] Hampshire Authorities, 2013. *Hampshire Minerals and Waste Plan*, p. 110. [online]. Accessed: 19/10/2017.
[58] Environment Agency, 2012. *Hampshire Mineral & Waste Plan, Assessment of Need for Waste Management Facilities in Hampshire: Waste Data Summary Report*. [online]. Accessed 19/10/2017.
[59] Hampshire Authorities, 2013. *Hampshire Minerals and Waste Plan*, p. 96. [online]. Accessed: 19/10/2017.
[60] Hampshire Authorities, 2013. *Hampshire Minerals and Waste Plan*, p. 12. [online]. Accessed: 19/10/2017.

earthworks) and materials brought on to the site but not used for their intended purpose (e.g. damaged goods or over ordering of a certain material).

11.3.2 Materials

The Hampshire authorities' administrative area has local supplies of sand and gravel, silica sand, chalk, brick-making clay[61]. A large part of the Hampshire authorities' administrative area is underlain by mineral deposits which may be required to meet the future needs for construction materials[62]. Soft sand and silica sand resources are scarcer compared to sharp sand and gravel[63]. Brick-making clay is important to maintain the productivity of Hampshire's brickworks[64].

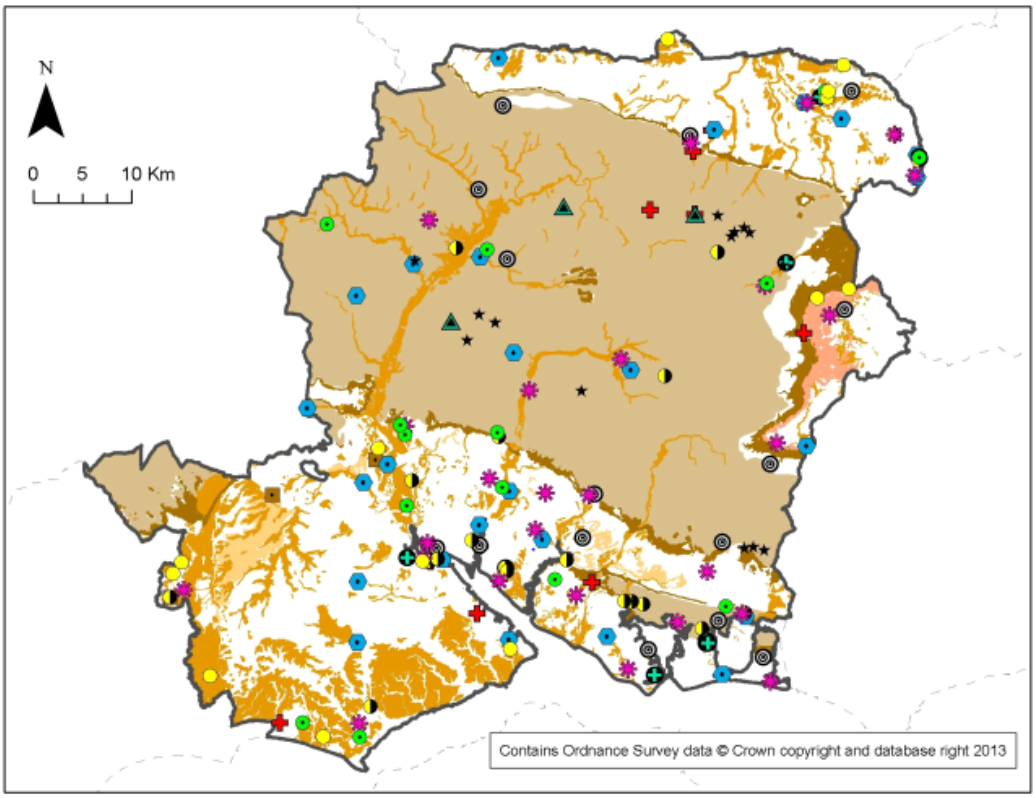
The Hampshire authorities' administrative area also has deposits of chalk, other non-brick making clay, malmstone and clunch[65], but does not have hard rock or other specialist aggregates or minerals. These would need to be imported into the county by sea or by rail[66].

Figure 11-31 displays Hampshire authorities' administrative areas main supply sources for minerals / aggregates, along with other important features including waste development interests and the principal constraints[67]. These minerals need to be managed carefully and used efficiently and their economic benefits need to be balanced with their environmental and social impacts.

The Sub-schemes and options will require materials to create and improve carriageways, bridges, footpaths and associated infrastructure. The options are likely to vary in terms of volumes of material usage but are likely to use the same broad categories of materials. These are likely to include primary materials, for example aggregates, and secondary recycled materials such as recycled concrete sourced on site.

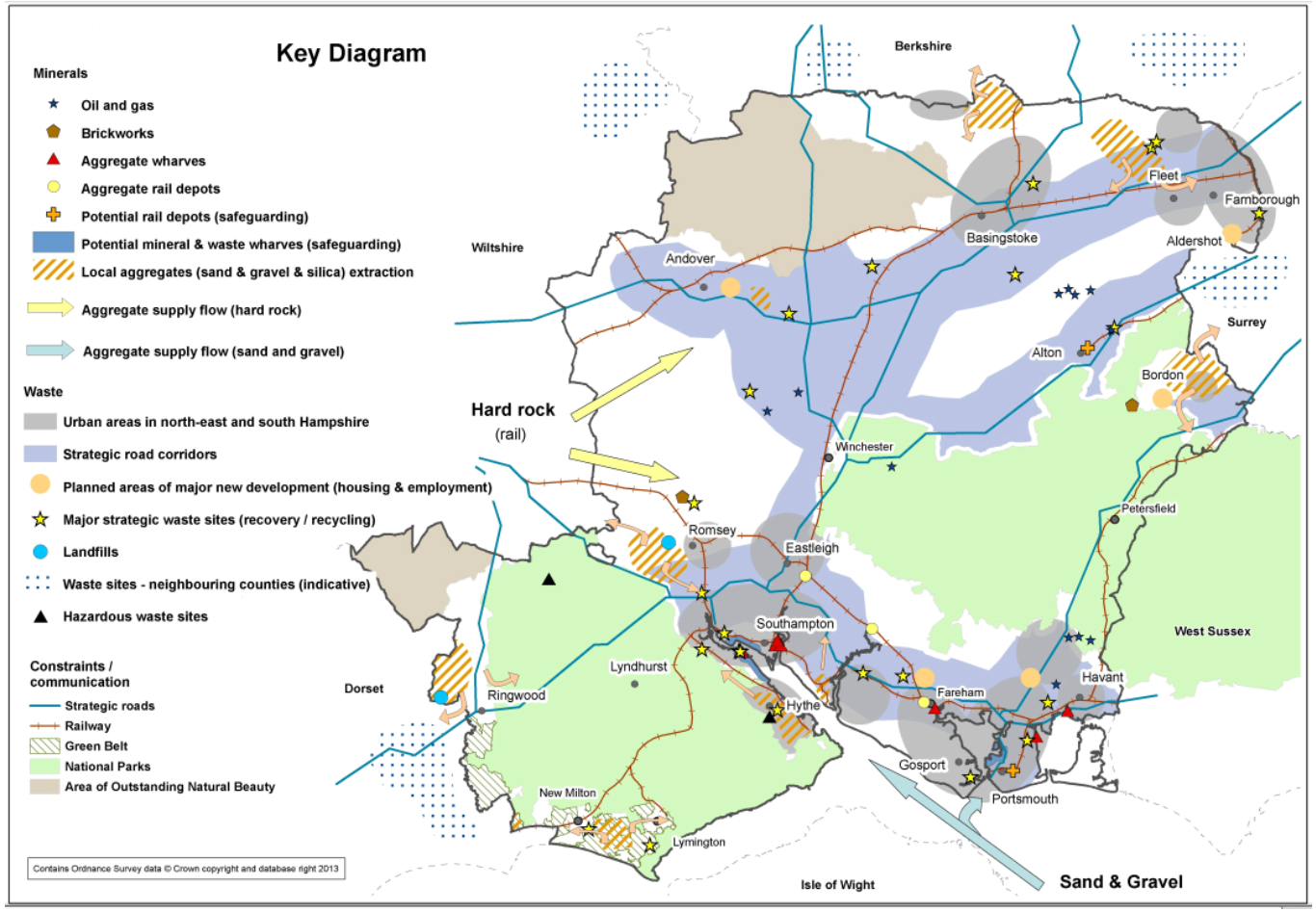
[61] Hampshire Authorities, 2013. *Hampshire Minerals and Waste Plan*, p. 12. [online]. Accessed: 19/10/2017.
[62] Hampshire Authorities, 2015. *Hampshire Minerals & Waste Plan, Minerals & Waste Safeguarding In Hampshire, Supplementary Planning Document*, p. 8. [online]. Accessed: 19/10/2017.
[63] Hampshire Authorities, 2015. *Hampshire Minerals & Waste Plan, Minerals & Waste Safeguarding In Hampshire, Supplementary Planning Document*, p. 16-17. [online]. Accessed: 19/10/2017
[64] Hampshire Authorities, 2015. *Hampshire Minerals & Waste Plan, Minerals & Waste Safeguarding In Hampshire, Supplementary Planning Document*, p. 174. [online]. Accessed: 19/10/2017.
[65] Hampshire Authorities, 2015. *Hampshire Minerals & Waste Plan, Minerals & Waste Safeguarding In Hampshire, Supplementary Planning Document*, p. 174. [online]. Accessed: 19/10/2017.
[66] Hampshire County Council, 2013. *Hampshire Minerals and Waste Plan*, p. 12. [online]. Accessed: 19/10/2017.
[67] Hampshire Authorities, 2013. *Hampshire Minerals and Waste Plan*, p. 22. [online]. Accessed: 19/10/2017.

Figure 11-2 Strategic waste infrastructure and mineral resources within the administrative area of the Hampshire Authorities[68].



[68] Hampshire Authorities, 2013. *Hampshire Minerals and Waste Plan*, p. 13. [online]. Accessed: 19/10/2017.

Figure 11-3 The Hampshire authorities' administrative areas main supply sources for minerals / aggregates, waste development interests and principal constraints[69].



[69] Hampshire Authorities, 2013. *Hampshire Minerals and Waste Plan*, p. 22. [online]. Accessed: 19/10/2017.

11.4 Potential impacts

The construction of the Scheme will require the use and consumption of material resources including primary raw materials and manufactured construction products, and hence may result in potential impacts on the environment. These include both direct and indirect impacts related to the depletion of natural resources, embodied carbon emissions associated with the manufacture of materials, and non-compliance of the Scheme with relevant sustainable development and materials policies and plans.

Construction will also result in surplus materials and waste, leading to potential direct impacts, most notably on the waste management infrastructure available to accept, treat and dispose of the various types of waste generated. For surplus materials and waste, the potential environmental impacts are associated with the production, movement, transport, processing, and disposal of arisings from the construction of the Scheme. For example, the generation of surplus materials and waste may lead to both permanent and temporary impacts on the available waste management infrastructure, i.e. through occupying landfill void space and/ or the short-term use of available waste storage, recycling, recovery capacity, and non-compliance of the Scheme with relevant policies and plans.

Significant environmental impacts are likely to arise from those materials which are used in the largest quantities or are high in embodied carbon, wastes which arise in the largest quantities which have hazardous properties, or which comprise a large proportion of the value of the Proposed Scheme.

The detailed construction methodology the Scheme has not yet been developed, until the engineering aspects of all elements of the Scheme have been identified (e.g. in the form of a detailed Bill of Quantities) it is not possible to identify the precise potential environmental impacts and effects associated with the use and consumption of materials and the production and management of waste during the construction period. Nevertheless, review of the information available at the time of preparing the EAR (including the general arrangement plans and experience of previous highways projects), suggests that the materials used and wastes generated by the Scheme are likely to include those identified in Table 10.1.

Major accidents and/or disasters will not result in any likely significant effects in the context of materials.

Table 10.1: Summary table of materials used and waste arisings from the Scheme

Material resource use	Waste arisings
▪ General fill and landscaping fill ▪ Capping materials ▪ Granular stone sub base ▪ Bituminous materials for road construction ▪ Road markings (thermoplastic materials) ▪ Drainage products – pipes, chambers and gully pots (including metal covers or grates), plastic, clayware or precast concrete ▪ Granular stone bedding and backfill to drainage pipes ▪ Traffic signage ▪ Steel including hot-rolled steel (for rail rails)[70] ▪ Precast concrete – kerbs (combined kerb and drain) ▪ Concrete for various purposes including the new Northam Rad Rail Bridge (Sub-scheme 3), box culvert, drainage, sign foundations etc. ▪ Timber (e.g. formwork, falsework) ▪ Traffic signal posts and heads, electrical cables, etc.	▪ Vegetation, tree and hedge removal (non-hazardous) ▪ Surplus excavated material (inert or non-hazardous); ▪ Hardened concrete waste (inert) ▪ Hot rolled steel (inert) ▪ Mixed (inert) waste ▪ Mixed construction and demolition waste (non-hazardous) ▪ Canteen /office / ad hoc waste (non-hazardous) ▪ Mixed packaging (non-hazardous) ▪ Timber and wood waste (non-hazardous) ▪ Plastics (non-hazardous) ▪ Metals (non-hazardous) ▪ Miscellaneous aqueous liquids wastes (non-hazardous) ▪ Miscellaneous hazardous waste ▪ Hydraulic oils (hazardous) ▪ Waste electrical and electronic equipment (hazardous or non-hazardous).

11.5 Assessment methodology

IAN 153/11[71] states that "For projects with an estimated cost greater than £300,000 it is assumed that the potential does exist for impacts and effects to take place. Therefore, an assessment of materials should be undertaken to at least the Simple level of assessment". The cost of constructing the Scheme is assumed to be greater than £300,000, therefore it has been assumed that the potential exists for environmental impacts and effects to occur from the use of materials and the generation of waste during the construction works.

The guidance within a 'Simple Assessment' will be undertaken before detailed design. The simple assessment assembles data and information that is readily available to address potential effects identified before detailed design information is available. This level of assessment is considered appropriate for the Scoping Stage, however as the Sub-scheme options being assessed within this EAR are preliminary, it is considered appropriate to follow this high-level assessment approach at this early design stage (due to the preliminary nature of information).

IAN 153/11 identifies that it is not possible to provide detailed guidance on some aspects of the assessment process, such as the significance and magnitude of effect. Therefore, this assessment follows the methodology set out in **Section** Error! Reference source not found. of this EAR. The sensitivity of the receptor is dependent on the capacity of the local environment to provide materials or dispose of waste (i.e. the capacity of available waste management infrastructure). Predicted quantities of materials to be used and the waste forecasts, based on professional judgement, have been used to identify the magnitude of an impact.

[70] Railway rails must be made of very high-quality steel alloy, it is considered that there could be a requirement to replace rail tracks as a result of works to Northam Road Rail Bridge

Using this high level professional judgement of significance and magnitude, an overall impact of each Sub-scheme option has been determined.

11.6 Assessment assumptions and limitations

The material requirements and level of waste generated by the Scheme is not known due to the limited design information available at this early stage in the design process. Furthermore, material sources are unknown.

The assessment provided is based upon information available at the time of writing. No details are currently available on the quantity of waste material that will be produced by the Scheme nor the quantity of material that will be required to construct the Scheme. In general, it is assumed that the larger development footprint, the larger scale ground works; and those Sub-schemes that require the construction or demolition of larger structures (i.e. Sub-scheme 3) will produce a higher level of waste and require increased amounts of materials to complete.

Calculations of waste arisings (for instance for the earth works balance) will be developed by the construction contractor for the preferred option. This EAR therefore provides a high-level assessment of the potential impacts associated with materials use and waste generated by the proposed options.

11.7 Design, mitigation and enhancement measures

Where impacts have been or are identified these will be addressed through ensuring that the construction of the Scheme responds to national regulatory standards and local policy requirements; and through the adoption of the following 'standard' or 'anticipated' mitigation measures taking into account legislation, policy and best practice guidance. These measures will promote positive scheme outcomes through:

- Designing for resource efficient construction; all opportunities to design for resource efficiency are covered by five key principles:
- Design for Reuse and Recovery,
- Design for Off-site Construction,
- Design for Resource Optimisation,
- Design for Resource Efficient Procurement, and
- Design for the Future.
- Employing simple carbon footprinting techniques[72] to identify opportunities to avoid, reduce, or substitute scheme related carbon emissions (e.g. through exploring different concrete specifications etc.).
- Responsibly sourcing key material elements (concrete, aggregate and steel) from suppliers who have a minimum ISO 14001 certification and, if available, BES 6001 (Framework Standard for the Responsible Sourcing of Construction Products)

[71] Interim Advice Note (IAN) 153/11; Highways England; Web Reference http://www.standardsforhighways.co.uk/ha/standards/ians/index.htm Accessed: 01/11/2017
[72] Environment Agency carbon calculator tool: https://www.ice.org.uk/disciplines-and-resources/best-practice/environment-agency-carbon-calculator-tool

certification for that material; all timber and wood-derived products (including formwork) should be similarly sourced from sustainable sources, i.e. Forestry Stewardship Council (FSC) or Programme for Endorsement of Forest Certification (PEFC) licensed timber or equivalent sources.

- Setting targets to recycle non-hazardous construction and demolition waste; and to reduce disposal of non-hazardous C&D waste to landfill in line with UK Government and construction industry good practice.
- Facilitating the prevention, reuse, recycling and recovery of construction and demolition waste through the implementation of a Site Waste Management Plan SWMP.
- Ensuring that all waste is stored, transported, treated, reprocessed and disposed of safely without harming the environment in accordance with the requirements outlined at gov.uk[73].
- During PCF Stage 3, a topographical survey will be undertaken to ensure land take for all Sub-Schemes is minimised where possible.

11.8 Assessment of effects

11.8.1 Appraisal Option 1

No change from PCF Stage 1

Sub-scheme 1

This option involves signalisation and localised widening at Windhover Roundabout and M27 Junction 8, and new Non-Motorised User (NMU) facilities.

The M27 Junction 8 improvement works include minor carriageway widening, in the north east and south west (off slip roads), new safety barriers; and some new NMU facilities. It is therefore assumed there will be some earthworks required.

The A3024 Bursledon Road arm of the Windhover Roundabout, heading towards Southampton, has some localised widening on its south-eastern side to provide a separate two-lane road existing from Windhover Roundabout on a new alignment. Widening to both sides of the A3025 Hamble Lane where it joins with Windhover Roundabout is also proposed. All other arms including the circulatory carriageway have small areas of localised carriageway widening. There is potentially that a small amount of land take is required for the construction of new shared pedestrian and cycle path.

Carriageway widening would result in the production of waste material through clearance and excavation of predominantly vegetated areas within the existing highway boundary. New material will be required to construct the widened carriageway, NMU facilities and to provide new signalling.

This option is considered to have a Neutral or Slight Adverse impact on materials.

Sub-scheme 2

[73] GOV.UK Environmental Management (Waste) Guidance: https://www.gov.uk/topic/environmental-management/waste

Sub-scheme 2 involves minor changes to kerblines at junctions (introducing flares and turning pockets) to improve localised stop-line capacity, changes to signals including installation of new signalling equipment; and changes to priorities on existing carriage way.

The main material requirements will be new signalling equipment. The option will result in the production of waste arising from a number of activities, including waste material from clearance and excavation where the existing carriage way is widened, damage to materials and products, off-cuts and packaging. The potential environmental impacts for waste are associated with its production, storage, transport, processing and disposal. The waste produced from this option would be minimal.

This option is considered to have a Neutral impact on materials.

Sub-scheme 3

Sub-scheme 3 involves constructing a new two-lane bridge and footpath cycleway to the north side of the existing bridge, and the demolition and replacement of the existing bridge structure and the stadium walkway. The demolition of the existing bridge and stadium walkway are likely to result in concrete and steel arisings, however there are no as built drawings of either structure and therefore there is currently uncertainty regarding the makeup of the structures.

depending upon the final design may require fill material (requirement for and volume of fill material would be dependent upon whether the subway is infilled of blocked off).

Demolition material can be reused elsewhere, potentially alleviating the need for landfill. Any materials that are not required for use within the Scheme would become waste. This would have potential impacts, including the consumption of landfill and waste treatment capacity and the movement of vehicles transporting waste arising's to final destinations.

Amendments to the existing road would be required to realign the carriage way to enable use of the new bridge structures. This would involve some demolition of the existing carriageway for the new alignment and additional land take of mainly vegetated areas. The resulting material would include bitumen, general construction materials and green waste / vegetation.

New materials would be required for the new carriageway and bridges. The material resource requirement for the new bridge would be considerable and the type of material requirement would depend on the final design.

Sub-scheme 3 is considered likely to have a Moderate Adverse impact on materials.

Sub-scheme 5

Sub-scheme 5 involves the construction of a new NMU bridge to the north of the existing Bitterne Rail bridge and amendments to existing carriageway and signals.

The main material requirements are likely to be steel and concrete for the construing of the new bridge and new signalling equipment. The option will result in the production of waste arising from a number of activities, including damage to materials and products, off-cuts and packaging. The potential environmental impacts for waste are associated with its production, storage, transport, processing and disposal. The waste produced from this option would be minimal.

This option is considered to have a Neutral impact on materials.

11.8.2 Appraisal Option 2

Operation and construction phase impacts for Appraisal Option 2 are the same as for Appraisal Option 1, Sub-scheme 1 and 2 as detailed in Section 10.8.1.

12. Noise and Vibration

12.1 Legislative and policy framework

The relevant legislative and policy framework considered for the assessment of noise and vibration during the construction and operational phases is summarised below.

- National Planning Policy Framework (NPPF) (Ref 11.1) - contains the aims of the government planning system policies and decisions;
- Planning Practice Guidance - Noise (PPG) (Ref 11.2) - advises on how planning can manage potential noise impacts in new development;
- National Policy Statement for National Networks (NPSNN) (Ref 11.3) - advises on noise and vibration in the context of Nationally Significant Infrastructure Projects (NSIPs) on the road and rail networks. It sets out the policy and reasoning by which the Secretary of State for Transport will make decisions on NSIPs;
- Control of Pollution Act 1974 - as amended (CoPA) (Ref 11.4) – sets out provisions to deal with noise nuisances and empowers local authorities to create noise abatement zones within their areas.
- Environmental Protection Act 1990 - as amended (EPA) (Ref 11.5) – defines what activities may constitute a Statutory Nuisance and empowers local authorities to investigate noise complaints and to serve notice when noise nuisance exists;
- Land Compensation Act 1973 (Ref 11.6) - provides a means by which compensation can be paid to owners of land or property due to a loss in value of these assets caused by the public works; and
- Transport Analysis Guidance (TAG) Unit A3 Environmental Impact Appraisal (Ref 11.7) – calculation undertaken as part of the transport appraisal process. The methodology is provided on the Department for Transport website to determine the Net Present Value (NPV) of noise and the number of households experiencing an increase or decrease in noise level as a result of a major project.
- Noise Policy Statement for England 2010 (NPSE) (Ref 11.8):

  Through the effective management and control of environmental noise within the context of Government policy on sustainable development, the NPSE aims to:

  - avoid significant adverse impacts on health and quality of life;
  - mitigate and minimise other adverse impacts on health and quality of life; and
  - contribute to improvements to health and quality of life, where possible.

  The Explanatory Note to the NPSE assists in the definition of significant adverse effects and adverse with the following definitions:

- 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 Government policy and guidance do not state values for the NOEL, LOAEL and SOAEL. Rather, it considers that they are different for different noise sources, for different receptors and at different times and should be defined at a strategic or project basis taking into account the specific features of that area, source or project.

12.2 Study area

12.2.1 Construction

For PCF Stage 2, the study area for construction noise covers a distance of 300 m from the locations of proposed construction activities. This chapter reports the potential estimated construction noise levels within different distance bands (i.e. 10 m, 20 m, 50 m, 100 m, 200 m and 300 m from the works) from the construction activities. The study area extends and distance bands to study any potential construction noise impacts has been selected based on professional judgement and guidance provided in the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7 – Noise and Vibration HD 213/11 - Revision 1 which states that "*the area in which construction is considered to be a nuisance is generally more localised than where the impacts of the road project are likely to be a cause of concern once it has opened to traffic. The impact of construction nuisance in one form or another, diminishes rapidly with distance".*

At this stage, no detailed construction plant and activities are available and thus construction impacts have been considered based experience of construction plant and activities used on other schemes of similar construction programme and size.

A full construction noise and vibration assessment will be carried out at PCF Stage 3 when the construction programme and methods have been developed.

12.2.2 Operation

The delimitation of the study area for the assessment of noise during operation has been undertaken considering the guidance contained in DMRB HD 213/11 (Ref 11.09) and professional judgement. Although HD 213/11 requires defining a boundary of 600 m from the scheme and any affected routes[74]; it is considered highly unlikely there will be any impacts beyond 300 m from the proposed scheme due to the high building density in the area surrounding the Scheme. Therefore, undertaking calculations beyond 300 m has been considered unnecessary. The urban nature of the A3024 and the area around the M27 Junction 8 and A27 Windhover roundabouts means that for most of the Scheme route there are buildings very close to the road. These buildings would act as obstacles for noise propagation. Consequently, the noise generated by the road is very unlikely to contribute to the noise levels beyond 300 m. Furthermore, being in a city, an area

[74] From DMRB HD 213/11 An affected route is where there is a predicted noise change between the Do-Minimum and Do-Something scenarios of 1 dB $L_{A10,18hr}$ or more in the short term or 3 dB $L_{A10,18hr}$ or more in the long term.

beyond 300 m would be dominated by sources of noise other than that from the A3024 or the roundabouts approach arms and links (e.g. other local roads).

For the simple assessment undertaken at PCF Stage 2, the calculation area for the noise model has included an area of 300 m from the edge of the existing carriageway of the Appraisal Options route and any affected routes within 1 km of the Appraisal option route. In addition, any affected routes beyond the calculation area have been considered for Basic Noise Level (BNL) calculations. Receptors within 50 m boundary from the carriageway edge of those affected road links have been counted.

12.3 Baseline conditions (including value/sensitivity of resources and receptors)

12.3.1 Approach

The baseline conditions have been established from:

- Information available from various databases (i.e. OS Mastermap August 2016, OS AddressBase Premium August 206, Extrium tool, Magic Map, Google Earth Pro); and
- Information contained within the PCF Stage 1 Appraisal Specification Report (ASR) (Ref 11.10) and PCF Stage 1 Environmental Study Report (ESR) (Ref 11.11).

12.3.2 Baseline noise climate

The main source of noise in the area is associated with traffic on the Scheme links with traffic from the local road network also contributing to overall noise level. In addition, other noise sources include the Southampton to Portsmouth coastal railway line which crosses under the A3024 at Sub-scheme 3.

Baseline noise surveys were undertaken in July 2016 at PCF Stage 1 in order to establish the noise climate close to the A3024 eastern access corridor. Further details of the assessment can be found in the PCF Stage 1 Appraisal Specification Report (ASR) (Ref 11.11). Measured noise levels near the A3024 and local roads indicate that the $L_{A10,18h}$ ranges between 68 and 71 dB.

From the Extrium tool Nose Map Viewer the road traffic noise level $L_{Aeq,16h}$ adjacent to Sub-Scheme 1 (SS1): M27 Junction 8 and A27 Windhover roundabouts is 70 to 75 dB and a noise level of 65 to 70 dB is noted alongside Sub-Scheme 2: A3024 corridor, Sub-Scheme 5: Bitterne Rail Bridge and Sub-Scheme 3: Northam Road Rail Bridge.

At the present no additional baseline surveys are proposed. At PCF Stage 3 the need for further baseline surveys would be revisited.

The following sections of noise barrier have been identified along the Scheme using aerial imagery:

- houses close to the A3024 on Pound Street (at SO18 6BL);
- along the back gardens overlooking the A3024 of the properties located on Glenfield Cress (at SO18 4RF) and;
- along the A3024 Northam Road at the junction with Brinton's Road (at SO14 0DE).

12.3.3 Sensitivity of resource

Noise sensitive receptors

The Scheme lies within the Southampton agglomeration and there is a high density of dwellings near much of the Scheme, including Sub-schemes 2, 3 and 5 and the area to the south of the A27 Windhover roundabout, at Lowford-Bursledon. There is a less developed area with some isolated semi-rural properties around Sub-Scheme 1 associated with the M27 Junction 8 and A27 Windhover roundabouts.

In total, 14,462 dwellings are included within the calculation area for Appraisal Option 1 (comprising Sub-schemes 1, 2, 3 and 5) and 1,812 dwellings for Appraisal Option 2 (which comprises Sub-scheme 1 and the Botley Road junction on the A3024). In addition, 41 other sensitive receptors have been identified within the calculation area for Appraisal Option 1 and three for Appraisal Option 2. Other sensitive receptors include community facilities, places of worship, medical facilities, educational establishments and leisure facilities. Other sensitive receptors associated with important open space only have been identified for Appraisal Option 1, in the area adjacent to the Northam Bridge which includes the Solent & Southampton Water Special Protected Area (SPA) and Ramsar Site, the Lee-on-the-Solent to Itchen Estuary Site of Special Scientific Interest (SSSI) and the Chessel Bay Local Nature Reserve (LNR).

The identification of the value or sensitivity of each noise sensitive receptor in the study area is set out in Table 11.1. This is based upon the guidance in HA205/08 (Ref 11.12).

Table 12.1: Sensitivity and Value of Receptors.

Receptor Value (Sensitivity)	Receptor Type Definition
Very High	Internationally designated areas and special cases for noise or vibration sensitivity
High	Residential, educational buildings, medical facilities
Medium	Hotels, community facilities and places of worship
Low	Commercial buildings (e.g. offices)
Negligible	Farmland and industrial premises
Within HA205/08 (vol11 section 2 part 5) 'Very High' is defined as: *"Very high importance and rarity, international scale and very limited potential for Substitution"* 'High' is defined as: *"High importance and rarity, national scale, and limited potential for substitution*	

Noise important areas (NIAs)

Defra has identified Noise Important Areas (NIAs)[75,76], as part of the production of strategic noise maps and action plans which are legal requirements set out in the Environmental Noise (England) Regulations. The NIAs are locations where dwellings are subject to noise levels considered high enough to warrant further investigation. The investigations are the responsibility of the noise making authority who should report possible mitigation measures at each IA to Defra. The noise making authority for the Strategic Road Network is Highways England.

Highways England's Road Investment Strategy (RIS) objectives and the Key Strategy objectives (measured by the Key Performance Indicator (KPI)) in relation to noise aim *"Mitigating at least 1,150 Noise Important Areas by the end of the first Road Period, to help improve the quality of life of around 250,000 people living and working near the Network".*

The locations of the NIAs for road traffic noise which lie within the Scheme study area (refer to section 11.2.2) are listed in Table 12.2 together with the number of dwellings within each NIA.

Table 12.2: Defra Noise Important Areas for road traffic within the scheme boundary

Sub-Scheme (SS)	NIA ID	Location	Number of dwellings	Asset Owner
SS1: M27 Junction 8 and A27 Windhover roundabouts	6207	On slip M27 J8 Northbound	7	Highways England
	5559	Off slip M27 J8 Northbound	3	Highways England
	5556	Hamble Lane	29[1]	Hampshire County Council
SS2: A3024 Eastern Access Corridor	2204	On A3024 near Coates Rd	17	Southampton
	2205	On A3024 near Orpen Rd	11	Southampton
	2206	On A3024 between Kathleen Rd and N E Rd	45	Southampton
	2207	On A3024 between Ruby Rd and White's Rd	67	Southampton
	2242	On A3024 and West End Rd	1	Southampton
	12664	On A334 Bitterne Rd E	1	Southampton
SS5: Bitterne Rail Bridge	2251	On A3024 between Glenfield Ave and Bitterne Bridge. Extends on A3035	743	Southampton
SS3: Northam Road Rail Bridge	2210	On A3024 between Summers St and Lumpy Ln	81	Southampton
	12661[1]	On A3024, Kingsway, St Andrews Rd, A335	212[1]	Southampton
[1] The NIA extends out of the study area of the Scheme. The number of dwellings reported is limited to those within the				

[75] Defra (2014), Noise Action Plan: Agglomerations.
[76] Defra (2014), Noise Action Plan: Roads (Including Major Roads).

Sub-Scheme (SS)	NIA ID	Location	Number of dwellings	Asset Owner
Scheme's study area for operational road traffic noise.				

All the NIAs listed in Table 12.2 are located within Appraisal Option 1 study area. Only the NIAs 6207, 5559 and 2204 lie within the Appraisal Option 2 study area.

12.4 Potential impacts

12.4.1 Construction noise

Construction activities have the potential to adversely impact nearby noise sensitive receptors. A non-exhaustive list of these activities includes:

- For Appraisal Option 1 only - the replacement of the Northam Road Rail Bridge (bridge demolition and construction); and improvements to the junction/road layouts around Bitterne Rail Bridge.
- For both Appraisal Options - the construction of pedestrian and vehicle parapets, central reserve paving works, partial and full depth resurfacing of Non-Motorised Users (NMU) paths, verge works, installation of new traffic signs, road widening and/or realignment, road resurfacing, and road marking works. With the construction works occurring on a larger area of the A3024 corridor Appraisal Option 1.

The construction programme for Appraisal Option 1 is longer than the construction programme for Appraisal Option 2. Given the extent of the proposed works along the A3024 corridor and the major works required at Northam Road Rail Bridge, the number of sensitive receptors with potential impacts will be larger for the construction phase for Appraisal Option 1.

Some of these construction activities may also generate vibration through piling and the use of vibratory rollers. Night-time construction works are likely to be required in both Appraisal Options.

The potential effects of route diversions, compound sites along the Scheme and construction heavy goods vehicles (HGVs) using local roads during construction should be identified in later stages of the project.

12.4.2 Operational noise

During the operational phase, the potential impacts would largely arise from changes in traffic flows on the highway networks resulting in the removal of traffic from the M27 peaks and re-routing along the A3024 and feeder roads, from the east into Southampton City Centre.

The overall increases in road traffic noise for both Appraisal Options would be caused by increased traffic flows due to the implementation of the Scheme, the localised widening of some sections of the A3024 and changes in the road alignment in some areas which brings the noise source slightly closer to sensitive receptors. Appraisal Option 1 will remove the existing weight restriction for HGVs on the Northam Road Rail Bridge, which has the potential to increase HGV flows along the A3024. However, a revision of the traffic data has indicated that the HGVs would not be the main cause of the noise increases. Appraisal Option 1 also includes localised road widening at junctions along the A3024, which would bring the road traffic noise source slightly closer to sensitive receptors such as nearby

housing. The re-routing of traffic could also potentially decrease ambient noise levels on some roads on the local road network due to decreased traffic flows.

Since Appraisal Option 2 is only concerned with improvements to the M27 Junction, Windhover Roundabout and the section of the A3024 at Botley Road junction, the changes in ambient noise to a smaller extent. Also, the weight restriction on Northam Road Rail Bridge would not be lifted and the number of dwellings likely to be affected by noise along the A3024 would be less for Appraisal Option 2.

Major accidents and/or disasters are not anticipated to result in any significant effects in the context of noise.

12.5 Assessment methodology

12.5.1 Scope

This chapter presents an assessment of the potential impacts of noise and vibration of the two Appraisal Options based on the Sub-schemes developed during PCF Stage 2.

Each topic within the scope of this chapter has its own methodology as shown in Table 12..

Table 12.3: Assessment methodology for each topic

Topic	Methodology
Construction noise from the scheme site	BS 5228-1 Section E.3.2 Table E.1 (Ref 11.13).
Operational road traffic noise	Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7 Noise and Vibration HD 213/11 Revision 1 (Ref 11.90)
Estimate the Net Present Value (NPV) of the Scheme based on the number of households experiencing an increase or decrease in noise level.	Transport Analysis Guidance Unit A3 by the Department of Transport (Ref 11.7)

Assessment of construction vibration requires detailed information on construction activities and methods following the guidance in BS 5228-2 (Ref 11.13). At PCF Stage 2 while there are anticipated potential sources of vibration associated with some of the proposed construction works, impacts from construction vibration have been qualitatively estimated.

An assessment of operational airborne vibration is not contained in the simple assessment at PCF Stage 2 but would be undertaken within the detailed DMRB assessment at PFC Stage 3 following the methodology set out in HD 213/11 (Ref 11.09).

Ground borne vibration effects during the operation of the Scheme are very unlikely and therefore these been scoped out of the assessment. This is because ground borne vibrations are only generally perceptible where the road surface is uneven and it is anticipated this would not be the situation following the completion of the Scheme.

12.5.2 Construction noise

The effects of construction noise are temporary and defined by the intrusion that construction noise causes in the existing noise environment (or soundscape) of the area. Table 12. shows the potential LOAELs and SOAELs for construction noise. Table 12.4 is adapted from Table E.1 in BS 5228-1 (Ref 11.13) Annex E which describes methods for evaluating the potential significant effect of construction noise.

Table 12.4: Threshold of potential significant adverse and adverse effects at dwellings in dB $L_{Aeq,T}$

Period	ABC Threshold Categories, $L_{Aeq,T\ façade}$ (dBA)		
	Category A [1] (LOAEL)	Category B [2] (LOAEL)	Category C [3] (SOAEL)
Daytime weekday (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
Evenings weekday (19:00-23:00), Saturdays (13:00-23:00) and Sundays (07:00-23:00)	55	60	65
Night-time weekday and weekend (23:00-07:00)	45	50	55
Note: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total $L_{Aeq,T}$ noise level for the period increases by more than 3 dB due to site noise.			
[1] Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. [2] Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. [3] Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			

Source: Adapted from BS 5228-1 Table E.1.

The ABC method presented in Table 12. considers that a potential adverse effect occurs when the construction noise level at 1 m from the dwelling façade exceeds the value listed in Table 12., where the Category of the site/area is dictated by the existing noise level and the time period of the day at which the noise level exist. As stated above, other project-specific factors are considered in determining if there is an adverse effect, such as the number of receptors affected and the duration and character of the impact.

12.5.3 Operational road traffic noise

Simple assessment of road traffic noise

The options appraisal assessment of operational road traffic noise impacts follows the methodology for a Simple Assessment set out in DMRB HD 213/11. In addition to HD 213/11, the prediction of noise generated during the operational phase is based on the guidance contained in the DfT's Calculation of Road Traffic Noise (CRTN) (Ref 11.15).

The objective of a Simple Assessment is to understand the impact on the noise and vibration climate with and without the Scheme, referred to as the Do-Something (DS) and Do-Minimum (DM) scenarios respectively. These scenarios

are required to be assessed for the proposed Opening and Forecast Year[77,78]. Changes in noise level at residential and other sensitive receptors have been assessed for the following road traffic scenario comparisons:

- Do-Something short term comparison: Do-Minimum scenario in the Opening Year (2019) against Do-Something scenario in the Opening Year (2019); and
- Do-Something long term comparison: Do-Minimum scenario in the Opening Year (2019) against Do-Something scenario in the future assessment year (2036).

Consideration has also been given to night-time noise levels in accordance with HD 213/11 for receptors where traffic noise levels are predicted to exceed 55 dB $L_{night,outside}$ in any scenario. Method 3 contained in the TRL Report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' (Ref 11.16) has been used to derive the night-time level $L_{night,outside}$ from the daytime $L_{A10,18h}$ noise index. The correction described for non-motorway roads has been used for this assessment as per the type of road links within the study area.

Method 3 has been used as hourly traffic data was not available. Method 3 is considered to provide a reliable representation of night-time noise levels.

For the assessment of night-time noise impacts, HD 213/11 advises that only noise impacts in the Do Something long-term road traffic scenario should be considered.

The proprietary software IMMI, which is compliant with CRTN and HD 213/11, has been used to predict noise levels at residential dwellings and other sensitive receptors within the Study Area for each option. All noise calculations have been made at façade locations of sensitive receptors on the first floor at a height of 4 m above the ground level. Although it is the potential for residential receptors to be at ground floor in bungalows these would be examined in Stage 3 assessment. At this stage if any bungalows exist the fact that those receptors are calculated at 4 m height is not considered to alter the outcome of the assessment.

The BNL calculations have been undertaken as part of the simple assessment of road traffic noise in order to address receptors in the proximity of affected road links outside of the study area. Calculations have follow the CRTN (Ref 11.16) methodology procedures, using calculation spreadsheets alongside OS mapping datasets and project traffic data.

Magnitude of impact

[77] The future assessment year is that defined as the year within the first +15 years of opening of the scheme where traffic flows are greatest.
[78] The traffic data was provided from the Sub-Regional Transport Model (SRTM) (managed by Solent Transport) which includes model horizons of 2019 and 2036. As these model horizons are close to the assumed scheme opening year of 2021 and design year of 2036, for the purposes of this initial high level assessment the 2019 and 2036 model horizons data was used.

In line with DMRB HD 213/11, this chapter assesses the magnitude of impact by comparing the increase or decrease in noise levels between scenarios. The magnitude of noise impacts associated with road traffic noise are reproduced from HD 213/11 in Table 12.2 for the short-term and

Table 12.3 for the long-term. Changes in noise level can be either an increase (adverse) or a decrease (beneficial).

Table 12.2: Classification of magnitude of noise impacts in the short term

Noise Change $L_{A10,18h}$ (dB)	Magnitude of Impact
0.0	No Change
0.1 – 0.9	Negligible
1.0 – 2.9	Minor
3.0 – 4.9	Moderate
5.0 +	Major

Source: DMRB HD 213/11 Table 3.1.

Table 12.3: Classification of magnitude of noise impacts in the long term

Noise Change $L_{A10,18h}$ / L_{night} (dB)	Magnitude of Impact
0.0	No Change
0.1 – 2.9	Negligible
3.0 – 4.9	Minor
5.0 – 9.9	Moderate
10.0 +	Major

Source: DMRB HD 213/11 Table 3.2.

Significant Effects – EIA impacts

The significance of effect in EIA terms is determined from the combination of the environmental value (sensitivity) of the receptors and the magnitude of the impact (degree of change in this case noise change). Table 2.4 of HD 205/08 Volume 11 Section 2 Part 5 presents the criteria. This is reproduced in Table 11.7.

Table 11.7: Significance of effect, DMRB.

Magnitude of Change	Value / Sensitivity of Receptor (Defined in Table 11.1)				
	Very High	**High**	**Medium**	**Low**	**Negligible**
Major	Vary Large	Large	Large	Moderate	Slight
Moderate	Large	Moderate	Moderate	Slight	Neutral
Minor	Moderate	Slight	Slight	Neutral	Neutral
Negligible	Slight	Slight	Neutral	Neutral	Neutral
No Change	Neutral	Neutral	Neutral	Neutral	Neutral

Source: DMRB HD 205/08 Table 2.4.

Most of the receptors within the study area are of High value/sensitivity. It is defined than any High sensitive receptor resulting in the Moderate or Major magnitude of change bands is considered to expect a significant effect. The noise change that would trigger a significant effect is considered to be of at least 3 dB in the Short term and/or 5 dB in the long term (refer to Tables 11.5 and 11.6).

Significant Effects – Policy impacts

The effects of operational noise are permanent. Table 12. shows the values this assessment has adopted for the daytime and night-time SOAEL and LOAEL which follows the approach adopted by Highways England (HE) on other previous highways schemes to define the significant effects in terms of noise from road traffic.

Table 12.8: SOAEL and LOAEL for long-term road traffic noise during daytime and night-time

Effect Level	Daytime threshold noise level		Night-time threshold noise level
	Free-field $L_{Aeq,16h}$ [dB]	Façade $L_{A10,18h}$ [dB]	Free-field $L_{Aeq,8h}$ [dB]
Significant effects (SOAEL)	≥ 63	≥ 68	≥ 55
Adverse effects (LOAEL)	≥ 50	≥ 55	≥ 40

Source: Night-noise guidelines for Europe, WHO, 2009 for night-time values. Noise Insulation Regulations Relevant Noise Level for the daytime SOAEL. Guidelines for community noise, WHO, 1999 for daytime LOAEL from the 50 dB $L_{Aeq,16h}$ (7-23), outdoors for the onset of moderate community annoyance.

Both the $L_{A10,18h}$ façade noise level and $L_{Aeq,16h}$ free-field noise level are shown due to the different parameters used in different sources. Conversion from $L_{A10,18h}$ to $L_{Aeq,16h}$ uses the relationship as set out in TAG unit A3 (Ref 11.8) ($L_{Aeq,16h} = L_{A10,18h} – 2$ dB) with a further subtraction of 2.5 dB for conversion from façade to free-field. Values of 67.5 dB $L_{A10,18h}$ are rounded up to 68.0 dB $L_{A10,18h}$ façade level for purposes of the NIR and hence an additional 0.5 dB has been allowed in the conversion for both the LOAEL and the SOAEL.

For night-time, the Night Noise Guidelines for Europe published by the World Health Organisation (Ref 11.18) introduced a Night Noise Guideline (NNG) of 40 dB $L_{night,outside}$ and an interim target (IT) of 55 dB $L_{night,outside}$ which have been adopted as the LOAEL and SOAEL for night-time respectively.

Any residential dwelling with an increase in noise of 1 dB or more in either the short term or long term where the absolute level is above the SOAEL, is considered to have a significant effect in terms of Policy[79]. However, to avoid the counting of dwellings where there would be an increase in noise of more than 1 dB without the scheme (i.e. an increase due to natural traffic growth), the Do-Something and the Do-minimum in the future years are considered for the long term comparison, i.e. DS2036 Vs DM2036. The short term comparison is the usual considered, i.e. DS2019 Vs DM2019.

12.6 Assessment assumptions and limitations

12.6.1 Construction

At this stage, detailed information on the construction programme is not available. Therefore, noise levels from the construction phase have been predicted based on similar projects in order to give an indication of the potential impacts from

[79] Planning Practice Guidance – Noise (PPG-N), Paragraph: 006 Reference ID: 30-006-20141224 states that: *"In cases where existing noise sensitive locations already experience high noise levels, a development that is expected to cause even a small increase in the overall noise level may result in a significant adverse effect occurring even though little to no change in behaviour would be likely to occur".*

construction at PCF Stage 2. Similarly, construction vibration levels have not been predicted, but it is likely that some of the construction works would cause vibration.

12.6.2 Operation

It is considered that all data inputs for this assessment are of an adequate level to support a Simple Assessment of operational traffic noise as defined in HD213/11 (Ref 11.09). For all modelling scenarios, the noise model assumes:

- Receptor locations and associated sensitivities from the OS AddressBase Premium and OS MasterMap database (August 2016);
- Hot Rolled Asphalt (HRA) has been assumed to be the road surface type for all the road links within the calculation area in both scenarios; and
- Modelled speeds have been used rather than speed bands set out in IAN 185/1580 (Ref 11.18). Sensitivity tests in the traffic data have been undertaken where it was found that, in a considerable number of links, jumps from one speed band to another would result in predicted changes of road traffic noise that would be unrealistically large when compared to the modelled speeds. These would have led to the over prediction of the Scheme road traffic noise impacts for what is a small change in speed, and thus it was considered that by using the modelled speeds that uncertainty is reduced.

The traffic data used in the noise model have incorporated other projects in the area which may affect or generate traffic. These include the M27 Smart Motorway Scheme (SM) Junction 8 to 5 which has been assumed to be in place from the Opening Year scenario as well as committed housing development in and around Southampton. Consequently, the cumulative effect of other projects have been incorporated into the assessment of traffic noise.

12.7 Design, mitigation and enhancement measures

12.7.1 Construction noise

Potential adverse effects during construction should be minimised through the implementation of a Construction Environmental Management Plan (CEMP), the use of best practicable means under Section 72 of CoPA 1974 (Ref 11.3) and good practice under BS 5228-1 (Ref 11.13) and BS 5228-2 (Ref 11.14). In addition, Highways England and the contractor should liaise with the Local Authority and the affected householders to inform them about the works. In some very specific cases the introduction of noise insulation or temporary re-housing would be required. The requirement for insulation would depend on the duration and the proximity of the works to the receptors. At this stage, it is anticipated the construction works in some cases to be at less than 10 m from the sensitive receptors and thus the risk for elevated noise levels is high. However, the works likely to cause the highest noise levels are unlikely to be of a duration in any single location to require insulation. The determination of eligible dwellings shall be undertaken at later stages of the project when a detailed construction noise and vibration assessment has been developed.

[80] This guidance is supplementary to existing guidance given in DMRB Volume 11, Section 3, Part 1 (HA207/07) and Part 7 (HD213/11)

12.7.2 Operational noise

At PCF Stage 2, there is no embedded noise mitigation within the scheme design. No mitigation has been included in the noise model or as part of the scheme design as none of the mitigation options are considered feasible at this Stage. However further analysis on mitigation and/or enhancement measures for the preferred Appraisal Option should be carried out at PCF Stage 3. Potential mitigation measures might include, but would not be limited to:

- Low Noise Surface (LNS) on the proposed resurfaced road sections, although it is recognised that this would not be as effective as on a 'motorway' because the traffic speeds expected along the route corridor are lower (i.e. 1.0 dB noise reduction at speeds below 75 km/h and up to 3.5 dB at speeds above 75 km/h). The additional 1 dB noise reduction provided by the LNS is likely to reduce the number of receptors with Minor noise increases but not the receptors resulting in the Moderate or Major noise increases.
- Erection of noise barriers or embankments to screen road traffic noise. It is not feasible to implement this type of mitigation along the Sub-Scheme 2: A3024 corridor due to space constraints but may be suitable for some areas in Sub-Scheme 1.

In addition, mitigation at the receptors located within the NIAs where significant effects are predicted need to be considered at PCF Stage 3. If Appraisal Option 1 is selected as the preferred option there would be more NIAs with significant impacts corresponding to all the NIAs along the A3024 corridor. If Appraisal Option 2 is taken forward there would not be significant impacts at NIAs. Refer to Table 12.8 and Table 12.8 which present a list with the number of dwellings with significant impacts at NIAs.

12.8 Assessment of effects

12.8.1 Construction noise

Error! Reference source not found. presents the indicative noise calculations undertaken at this stage at different distance bands for each of the proposed construction works.

Table 12.9 BS 5228-1 Predicted Indicative Construction Noise Levels at given distances

Construction Activity		Calculated Noise Level, $L_{Aeq, 10h}$ at given generic distances (dBA)[1]					
		10 m	20 m	50 m	100 m	200 m	300 m
Temporary Construction Sites	Site Clearance	78	72	64	58	52	48
	Compound Construction	82	76	68	62	56	53
Road Works - Road widening	Demolition and clearance	83	77	69	63	57	53
	Construction	81	75	67	61	55	52
Road Works - Resurfacing Works	Removal of existing surface	85	79	71	65	59	56
	Lying new surface	79	73	65	59	53	49
Road Works	Central Reservation Paving	83	77	69	63	57	53
	Road Marking Works	78	72	64	58	52	49
	Signage & Crossings Works	83	77	69	63	57	54
	Retaining wall construction	87	81	73	67	61	57
NMU Works	Clearance	83	77	69	63	57	53
	Pavement surfacing partial depth	80	74	66	60	54	51
	Pavement surfacing full depth	83	77	69	63	57	54
Bitterne Rail Bridge [2] and Northam Road Rail Bridge Works	Demolition & Clearance	90	84	76	70	64	60
	Bridge structure widening	83	77	69	63	57	53
	Bridge parapets	84	78	70	64	58	55
	Retaining wall on bridge	83	77	69	63	57	53

[1] The reported noise level is a Façade level. No ground absorption or screening effects have been considered in the calculations. The working shift is based on a 12-hour with a percentage of time the activity will take place considered to be 10-hours.

[2] Demolition and Retaining wall on bridge activities do not apply for the works at Bitterne Rail Bridge.

Calculations have considered noise emission data form Annex C of BS5228-1:2009+A1:2014. Code of practice for noise and vibration control on construction and open sites – Part 1: Noise (Ref 11.14)

From **Error! Reference source not found.** it is clear that certain activities as part of both Appraisal Options will exceed the limit criteria set out in Table 12. for the SOAEL of the day, evening and night-time periods, and as a result a detailed assessment at PCF Stage 3 would need to be undertaken considering the exact location of the works and the number of sensitive receptors laying within the distance bands to further understand the risks involved during the construction phase of the Scheme.

Significant adverse effects from noise and vibration are likely to occur during construction of the two Appraisal Options. The effects from construction would depend not only on the absolute noise level but also the duration of the works. Some of the works would be of temporary duration, other of long term duration but the sources of noise would be moving due to the type of works (i.e. road resurfacing), and some of long term and stationary in a single location (i.e. works at Northam Road Rail Bridge). Potential adverse effect during construction should be reduced through the implementation of a Construction Environmental Management Plan (CEMP) in accordance with best practice measures.

The mitigate of the impacts arising from construction traffic and any local traffic on diversion routes during the construction phase should form part of the Traffic Management Plan in the CEMP. Given that the works will be almost entirely on local authority managed roads and can be undertaken with localised traffic management, it is unlikely that diversion routes would be required. However, the construction of the bridge works may require some night-time closes if sections of bridge need to be listed into place

12.8.2 Operational noise and vibration

This section presents the results from the predicted noise levels in relation to the noise change bands defined in HD213/11 and the absolute levels compared with the NPSE derived criteria for road traffic noise.

In relation to the operational airborne vibration, a qualitative overview of the potential impacts is included. The study area for airborne vibration impacts is normally considered to include the dwellings within 40 m from the affected road links and only those with predicted traffic noise levels greater than 58 dB $_{LA10,\ 18h}$, as stated in HD 213/11. At Stage 2, it is known that there are about 1,000 dwellings within 40 m and most of them very likely to be above the 58 dB $_{LA10,\ 18h}$ level. In addition, increases in noise levels are anticipated at receptors close to the scheme, i.e. within 40 m which would increase the likelihood of having increases in nuisance levels from operational airborne vibration. In addition, no ground-borne vibration impacts would be expected from the operation

DMRB Magnitude of impact and significant effects – EIA terms

The resultant noise change magnitude for the short term assessment of Do-Minimum 2019 to Do-Something 2019 is presented in During the operational phase, the potential impacts would largely arise from changes in traffic flows on the highway networks resulting in the removal of traffic from the M27 peaks and re-routing along the A3024 and feeder roads, from the east into Southampton City Centre.

The overall increases in road traffic noise for both Appraisal Options would be caused by increased traffic flows due to the implementation of the Scheme, the

localised widening of some sections of the A3024 and changes in the road alignment in some areas which brings the noise source slightly closer to sensitive receptors. Appraisal Option 1 will remove the existing weight restriction for HGVs on the Northam Road Rail Bridge, which has the potential to increase HGV flows along the A3024. However, a revision of the traffic data has indicated that the HGVs would not be the main cause of the noise increases. Appraisal Option 1 also includes localised road widening at junctions along the A3024, which would bring the road traffic noise source slightly closer to sensitive receptors such as nearby housing. The re-routing of traffic could also potentially decrease ambient noise levels on some roads on the local road network due to decreased traffic flows.

Since Appraisal Option 2 is only concerned with improvements to the M27 Junction, Windhover Roundabout and the section of the A3024 at Botley Road junction, the changes in ambient noise to a smaller extent. Also, the weight restriction on Northam Road Rail Bridge would not be lifted and the number of dwellings likely to be affected by noise along the A3024 would be less for Appraisal Option 2.

Major accidents and/or disasters are not anticipated to result in any significant effects in the context of noise.

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Table 12.10: Magnitude of impact in the short term Do-Something (DS2019 Vs DM2019)

Change in noise levels Daytime (dB $L_{A10,18h}$)			Short Term Do-Something			
			Appraisal Option 1		Appraisal Option 2	
			Number of dwellings	Number of other sensitive receptors	Number of dwellings	Number of other sensitive receptors
Increase in noise levels	0.1 – 0.9	Negligible	7,040	16	1,602	3
	1.0 – 2.9	Minor	3,871	15	0	0
	3.0 – 4.9	Moderate	21	0	0	0
	5.0 +	Major	29	0	0	0
No Change	0.0		57	0	28	0
Decrease in noise levels	0.1 – 0.9	Negligible	2,409	4	181	0
	1.0 – 2.9	Minor	758	6	1	0
	3.0 – 4.9	Moderate	277	0	0	0
	5.0 +	Major	0	0	0	0

In the short term assessment (During the operational phase, the potential impacts would largely arise from changes in traffic flows on the highway networks resulting in the removal of traffic from the M27 peaks and re-routing along the A3024 and feeder roads, from the east into Southampton City Centre.

The overall increases in road traffic noise for both Appraisal Options would be caused by increased traffic flows due to the implementation of the Scheme, the localised widening of some sections of the A3024 and changes in the road alignment in some areas which brings the noise source slightly closer to sensitive receptors. Appraisal Option 1 will remove the existing weight restriction for HGVs on the Northam Road Rail Bridge, which has the potential to increase HGV flows along the A3024. However, a revision of the traffic data has indicated that the HGVs would not be the main cause of the noise increases. Appraisal Option 1 also includes localised road widening at junctions along the A3024, which would bring the road traffic noise source slightly closer to sensitive receptors such as nearby housing. The re-routing of traffic could also potentially decrease ambient noise levels on some roads on the local road network due to decreased traffic flows.

Since Appraisal Option 2 is only concerned with improvements to the M27 Junction, Windhover Roundabout and the section of the A3024 at Botley Road junction, the changes in ambient noise to a smaller extent. Also, the weight restriction on Northam Road Rail Bridge would not be lifted and the number of dwellings likely to be affected by noise along the A3024 would be less for Appraisal Option 2.

Major accidents and/or disasters are not anticipated to result in any significant effects in the context of noise.

10) the majority of receptors fall within the Negligible magnitude category for both increases and decreases in both Appraisal Options.

In Appraisal Option 1 most of these receptors will experience a negligible increase in the noise level in the short term. The receptors located along Sub-scheme 2 A3024 corridor and Sub-scheme 3 the Northam Road Rail Bridge fall into the bands of Negligible and Minor increase while receptors in proximity of Sub-scheme 1 M27 Junction 8 and A27 Windhover roundabouts will mainly expect to have Negligible and Minor decreases in noise level. Some of the dwellings with Moderate increases and thus with significant effects, are located at local roads not in the proximity of the scheme, while others are near Sub-scheme 2 A3024 at the Botley Road junction and Bursledon Road junction and each side of A3024 near Barry Road. Receptors in the Major increase band, also considered to result with significant effects, are in proximity to the new road link introduced in the Do Something as part of the scheme at Sub-scheme 2[81]. The majority of dwellings with Minor and Moderate increases are located along Kathleen Road at the junction with A3024 and further down the road.

In Appraisal Option 2, 1783 of the receptors are in the Negligible decrease and increase bands; and 28 are in the No Change band.

The long term assessment results of Do-Minimum 2019 to Do-Something 2036 are presented in Table 12. and Table 12. for Appraisal Option 1 and Appraisal Option 2 respectively. The results for night-time noise levels include dwellings with calculated noise levels in excess of $L_{night,outside}$ 55 dB in either Do-Minimum 2019 or Do-Something 2036.

Table 12.11: Appraisal Option 1 - Magnitude of impact in the long term Do-Something (DS2036 Vs DM2019)

Change in noise levels (dB $L_{A10,18h}$ daytime) (dB $L_{night, outside}$ night-time)			**Option 1- Long term Do-Something**		
			Daytime		**Night-time [1]**
			Number of dwellings	**Number of other sensitive receptors**	**Number of dwellings**
Increase in noise levels	0.1 - 2.9	Negligible	12,534	34	2,751
	3.0 – 4.9	Minor	65	0	0
	5.0 – 9.9	Moderate	28	0	0
	10.0 +	Major	1	0	0
No Change	0.0		10	0	0
Decrease in noise levels	0.1 - 2.9	Negligible	1,6677	7	26
	3.0 – 4.9	Minor	157	0	0
	5.0 – 9.9	Moderate	0	0	0
	10.0 +	Major	0	0	0

Table 12.12: Appraisal Option 2 - Magnitude of impact in the long term Do-Something (DS2036 Vs DM2019)

Change in noise levels (dB $L_{A10,18h}$ daytime) (dB $L_{night, outside}$ night-time)			**Option 2 - Long term Do-Something**		
			Daytime		**Night-time [1]**
			Number of dwellings	**Number of other sensitive receptors**	**Number of dwellings**
Increase in noise	0.1 - 2.9	Negligible	1,665	3	295

[81] The new link is a proposed diversion at the junction of the A3024 Northam Road / Union Road / Princes Street.

Change in noise levels (dB $L_{A10,18h}$ daytime) (dB $L_{night, outside}$ night-time)			Option 2 - Long term Do-Something		
			Daytime		Night-time [1]
			Number of dwellings	Number of other sensitive receptors	Number of dwellings
levels	3.0 – 4.9	Minor	0	0	0
	5.0 – 9.9	Moderate	0	0	0
	10.0 +	Major	0	0	0
No Change	0.0		4	0	0
Decrease in noise levels	0.1 - 2.9	Negligible	143	0	8
	3.0 – 4.9	Minor	0	0	0
	5.0 – 9.9	Moderate	0	0	0
	10.0 +	Major	0	0	0

In the long term, for the Appraisal Option 1, the majority of the receptors are predicted to have a Negligible increase in noise. Negligible decreases are noted at receptors close to local roads adjacent to the scheme corridor. Minor decreases are noted at dwellings located by Kathleen Road which connects to the A3024.

Receptors forecast to have Moderate and Major increases in noise, and thus predicted to have significant effect, correspond to dwellings located on Leyton Road and Summers Street where there will be a new road link opening (i.e. proposed diversion at the junction of the A3024 Northam Road / Union Road / Princes Street). Equally some of the receptors predicted to have a Minor increase in noise levels are located by the new road link and some dwellings sitting each side of A3024 near Barry Road and N E Road and new link.

In Appraisal Option 2, all the receptors are distributed in the bands between Negligible increase and decrease.

The predicted results for the night-time indicate that for both Appraisal Options most receptors show Negligible increases in noise although some of them show Negligible decreases.

The overall increases in road traffic noise in both options are due to an increase in vehicles, including HGVs, on the route, with the implementation of the Scheme. There is also some localised widening of the road in some areas which brings the noise source slightly closer to sensitive receptors.

Basic Noise Level (BNL) results – Assessment in EIA terms

Calculations of the basic noise level (BNL) for each 'affected routes' identified outside the study area for a reference position at 10 m from the edge of the road has been undertaken. A count of the number of dwellings within 50 m of the centreline of these affected routes is presented in Table 12.13 and classified in each of the noise change magnitude bands for both; short and long term comparisons in the Do-Something scenario.

Table 12.13: Magnitude of impact for BNL assessment

Change in noise levels Daytime (dB $L_{A10,18h}$)		Number of dwellings short term		Change in noise levels Daytime (dB $L_{A10,18h}$)		Number of dwellings long term	
		Option 1	Option 2			Option 1	Option 2
Increase in	0.1 – 0.9	0	100	Increase in	0.1 - 2.9	509	33

Change in noise levels Daytime (dB $L_{A10,18h}$)		Number of dwellings short term		Change in noise levels Daytime (dB $L_{A10,18h}$)		Number of dwellings long term	
		Option 1	Option 2			Option 1	Option 2
noise levels	1.0 – 2.9	245	0	noise levels	3.0 – 4.9	100	205
	3.0 – 4.9	0	0		5.0 – 9.9	0	0
	5.0 +	0	0		10.0 +	0	0
No Change	0.0	0	0	No Change	0.0	0	0
Decrease in noise levels	0.1 – 0.9	102	107	Decrease in noise levels	0.1 - 2.9	111	0
	1.0 – 2.9	270	33		3.0 – 4.9	2	2
	3.0 – 4.9	105	0		5.0 – 9.9	0	0
	5.0 +	0	0		10.0 +	0	0

There were no other sensitive receptors different from residential dwellings located within the 50 m study areas around the affected links. Only Negligible to Minor noise increases are predicted in both short term and long term comparisons for both Appraisal Options and thus no significant effects are triggered at these receptors. In Appraisal Option 1 Moderate decreases in the short term are predicted for noise changes on Kathleen Road in the section between Drove Road and Chapel Cress to the south of A3024.

Assessment of significance – Policy Terms

The first aim of the NPSE is to avoid significant adverse impacts on health and quality of life from noise, within the context of Government policy on sustainable development.

Table 12.4 shows the percentage of change in the number of dwellings above and below the SOAELs and LOAELs in the short term comparison.

Table 12.44: Short term NPSE significance

Do-Something short term		
Noise Criteria [1]	% Change (Number of dwellings) - Daytime	
	Appraisal Option 1	Appraisal Option 2
Above SOAEL	1.5 %	-0.4 %
Between SOAEL and LOAEL	0.2 %	1.7 %
Below LOAEL	-1.7 %	-1.3 %

[1] The adverse effect levels consider the free field $L_{Aeq, 16h}$ noise index for the daytime and $L_{Anight(8h), outside}$ index for the night-time period. The threshold criteria considered to the assess road traffic effects has been is set out in Table 11.6.

In general, the number of receptors below the LOAEL will be reduced in the short term Do-something scenario in both Appraisal Options. For Appraisal Option 1,

Table 12.4 shows a 1.5% increase in dwellings moved to the ‘above the SOAEL’ Category from the Do-minimum to the Do-Something. For Appraisal Option 2 there is a 0.4% decrease in the number of receptors moved to ‘the above SOAEL’ (this is 7 dwellings).

Table 12.5 presents the results for the long term comparison.

Table 12.55: Long term NPSE significance

Do-Something long term

Noise level [1]	% Change (Number of dwellings) - Daytime		% Change (Number of dwellings) - Night-time	
	Appraisal Option 1	Appraisal Option 2	Appraisal Option 1	Appraisal Option 2
Above SOAEL	3.3 %	1.0 %	3.1 %	0.9 %
Between LOAEL and SOAEL	-0.2 %	1.4 %	0.6 %	2.0 %
Below LOAEL	-3.1 %	-2.4 %	-3.6 %	-2.9 %

[1] The adverse effect levels consider the free field $L_{Aeq, 16h}$ noise index for the daytime and $L_{Anight(8h), outside}$ index for the night-time period. The threshold criteria considered to the assess road traffic effects has been is set out in Table 11.6

In the long term, the predicted traffic flow increases cause an increase in the number of dwellings exposed to significant adverse noise levels during both during the day and at night in both Appraisal Options. Table 12.5 shows, for Appraisal Option 1, there is an increase of 3.3% (day) / 3.1% (night) in the number of dwellings above the SOAEL, while for Appraisal Option 2 the increase is 1.0% (day) / 0.9% (night), respectively. The negative percentages on the 'below LOAEL' category mean that are less receptors in that category which have been moved up to the other two bands due to noise increases.

The noise increases at dwellings in relation to the effect level categories[82] are presented in **Error! Reference source not found.** and **Error! Reference source not found.** for the determination of the significant effects in terms of Policy.

Error! Reference source not found. presents the magnitude of noise change for the short-term assessment of Do-Minimum 2019 to Do-Something 2019 in relation to the effect level categories.

Table 12.6: NPSE effect level categories in relation to the magnitude of noise change in the short term Do-Something (DS2019 Vs DM2019)

Do-Something short term							
Change in noise levels Daytime $L_{Aeq, 16h}$ (dB)		**Above SOAEL**		**Between LOAEL and SOAEL**		**Below LOAEL**	
		Option 1	**Option 2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**
Increase in noise levels	0.1 – 0.9	1,118	230	2,153	855	3,769	517
	1.0 – 2.9	948	0	1,662	0	1,261	0
	3.0 – 4.9	5	0	16	0	0	0
	5.0 +	0	0	29	0	0	0
Change in noise levels Night-time $L_{Aeq,8h}$ (dB)		**Above SOAEL**		**Between LOAEL and SOAEL**		**Below LOAEL**	
		Option 1	**Option 2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**
Increase in noise levels	0.1 – 0.9	1,108	221	3,366	1,118	3,146	274
	1.0 – 2.9	873	0	1,905	0	595	0
	3.0 – 4.9	0	0	9	4	0	0
	5.0 +	0	0	26	0	0	0

Error! Reference source not found. presents the magnitude of noise change for the long term assessment of Do-Minimum 2036 versus Do-Something 2036 in relation to the effect level categories. This comparison assesses traffic noise increases due to the scheme excluding the effect from natural traffic growth.

[82] As per criteria set out in Table 11.8.

Table 12.77: NPSE effect level categories in relation to the magnitude of noise change in the long term Do-Something (DS2036 Vs DM2036)

Do-Something long term[1]							
Change in noise levels Daytime $L_{Aeq, 16h}$ (dB)		**Above SOAEL**		**Between LOAEL and SOAEL**		**Below LOAEL**	
		Option 1	**Option 2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**
Increase in noise levels	0.1 – 0.9	1,453	235	2,504	843	3,901	457
	1.0 – 2.9	851	0	1,349	0	762	0
	3.0 – 4.9	0	0	8	0	42	0
	5.0 +	0	0	29	0	26	0
Change in noise levels Night-time $L_{Aeq,8h}$ (dB)		**Above SOAEL**		**Between LOAEL and SOAEL**		**Below LOAEL**	
		Option 1	**Option 2**	**Option 1**	**Option 2**	**Option 1**	**Option 2**
Increase in noise levels	0.1 – 0.9	1,513	232	3,798	1,114	3,101	226
	1.0 – 2.9	732	0	1,506	0	293	0
	3.0 – 4.9	0	0	45	0	1	0
	5.0 +	0	0	42	0	0	0

[1] Note that the DMRB magnitude criteria for short term also applieso to the long-term comparison.

Based on the methodology described in section 11.5.3, a significant effect would occur for receptors above the SOAEL (presented in Tables 11.16 and 11.17).

The number of dwellings with significant effects, for the short and long term scenarios presented in **Error! Reference source not found.** and **Error! Reference source not found.** are highlighted in yellow. The significant effect occurs when the noise increase is 1 dB or more for both the short term and long term (i.e. receptors reported in the bands 1.0 to 2.9 and 3.0 to 4.9).

For Appraisal Option 1, some 851 dwellings are forecast 'significant' policy effects in the long term and 948 in the short term. The dwellings are located each side of the A3024 in the proximity of Bursledon Road Junction, on Botley Road and along the A3024 corridor between Botley Road and Bursledon Road, Deacon Road junction up to White's Road, and from Little Lances Hill to the Northam Road Rail Bridge.

Although the receptors located close to the new road link (i.e. at Summers Street introduced as part of the Scheme) are predicted to have a Moderate to Minor magnitude of change (in EIA terms); the majority are not above the SOAEL at any of the scenarios. There is one exception, this is the residents in the flats at Ashcombe House and Eaton House in the proximity of the new link.

For Appraisal Option 2, **Error! Reference source not found.** and **Error! Reference source not found.** indicate that there are no significant policy impacts resulting from the scheme as the forecast noise changes for receptors above SOAEL are less than 1 dB when assessing the traffic noise contribution from the scheme alone.

Summary of operational effects

The significance of the effect due to the Scheme has considered the guidance and criteria to assess environmental impacts provided in the current HD 213/11. Using professional judgement, the assessment has also considered the likely noise

impacts in terms of policy by relating the effect level categories presented in the NPSE with the noise change criteria in HD 213/11 where a noise increase of 1 dB, due to the scheme, for any receptor above the SOAEL category has been considered to result in a significant policy impact. The appraisal options have been assessed without mitigation as in this Stage it is considered that mitigation is impractical (refer to section 11.7.2).

For Appraisal Option 1 the major magnitude of impact results in a 'Large Adverse' significance of effect in terms of EIA. The increased noise is due to the realignment and widening of the roads which bring the sound source closer to sensitive receptors and the redistribution of traffic on the network with greater volumes of traffic routing along Sub-scheme 2: A3024 corridor and the introduction of a new road link.

For Appraisal Option 2 effects are forecast to be of Neutral significance ('Negligible' magnitude) in terms of EIA.

In terms of policy, only Appraisal Option 1 is expected to result in 'significant effects' (i.e. dwellings above SOAEL with noise increases of more than 1 dB due to the scheme).

Appraisal Option 2 will not result in 'significant effects' when considering noise policy.

The method of calculation of night time noise may not provide a good indication of the noise changes at night as the potential variations in traffic due to the scheme may not be reflected in the traffic data available at this stage. The present assessment has used Method 3 to derive night time levels; $L_{night,outside}$ from the daytime $L_{A10,18h}$ noise index and thus only daytime traffic data has been used. In order to model night-time levels hourly data for the night-time period would be required. It is recommended in Stage 3 to revise the method of calculation is accurate and aligned with the traffic data available for the night-time assessment. In particular, the case of Appraisal Option 1 which consist on lifting the HGV weight restriction on Northam Rail Road Bridge. Operation of local HGV business or traffic from the port during night time may not be accurately represented by Method 3.

Significant effects at receptors within NIAs

The number of residential properties within the NIAs listed in Table 12. which would result above the SOAEL category in the short and/or long term Do-Something scenarios are presented in Table 12.8 for Appraisal Option 1 and Table 12.8 for Appraisal Option 2.

Table 12.88: Significant effects at receptors within NIAs for Appraisal Option 1

Sub-Scheme	NIA ID	Number of Dwellings within NIA	Number of dwellings above SOAEL with noise increases of >1 dB due to the scheme	
			Short term	Long term
SS1	6207	7	0	0
	5559	3	0	0
	5556	29[1]	0	0
SS2	2204	17	16	13
	2205	11	11	11

	2206	45	44	44
	2207	67	67	67
	2242	1	0	0
	12664	1	0	0
SS5	2251	743	277	282
SS3	2210	81	17	17
	12661[1]	2121[1]	18	18
Total No. Dwellings		3126	447	452
[1] The NIA extends out of the study area of the Scheme. The number of dwellings reported is limited to those within the Scheme's study area for operational road traffic noise.				

Table 12.9: Significant effects at receptors within NIAs for Appraisal Option 2

Sub-Scheme	NIA ID	Number of Dwellings within NIA	Number of dwellings above SOAEL with noise increases of >1 dB due to the scheme	
			Short term	Long term
SS1	6207	7	0	0
	5559	3	0	0
	5556	29[1]	0	0
SS2	2204	17	0	0
Total No. Dwellings		56	0	0
[1] The NIA extends out of the study area of the Scheme. The number of dwellings reported is limited to those within the Scheme's study area for operational road traffic noise.				

Table 12.8 indicates that a total of 447 dwellings within NIAs are forecast to have significant adverse policy impacts in the short term and 452 dwellings in the long term as a result of Appraisal Option 1. For the case of Appraisal Option 2, presented in Table 12.8, no dwellings within NIAs are forecast to have significant adverse effects.

The NIAs affected by Appraisal Option 1 are all managed by the local authority, i.e. Southampton, and not by Highways England as listed in Table 12.. This means that if any are mitigated they will not contribute to the Highways England KPI.

In relation to noise decreases the assessment, of both Appraisal Options, indicates that only negligible decreases (in the band of -0.1 to -0.9 dB) would occur at the NIAs.

WebTAG Valuation of net present value benefits

Following the methodology set out in WebTAG Unit A3, an estimation of the Net Present Value (NPV)[83] of change in noise level and the number of households experiencing increased or reduced noise levels as a result of the proposed Appraisal Options has been undertaken. Results are presented in Table 12.8.

[83] The assessment considers a standard 60-year appraisal period, the income and price base year is 2010 and opening year is 2022. The night-time noise (sleep disturbance impacts) are included and the night noise levels (dB Lnight) have been entered as a modelling input.

Table 12.20: WebTAG assessment of Appraisal Options

Appraisal Option	Net Present Value of change in noise (£)[1]	Number of households experiencing a change in noise in the forecast year [2]			
		Increases		Decreases	
		Daytime	Night-time	Daytime	Night-time
1	-£18,524,508	4201	2625	558	370
2	-£1,320,408	290	209	11	5

[1] Positive value reflects a net benefit (i.e. a reduction in noise).
[2] Average household size is 2.3. Forecast year is 2036 and refers to the long term.

The Appraisal Options are not expected to provide a beneficial monetary NPV. This is because there are significantly more noise increases than decreases predicted in the long term as a result of the Appraisal Options. The large difference in the NPV between the two Appraisal Options is mainly associated with the area extents of each option, and consequently the number of households included within the study areas for each option. If mitigation measures were to be incorporated in the scheme design it is anticipated the monetary dis-benefits would be lower but the scheme would still result in monetary dis-benefits for either of the two Appraisal Options. This can be inferred from the results of the assessment and figures shown in Table 12.8 which have indicated a large number of residential properties with noise increases in the Do- Something scenarios. Appraisal Option 1 would result in greater monetary dis-benefits than Appraisal Option 2 due to the extent of the scheme.

12.9 References (Noise and Vibration)

Ref 11.1 Department for Communities and Local Government (2012). National Planning Policy Framework (NPPF).

Ref 11.2 Department for Communities and Local Government, DCLG (2014). Planning Practice Guidance - Noise, PPG

Ref 11.3 Department for Transport DfT (2014). National Policy Statement for National Networks (NPSNN).

Ref 11.4 Her/His Majesty's Stationery Office, HMSO (1974). Control of Pollution Act (as amended), CoPA 1974.

Ref 11.5 Her/His Majesty's Stationery Office, HMSO (1974). Environmental Protection Act (as amended), EPA 1990.

Ref 11.6 Her/His Majesty's Stationery Office, HMSO (1973). Land Compensation Act, LCA 1973.

Ref 11.7 Department of Transport (2015). TAG Unit A3 Environmental Impact Appraisal. December 2015.

Ref 11.8 Department for Environment Food & Rural Affairs, Defra (2010). National Policy Statement for England (NPSE).

Ref 11.9 Highways England (2011). Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 7 – Noise and Vibration HD 213/11. Revision 1.

Ref 11.10 Highways England (2016). PCF Stage 1 Appraisal Specifications Report, ASR. M27 Southampton Junctions.

Ref 11.11 Highways England (2016). PCF Stage 1 Environmental Study Report (ESR) M27 Southampton Junctions.

Ref 11.12 Highways England (2008). Design Manual for Roads and Bridges (DMRB), Volume 11, Section 2, Part 5 – Assessment and Management of Environmental Effects - HD 205/08.

Ref 11.13 British Standards Institution, BSI (2009). BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration.

Ref 11.14 British Standards Institution, BSI (2009). BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Part 1: Noise.

Ref 11.15 Department for Transport, DfT (1988). Calculation of Road Traffic Noise, CRTN. Welsh Office; HMSO.

Ref 11.16 Department Transport Research Laboratory Limited, TRL (2002). P. G Abbott & P M Nelson. Converting the UK traffic noise index LA10,18h to EU noise indices for noise mapping. Project Report PR/SE/451/02.

Ref 11.17 World Health Organisation (WHO), 2009. Night Noise Guidelines for Europe.

Ref 11.18 Highways England (2015). Interim Advice Note (IAN) 185/15. Updated traffic, air quality and noise advise on the assessment of link speeds and generation of vehicle data into ‘speed-bands’ for users of DMBR Volume 11, Section 3, Part 3 Air Quality and Part 7 Noise.

13. People and Communities

13.1 Legislative and policy framework

13.1.1 National policy and legislation

National Policy Statement for National Networks (NPSNN)

The NPSNN (Department for Transport, 2014) sets out the Government's policies to deliver development of Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England.

If categorized as an NSIP, the Scheme will need to meet the policies outlined in the NPSNN, including the following relevant objectives (Department for Transport, 2014):

- Support and improve journey quality, reliability and safety;
- Support the delivery of environmental goals and the move to a low carbon economy; and
- Join up our communities and link effectively to each other

These objectives have been used to develop the objectives within the Road Investment Strategy, and in turn the scheme.

National Planning Policy Framework (NPPF)

The NPPF recognises that the purpose of the planning system is to strive towards sustainable development, which can be achieved when economic, social and environmental gains are sought jointly. At the heart of the NPPF is a presumption in favour of sustainable development where the proposal accords with the local development plan.

The NPPF highlights a number of 'Core Planning Principles' that should govern development planning. One of the principles, most relevant to this chapter, emphasises the need to manage patterns of growth to make the fullest possible use of public transport, walking and cycling.

The NPPF aims to integrate development and infrastructure planning and notes that infrastructure is crucial to supporting economic development and building a strong, competitive economy. It states that local authorities should *"develop strategies for the provision of viable infrastructure necessary to support sustainable development".*

The Countryside and Rights of Way Act 2000 The CROW Act

The CRoW Act (HM Government, 2000) regulates all Public Rights of Way (PRoW) and ensures access to them. It requires local highway authorities to publish a Rights of Way Improvement Plan (RoWIP), which should be reviewed every 10 years. The Act also obliges the highway authority to recognise the needs of the mobility impaired when undertaking improvements. The Scheme will therefore need to consider those who currently use the footpaths surrounding the junction options during the design process.

13.1.2 Local Policy

Southampton City Council Adopted Core Strategy 2015[84]

Southampton's Local Development Framework (LDF) replaces the Local Plan Review adopted in March 2006, it provides the framework for all development in the city until 2026; and sets out the planning policies by which Southampton Council wish to see development guided. The LDF is a collection of adopted plans, it comprises:

- the City Centre Action Plan (adopted 2015),
- Core Strategy;
- Local Plan review (amended 2015);
- The Bassett Neighbourhood Plan (2016); and
- The Minerals and Waste Plan (adopted 2013).

The following policies in **Table 131** are relevant to the People and Communities assessment.

Table 13.1: Relevant planning policies from the Southampton Local Development Framework

Policy Reference	Policy Details
Policy CS 3 – Town, district and local centres, community hubs and community facilities	New development should make a positive contribution to the centre's viability and vitality, promote and enhance its attractiveness, respect where possible the historic street patterns and building lines and improve its connectivity to surrounding residential neighbourhoods.
CS 4 – Housing Delivery	An additional 16,300 homes will be provided within the City of Southampton between 2006 and 2026.
Policy CS 18 – Transport: Reduce – Manage - Invest	To support the regional economy, enhance air quality and achieve a modal shift to more environmentally sustainable transport, a 'reduce-manage-invest' approach will approach will be taken.
Policy CS 21 – Protecting and Enhancing Open Space	The Council will retain the quantity and improve the quality and accessibility of the city's diverse and multi – functional open spaces and help deliver new open space both within and beyond the city to meet the needs of all age groups through: 1. Protecting and enhancing key open spaces including Southampton Common, central, district and local parks; 2. Replacing or reconfiguring other open spaces in order to achieve wider community benefits such as improving the quality of open space, or providing a more even distribution across the city; 3. Safeguarding and, when opportunities arise, extending the green grid; 4. Seeking developer contributions to provide high quality, accessible open spaces.

Local Transport Plan 3: Strategy and Implementation Plan for Southampton

The Local Transport Plan sets out the Council's proposals to improve the transport network. The following policies in **Table 132** detail those relevant to the People and Communities assessment and outlines measures by which they will be obtained.

Table 13.2: Relevant planning policies from the Southampton Local Transport Plan

[84]Southampton Local Plan: [online] available at: http://www.southampton.gov.uk/planning/planning-policy/adopted-plans/default.aspx

Policy Reference	Policy Details
Policy C: To optimise the capacity of the highway network and improve journey time reliability for all modes	The Transport for South Hampshire (TfSH) authorities will work to better manage the existing highway network to ensure that existing capacity is optimised and used efficiently. This policy will maximise the through put of the highway network for all users and modes. This will entail using traffic signal control and other highway technologies, helping to improve network management, and greater priority for buses.
Policy G: To improve road safety across the sub-region	Work to date has been effective at reducing incidences of speeding and unsafe road-user behaviour through education, engineering measures at sites with high casualty records and enforcement of speed limits. Reductions in speed limits and crossing improvements within built up areas have further improved the safety of vulnerable road users
Policy H: To promote active travel modes and develop supporting infrastructure	The TfSH authorities will work with health and activity partners, including public health teams, to develop a network of high-quality, direct, safe routes targeted at pedestrians and cyclists. Well-designed routes and secure cycle parking can be partly delivered through the planning system.

13.2 Study area

Effects on All Travellers

The study areas for the assessment of the effects on all travellers are as follows:

- The study area for both views from the road and driver stress is along the extent of the scheme, from Junction 8 of the M27, past Windhover Roundabout, and along the A3024 corridor extending from the A27 Windhover Roundabout to just east of the Six Dials junction in Southampton, in accordance with DMRB[85] Volume 11, Section 3, Part 9.
- Non-Motorised Users - The study area for the assessment of impact on Non Motorised Users (NMU) includes those PRoWs and NMU routes directly affected by the route options, and any feeder PRoWs.

Scheme design drawings are included in **Error! Reference source not found.**.

Effects on Communities

The study areas for the assessment of effects on communities are as follows:

- Community Severance - The study area for community severance includes communities that may potentially be directly affected by the scheme, for example, through severance.
- Tourism and Recreation - The study area for tourism and recreation facilities includes any facilities accessed directly from the A3024 corridor from the A27 Windhover Roundabout in the west to just east of the Six Dials junction in Southampton and its feeder roads in a 500m radius. This enables direct impacts through land take and indirect impacts from access and amenity to be considered.

[85] Design Manual for Road and Bridges; [online] available at: http://www.standardsforhighways.co.uk/dmrb/

- Housing – This considers housing within the administrative boundary of SCC, as set out in the Adopted Core Strategy[86], and identifies those which could be directly or indirectly impacted because of access or amenity.
- Private Assets and Demolition of Private Property - The study area for private assets consists of the land parcels required to accommodate the proposed development. Private property is land and buildings outside the existing highways boundary that does not accommodate public open space or any other community facility or asset. It can be residential or commercial/industrial land, in accordance with DMRB Volume 11, Section 3, Part 6.2.
- Community Land - Community land is any area of public open space, such as allotments and common land, and other public facilities such as schools, hospitals, libraries and recreation facilities which are used by the local community for a range of social services, recreation and health and well-being. The study area for 'community land' consists of the land parcels required to accommodate the proposed development and adjoining land, in accordance with DMRB Volume 11, Section 3, Part 6.4.
- Development Land - Development land is land designated within the development plan for particular development purposes, or for which planning permission has been granted or is pending. The study area for development land consists of the land parcels required to accommodate the proposed development and adjoining land, in accordance with DMRB Volume 11, Section 3, Part 6.5.
- Agricultural Land - The study area for agricultural land consists of the agricultural land parcels required to accommodate the proposed development, in accordance with DMRB Volume 11, Section 3, Part 6.7.

Effects on People

The approach and study areas for the assessment of effect on people are as follows:

- Local Economy - Publicly available data have been gathered for the relevant Lower Super Output Areas (LSOA) for which data sets are available and publicly available information maintained by the Office of National Statistics (ONS).
- Social Profile - Publicly available data have been gathered for the administrative area of SCC.
- Health Profile - Publicly available data have been gathered for the administrative area of SCC, according to the data sets within the published Public Health England Health Profile and available ONS data sets (2011 census).

13.3 Baseline conditions (including value/sensitivity of resources and receptors)

13.3.1 Effects on All Travellers

Motorised Travellers: Views from the Road

[86] Southampton Local Plan: [online] available at: http://www.southampton.gov.uk/planning/planning-policy/adopted-plans/default.aspx

From the east to the west of the existing A3024, the current views from the road are as follows:

- Sub-scheme 1: There are no views from the road between Junction 8 of the M27 and the Windhover Roundabout due to dense vegetation on both sides of the carriageways.
- Sub-scheme 2: On exiting the Windhover Roundabout, the views to the south are enclosed by vegetation (no view) and there are open views of the adjacent fields to the north;
- Continuing on the Bursledon Road, the views are restricted on both sides by bordering vegetation;
- On approaching the junction with Botley Road, vegetation on either side of the carriageway becomes denser so that there is no view;
- West of the junction with Botley Road, the vegetation remains dense on the north side of the carriageway and obstructs views. Residential properties line the southern side of the carriageway, resulting in a restricted view. Views remain at best restricted due to the built environment until reaching Mobray King Way;
- On reaching Mobray King Way, cuttings and dense vegetation reduce the view further to no view;
- There remains no view on the Bitterne Road, due to bordering residential properties;
- Over the Northam Road Rail Bridge, views are open on both sides, extending over the River Itchen; and
- Once crossing over the river on Northam Road, views are again reduced to a mixture of restricted and no view.
- Sub-scheme 3: Over the Northam Road Rail Bridge, views are open on both sides, extending over the River Itchen
- Sub-scheme 5: near Bitterne Bridge, residential properties line the southern side of the carriageway

Motorised Travellers: Driver Stress

Road safety within Southampton has been steadily improving since 2000. However, casualties are still seen at hot spots and bottlenecks. Although not identified as a road safety ‘hot spot’ by the Southampton’s Local Transport Plan, it is likely that the A3024 still causes increased driver fear levels through the combination of the presence of pedestrian routes, bus stops; and variation of speeds.

There are a number of PRoW on, under and over the sub-scheme options via the footpaths, subways and footbridges. This means that pedestrians are near to, crossing on, or over, the existing roads which has the potential to create fear for the vehicle driver while using the highway.

Bottlenecks along the A3024 at key junctions and restricted road bridges cause delays and increase frustration for motorised travellers.

Although it is not possible to assess route uncertainty, it is thought due to the level of fear and frustration experienced by motorised travellers, and the levels of congestion along the route, that the level of Driver Stress experienced is high.

Non-Motorised Users: Amenity and Journey Length

Sub-scheme 1

There are no footways or PRoWs between M27 Junction 8 and the Windhover Roundabout. There are existing footpaths on the roadside for the A27 exit and approach to the Windhover Roundabout, both north and south, connected by a path on the central reserve. There are no dedicated traffic control measures for pedestrians at these crossings.

Sub-scheme 2

There are pavements along the length of the A3024 for pedestrians. On the Burlesdon Road, there is also an off road, shared cycle path and the pedestrian walk way.

There are several paths accessed from the A3024 which are displayed as “Routes for Research” on the Southampton Council Interactive PRoW map[87]:

- Two paths are accessed from Sholing Common;
- Two paths are accessed from the Muddy Bottom allotments; and
- Two paths on the land adjacent to Summers Street, south of the River Itchen.

A footpath identified on the Interactive PRoW map (Route: Southampton 02) is accessed 13m to the west of Northam Road, this path travels in a northerly direction.

The Itchen Way, is a long distance recreational route 43.5 km in length, the route follows the River Itchen from its source to Southampton Water. The Itchen Way has two short sections located within the footprint of Sub-schemes 2. The path meets the A3024 at Quayside Road where it turns left and runs along the A3024 for a short distance before turning into Bitterne Clausentum Roman Station, the route then travels along Vespian Road and Chapen Road before re-joining the A3024 again for another short section before it once again turns north and joins Macnaghten Road to the east of Bitterne Bridge.

Sub-scheme 3

There are pavements on either side of the relevant section of the Northam Road, on the A3024. There is also a foot bridge over the railway which connects to the south-east side of Northam Rail Bridge from Melbourne Street. A shared cycleway and footpath crosses under Northam Road Rail Bridge, accessible by the footbridge. There is also a pedestrian link from Northam Road to Northumberland Road and Derby Road.

There is no designated PRoW within the footprint of the Sub-scheme, however, a footpath identified on the Interactive PRoW map (Route: Southampton 02) is accessed 13m to the west of Northam Road Rail Bridge, this footpath path travels in a northerly direction and appears to be accessed from the A3024.

Sub-scheme 5

There are pavements on either side of the A3024 within the footprint of Sub-scheme 5. The Itchen Way travels along the A3024 within the footprint of Sub-scheme 5 before it turns north and joins Macnaghten Road to the east of Bitterne Bridge.

There are no other PRoWs crossing or accessed from this section of the A3024. There is no direct pedestrian crossing point on the A3024 at Bitterne bridge, to cross the A3024 in this location using the lights, pedestrians must cross several sides roads and the main road.

[87] Southampton Council Interactive PRoW map; [online] available at https://www.southampton.gov.uk/roads-parking/roads/rights-way-map.aspx

13.3.2 Effects on Communities

Community Severance

Community severance is defined as the separation of residents from facilities and services that they use within their community, in this case as a result of the scheme. Severance can also be considered to include physical obstruction and delayed or postponed journeys due to fear of crossing the road or heavy traffic.

All sub-scheme options are to be largely online, with no new roads to be built. It is considered that the Scheme introduces opportunities to enhance links between communities through provision of increased opportunities to cross the A3024; and it is thus not considered there will be any new severance between communities and this will therefore not be considered any further at PCF Stage 2.

Any impacts caused by temporary disruption to NMUs or regarding NMU access will be covered under NMU Amenity and Journey Length.

Tourism and Recreation

There are a number of tourist and recreational facilities located within Southampton which can be accessed either directly from the A3024 or its feeder roads, including:

Sub-scheme 1

- Bursledon Windmill museum and nature reserve, located east of Windhover Roundabout and accessed from the A27 southbound;

Sub-schemes 2, 3 and 5

- Coalporters Rowing Club is accessed from Northam Road, south of Northam River Bridge;
- St Mary's Football Stadium (immediately south of Sub-scheme 5) is accessed from the B3038; and
- A number of recreational businesses (including several bars and restaurants a boat chandlers and a vehicle hire outlet) operate from Shamrock Quay, accessed from the A3024 from Princes Street.

Housing

Under Policy CS 4 of the Adopted Core Strategy[88], an additional 16,300 homes will be provided within the City of Southampton between 2006 and 2026. Some 2,150 homes were completed between 2006/7 and 2007/8. The pattern of future delivery is expected to be (approximately) as follows:

[88] Southampton Core Strategy (2015): [online] available at https://www.southampton.gov.uk/policies/Amended-Core-Strategy-inc-CSPR-%20Final-13-03-2015_tcm63-371354.pdf

- 10,150 completions on allocated and identified sites between April 2009 and March 2019 (the ten-year supply). These delivery levels do not include windfall sites.
- 3,150 completions between 2019/20 and 2025/26.

The following sites, which border or are directly accessed from the A3024, are allocated for housing under the Adopted Local Plan[89]:

- Land surrounding Lumpy Lane;
- Land adjacent to Parsonage Road;
- Quayside Road scrapyard site;
- Land accessed by Hawkeswood Road;
- 71 Bitterne Road West;
- Land adjacent to Rampart Road; and
- Land adjacent to Bitterne Road East.
- Private Assets and Demolition of Private Property

No private housing land is required to accommodate the Scheme. It may be necessary to acquire small sections of private land to accommodate the widening of the northbound off slip road of Junction 8 of the M27. However, other than this it is anticipated all works would be within the highway boundary and on land owned by either Highways England or SCC. If works are required outside the highway boundary, it is envisaged this will be limited to undeveloped land and no property demolition will be required.

Community Land

There are several areas of community land close to the Scheme.

- Scholing Common (also known as Donkey Common), lies adjacent to the north of Burlesdon Road, and is registered as Common Land under the CRoW Act 2000.
- Allotments are located adjacent and on either side of Burlesdon Road at Muddy Bottom (East and West) and Bitterne Road West (East and West) [90].
- There are a number of areas of public open space shown on SCC's online Interactive Map[91], including:
    - Netley Common, adjacent to the north east of Windhover Roundabout and north of the A3024;
    - Eastpoint, adjacent north of Burlesdon Road;
    - Shoreburs Greenway, adjacent south of Burlesdon Road;
    - Hum Hole Park, adjacent north of the A3024 Maybray King Way; and
    - Bitterne Manor Open Space adjacent north of Bitterne Road West

[89] Southampton Adopted Local Plan map: [online] available at: https://www.southampton.gov.uk/planning/planning-policy/adopted-plans/local-plan-adopted-map.aspx
[90] SCC's online Interactive Map [online] available at http://www.southampton.gov.uk/WhereILive/MapSouthampton.aspx
[91] SCC's online Interactive Map [online] available at http://www.southampton.gov.uk/WhereILive/MapSouthampton.aspx

Development Land

There are no Major Development Zones, as defined by the Adopted Local Plan, which are within the land take required for any of the options. As such, development land will not be considered further within this assessment.

Agricultural Land

Agricultural land has been classified by the Ministry for Agriculture, Fisheries and Food (MAFF), now Department for Environment, Food and Rural Affairs (Defra), according to the extent to which chemical and physical characteristics impose long term limitations on agricultural use for food production.

Land use around Sub-scheme 1 is predominantly rural and the Agricultural Land Classification (ALC) system maps classify the area as Grade 4 (poor). The study area does not contain any 'best and most versatile' (BMV) agricultural land taken to be ALC Grades 1-3 as defined in Annex 2 of NPPF and therefore this will not be considered further.

13.3.3 Effects on People

Local Economy

Deprivation

The Indices of Multiple Deprivation use a combination of information relating to income, employment, education, health, skills and training, barriers to housing and services and crime to create an overall score of deprivation. As a lower score indicates greater deprivation, the most deprived area is indicated by a rank of 1. The scores of the relevant Lower-layer Super Output Areas (LSOAs) which are affected by the sub-scheme options are detailed below. The scores for all LSOA in the district provide an average for which the district is given a rank.

Southampton is ranked 81st most deprived authority out of 326 Local Authorities in England[92].

23% of the city's population lives in the most deprived LSOAs in England.

Between 2007 and 2010, 63% of the LSOAs have not moved between deciles whilst 16% have become less deprived and 23% more deprived.

The most deprived areas based on the IMD 2010 are in Bevois, Redbridge, Millbrook, Woolston (Weston) and Bitterne (Thornhill) wards. This is unchanged from 2007.

Employment

Employment statistics[93] for the City of Southampton show that the numbers of economically active employed is lower than the regional and national average, as shown in **Table 13.**. The number of economically inactive residents is higher than both the regional and national averages.

Table 13.3: Employment Statistics for Southampton, South East and England

[92] Southampton City Council (2013) Equalities Profile for Southampton
[93] Office for National Statistics, Census 2011

	Southampton	South East	England
Residents aged 16-74	180,201	6,274,341	38,881,374
Economically Active	103,902 (57.7%)	4,095,333 (65.2%)	24,143,464 (62.1%)
Economically Active - Unemployed	7,631 (4.2%)	216,231 (3.4%)	1,702,847 (4.4%)
Economically Inactive	64,491 (35.8%)	1,968,052 (31.3%)	13,430,386 (34.5%)

The key industries of the area are wholesale and retail trade (17.4%), health and social work (13.4%), education (10.3%), manufacture (8.5%), and construction (7.9%)[94].

The average annual income of resident workers in Southampton was £23,998 in 2011. This is 86% of the average annual income of the Southampton workforce, £27,909 for the same year – representing a pay gap of 16.3% between residents and the general workforce. The ONS Annual Survey of Hours and Earning also shows that the median hourly rate for full time workers is £11.47 compared to £14.13 for the South East and £12.77 for Great Britain. Although there is a difference between the male and female hourly rate, £11.71 compared to £10.76, the difference is less than for the South East (£15.26 for men and £12.66 for women) and Great Britain (£13.32 and £11.95)[95].

There are several safeguarded employment and industrial sites adjacent to the A3024:

- Northam Industrial Estate, safeguarded under Policy AP3 of the City Centre Action Plan[96] (partially within Sub-scheme 3);
- Centurion Industrial park, safeguarded under Policy REI10 Industry and Warehousing of the Amended Local Plan Review[97]; and
- Quayside Road Industrial Park, safeguarded under REI11 of the Amended Local Plan Review.

Social Profile

The following statistics detail the age and sex profile[98] (Table 13), religion (Table 13.4: 2012 Mid-Year Population Estimates for Southampton

Age	Male	Female
0-14	20,300	19,200
15-24	25,100	23,100
25-44	36,700	33,700
45-64	25,100	24,500

[94] Office for National Statistics, Census 2011
[95] Southampton City Council (2013) Equalities Profile for Southampton
[96] City Centre Action Plan: [online] available at http://www.southampton.gov.uk/Images/CCAP-18-March-2015_tcm63-371356.pdf
[97] City Centre Action Plan: [online] available at http://www.southampton.gov.uk/policies/Amended-LPR-with-CCAP-and-CS-changes-13-03-2015_tcm63-371355.pdf
[98] Southampton City Council (2013) Equalities Profile for Southampton

Age	Male	Female
65+	14,000	17,800
Total	121,200	118,300

) and ethnicity[99] (Table 13.5: Religious followers in Southampton, the South East and England from 2011 Census

Religion	Southampton	South East	England
Christian	12,2018	5,160,128	31,479,876
Buddhist	1,331	43,946	238,626
Hindu	2,482	92,499	806,199
Jewish	254	17,761	261,282
Muslim	9,903	201,651	2,660,116
Sikh	3,476	54,941	420,196
Other Religion	1,329	39,672	227,825
No Religion	79,379	2,388,286	13,114,232
Religion Not Stated	16,710	635,866	3,804,104

) of the population of Southampton.

Table 13.4: 2012 Mid-Year Population Estimates for Southampton

Age	Male	Female
0-14	20,300	19,200
15-24	25,100	23,100
25-44	36,700	33,700
45-64	25,100	24,500
65+	14,000	17,800
Total	121,200	118,300

Table 13.5: Religious followers in Southampton, the South East and England from 2011 Census

Religion	Southampton	South East	England
Christian	12,2018	5,160,128	31,479,876
Buddhist	1,331	43,946	238,626
Hindu	2,482	92,499	806,199
Jewish	254	17,761	261,282

[99] Office for National Statistics, Census 2011

Muslim	9,903	201,651	2,660,116
Sikh	3,476	54,941	420,196
Other Religion	1,329	39,672	227,825
No Religion	79,379	2,388,286	13,114,232
Religion Not Stated	16,710	635,866	3,804,104

Table 13.6: Ethnicity for Southampton, the South East and England as recorded in 2011 Census

Ethnicity	Southampton	South East	England
White; English/Welsh/Scottish/Northern Irish/British	183,980	73,58,998	42,279,236
White; Irish	1,746	73,571	517,001
White; Gypsy or Irish Traveller	341	14542	54895
White; Other White	17461	380709	2430010
Mixed/Multiple Ethnic Groups; White and Black Caribbean	1678	45980	415616
Mixed/Multiple Ethnic Groups; White and Black African	941	22825	161550
Mixed/Multiple Ethnic Groups; White and Asian	1796	58764	332708
Mixed/Multiple Ethnic Groups; Other Mixed	1263	40195	283005
Asian/Asian British; Indian	6742	152132	1395702
Asian/Asian British; Pakistani	3019	99246	1112282
Asian/Asian British; Bangladeshi	1401	27951	436514
Asian/Asian British; Chinese	3449	53061	379503
Asian/Asian British; Other Asian	5281	119652	819402
Black/African/Caribbean/Black British; African	3508	87345	977741
Black/African/Caribbean/Black British; Caribbean	1132	34225	591016
Black/African/Caribbean/Black British; Other Black	427	14443	277857
Other Ethnic Group; Arab	1312	19363	220985
Other Ethnic Group; Any Other Ethnic Group	1405	31748	327433

According to the SCC Equalities Profile[100], the following conclusions were drawn about the social profile of residents within the area:

- According to the Census 2011, the residential population of Southampton was recorded as 236,900. This is an increase of 19,500 or 8.9% on the 2001 census population of 217,400. In England, the population increased by 12.7%. The population of Southampton is predicted to grow by 7% by 2021.
- The 2011 Census recorded the following statistics about residents' ethnicity:
    - The White British population of Southampton has fallen by 4.7% (-8,990) from 192,970 (88.74%) in to 2001 to 183,980 (77.7%) in 2011.
    - The other White population, which includes migrants from Europe, has increased in the last ten years by over 212% from 5,519 to 17,461 or 7.4% of the population.
    - The Indian population is 2.8% and the Asian or British Asians form 8.4% of the whole population.
- Some 7,522, or 7.7%, of households in Southampton have no people in them with English as a main language.
- The city has high levels of child poverty. According to HMRC data (2010) 26.1% of the city's children live in poverty. In some wards of the city this figure is as high as 40%. This compares to an average of 20.6% in England and 15% for the South East. In Southampton, 80% of children in poverty in the city are in households claiming Jobseekers Allowance or Income Support.
- There are 3,863 households in the city, defined as 'deprived, very elderly, mainly single pensioners living in council owned, purpose built accommodation'. A higher proportion of older people in Southampton rely upon input from social services than the national average (5.2% compared to 3.8% nationally). There is a forecast increase of 15% in the number of people over 85 from 5,200 to 6,000 and a rise in the number of people with dementia related conditions, of whom two thirds live in the community and one third live in care homes.

Health Profile

The state of health of all residents in Southampton, the South East and England as recorded within the 2011 census[101] is shown in

[100] Southampton City Council (2013) Equalities Profile for Southampton
[101] Office for National Statistics, Census 2011

Table 13. Southampton is more closely aligned with the recorded percentages in each category, apart from those in fair health, with England as a whole. It has a lower number of people than the South East listed as in very good health, and a higher number of those considering themselves to be in bad and very bad health.

Table 13.7: Health of people in Southampton, the South East and England in 2011

State of Health	Southampton	South East	England
Very Good Health	112,653 (47.56%)	4,232,707 (49.02%)	25,005,712 (47.17%)
Good Health	82,880 (34.99%)	2,989,920 (34.63%)	18,141,457 (34.22%)
Fair Health	29,278 (12.36%)	1,037,592 (12.02%)	6,954,092 (13.12%)
Bad Health	9,223 (3.89%)	291,456 (3.38%)	2,250,446 (4.25%)
Very Bad Health	2,848 (1.2%)	83,075 (0.96%)	660,749 (1.25%)

Table 13.8: outlines the numbers of people within Southampton, the South East and England who consider their day-today activities to be limited by their health[102].

Table 13.8: Day to day Activity Limits in Southampton, the South East and England in 2011

	Southampton	South East	England
Day-to-Day Activities Limited a Lot	18,165 (6.60%)	593,643 (5.94%)	4,405,394 (7.06%)
Day-to-Day Activities Limited a Little	20,234 (7.35%)	762,561 (7.63%)	4,947,192 (7.93%)
Day-to-Day Activities Not Limited	198,483 (72.10%)	7,278,546 (72.85%)	43,659,870 (70.01%)

The Health Profile for Southampton in 2015[103], published by Public Health England, summarises that:

- The health of people in Southampton is generally worse than the England average. Deprivation is higher than average and about 23.5% (9,800) children live in poverty. Life expectancy for both men and women is lower than the England average;
- In Year 6, 21.8% (427) of children are classified as obese, worse than the average for England. In 2012, 25.1% of adults are classified as obese;
- Priorities in Southampton include tobacco control, alcohol and drugs, improving outcomes for children and young people and reducing inequalities.

There are 13 Air Quality Management Areas (AQMAs) (10 in SCC and three in EBC) that are in the vicinity of the Scheme options. One of which (AQMA 2 - Bitterne Road West) is located within the Scheme, AQMAs are discussed further in Section **Error! Reference source not found.** – *Air Quality*.

[102] Office for National Statistics, Census 2011
[103] Public Health England (2015) Southampton Health Profile 2015

13.4 Potential impacts

The impacts of the Scheme on '*People and Communities*' will vary depending on the Sub-scheme and the affected community. Not all impacts will be adverse. Indeed, a proportion may be beneficial such as those associated with improving road safety, reducing congestion or enhanced NMU facilities. Those elements of the Scheme which have less interaction with people and communities, such as those on the existing network and not involving new land take are likely to give rise to fewer effects than carriage way widening into private land.

Appraisal Option 1 will result in both temporary and permanent impacts to public transport users through the removal of bus lanes and removal/ relocation of bus stops. Appraisal Option 2 will result in few impacts due to the lesser extent of the works being proposed.

Major accidents and/or disasters could result in significant effects in the context of people and communities, for both Appraisal Options, for example, a major road traffic accident resulting in fire could affect human health.

13.5 Assessment methodology

The methodologies for the topics considered in this section of the EAR have been taken from the sections of the DMRB:

- Guidance contained within DMRB Volume 11, Section 3, (Parts 8 Pedestrians, Cyclists, Equestrians and Community Effects) and 9 (Vehicle Travellers) has been used to assess the impacts on transport systems.
- In accordance with DMRB Volume 11, Section 3, Part 8, impacts on NMUs are based on changes to journey length and changes to journey amenity, and impacts on vehicle travellers are based on changes in view from the road and driver stress.

These are discussed further in the following sections.

Motorised Vehicle Travellers

In accordance with DMRB Volume 11, Section 3, Part 9, for vehicle travellers, the assessment considers view from the road, driver stress, and public transport.

View from the road

Paragraph 2.4 describes 'Views from the Road' as: "…the extent to which travellers, including drivers are exposed to the different types of scenery through which a route passes." View from the road is closely related to landscape and townscape character and visual amenity. Aspects to be considered are:

- The types of scenery or the landscape/townscape character as described and assessed for the baseline studies;
- The extent to which travellers may be able to view the scene;
- The quality of the landscape/townscape as assessed for the baseline studies;
- Features of particular interest or prominence in the view; and
- The extent to which travellers perceive how the landscape/townscape through which they are passing would vary with the relative level of the road and its

surrounding ground and vegetation. The following four categories are used to assess vehicle traveller's ability to see the surrounding landscape/townscape:

- **No view** - road in deep cutting or contained by earth bunds, environmental barriers or adjacent structures;
- **Restricted view** - frequent cuttings or structures blocking the view;
- **Intermittent view** - road generally at ground level but with shallow cuttings or barriers at intervals; and
- **Open view** - view extending over many miles, or only restricted by existing landscape features.

For changes in view from the road, an adverse impact would result where views become more enclosed/limited/cluttered; or a beneficial impact would result if views are more open or expansive as a result of proposed improvement schemes.

The sensitivity of views from the road and the magnitude of impact on views from the road has been assessed using the criteria in DMRB Volume 11, Section 3, Part 9.

Consideration of views from the road has been presented in Section 9 - *Landscape and Visual Assessment*, therefore is not considered further in this chapter.

Driver stress

Driver Stress is defined in Volume 11 of the DMRB as the adverse mental and psychological effects experienced by a driver traversing a road network. Driver stress can be considered in terms of three main components; frustration, fear of potential accidents and route uncertainty.

Frustration refers to the actual travelling speed in relation to a driver's expectation of travel speed for the standard of the road. Factors that can influence frustration include traffic flow, congestion, roadwork and difficulties overtaking vehicles.

- Fear of potential accidents is influenced by other vehicles on the road, sight lines, and separation from pedestrians and cyclists. Improved flow of traffic, with more consistent speeds, should reduce fear of accidents and have a beneficial impact. However, narrower lanes may increase fear of potential accidents, due to proximity of other vehicles.
- Route uncertainty is influenced by the standard of signing or lane markings and junction layout. With technology measures, route uncertainty is likely to decrease (beneficial impact).

Levels of driver stress have been assessed qualitative. The assessment uses a three-point scale as described in DMRB:

- Low,
- Moderate or
- High,

based on the criteria set out in Table 12.9 for a single-carriageway road (i.e. the roads along the Scheme), which consider speed and flow during peak hours in urban areas.

Table 13.9: Stress categories for Single-Carriageway Road

Average peak hourly flow per lane (Flow Units*/1 hour)	Average Journey Speed Km/hr		
	Under 50	50-70	Over 70
Under 600	High**	Moderate	Low
600-800	High	Moderate	Moderate
Over 800	High	High	High

*A car or light van equals one flow unit. A commercial vehicle over 1½ tons unladen weight or a public service vehicle equals 3 flow units.

** Moderate in urban areas such as the proposed Scheme

Transport Systems - Public Transport

Impacts on existing bus and rail services within the area have been considered along with impacts on bus stops within the study area.

Transport Systems – Non-Motorised Users (NMUs)

Generic impacts on NMUs in the study area would result from changes to, or diversions or closures of NMU routes during and/or after the construction period. These changes would typically be as a result of demolition works, road widening, junction alterations, changes to the location of bus stops, changes to locations or types of crossing; and changes in traffic flow. Impacts may be direct if there are actual changes to routes or facilities, or indirect in terms of certain changes to journey amenity, for example an increase in road noise.

The proposed methodology is based on the procedures set out in the DMRB Volume 11, Section 3, Parts 8 and 9 and the application of DMRB Volume 5, Section 2, Part 5, HD42/05 and will consider:

- The option's impact on the journeys that NMUs make in its locality;
- The impact on existing usage of the community facilities and routes by pedestrians and others;
- Changes in safety and amenity value of routes which may be affected by the proposed option; and
- The effects of the scheme options on journey length.

The assessment involved a desk study to identify likely NMU activity and how local community facilities are likely to be affected by the construction and operation of the scheme options and NMU counts at specific locations. This includes both adverse and beneficial effects.

The level of new severance has considered criteria set out by DMRB Volume 11, Section 3, Part 8, which categorises the level of impact on journey length, using a three-point scale of slight, moderate and severe.

The method of assessment for journey amenity follows guidance in DMRB Volume 11, Section 3, Part 8. Amenity is defined as the relative pleasantness of a journey. The value of a route should not be considered solely in terms of the quantity and frequency of use. Amenity is therefore concerned with changes in the degree and duration of people's exposure to traffic - fear/safety, noise, dirt and air quality - and

the impact of the road itself - primarily any visual intrusion associated with the scheme and its structures. Whilst the volume and composition of traffic are very important determinants of amenity, other factors should also be considered, such as signage, width of footpaths and so on.

In assessing amenity for the routes used by NMUs, a descriptive approach has been employed which gives an overall indication of the change in amenity.

Community and People

Existing guidance in DMRB Volume 11, Section 3, Parts 6 and 8 has been used to inform this assessment. This topic includes both public and privately-owned tourism and leisure facilities. It also includes an assessment of community severance.

DMRB Volume 11, Section 3, Part 6 advises that an assessment of effects should include loss of land used by the community. Land which may be used by the community is defined in the document as:

- Common Land (registered under the Commons Registration Act 1965);
- Town or Village Green (registered under the Commons Registration Act 1965);
- Fuel and Field Garden Allotments; and
- Public Open Space.

In line with DMRB Volume 11, Section 3, Part 8, community facilities include doctors' surgeries and hospitals, homes for the elderly, schools, shops, post offices, places of worship, parish halls, recreational areas and leisure facilities, libraries, railway stations, and bus services.

Community Severance and Recreation

Community severance is the separation of residents from facilities and services they use within their community. The assessment of community severance considers changes in severance as a result of the proposed Scheme.

A desk study using publicly available information has been undertaken to inform this topic. The assessment of impacts on recreational facilities considers how improvements to the transport network may affect access to, and use of, these features. Potential impacts on recreational use of PRoWs, footways and cycle routes have been included within the assessment of Transport Systems - NMUs.

13.6 Assessment Assumptions and limitations

A site visit has not been carried out at this stage of assessment, and therefore the assessment is based on publicly available data.

At this stage, no detailed air quality modelling is available to allow quantitative assessment of impacts on sensitive receptors, Motorised Travellers (MT) and NMUs.

13.7 Design, mitigation and enhancement measures

13.7.1 Whole Scheme

The Scheme aims to alleviate congestion along the A3024 and on the M27 between Junctions 5 and 8. The Scheme will support local growth in housing and employment through the provision of viable alternative access into and out of Southampton City Centre.

Public consultation will help to inform the design team on any community issues that might not otherwise be noted.

Once a preferred option is chosen (at PCF Stage 3), a review will be undertaken to determine how the effects of severance or effects on access would potentially affect other committed developments. Opportunities will be considered for improvements to NMU routes.

Careful consideration of construction compounds will be required to minimise distance between compound and works. Construction methods will seek to minimise the generation of noise and dust; and construction sites and compounds will be appropriately fenced off to restrict access to site personnel only and to ensure the safety of the general public.

A detailed construction programme, indicating the main types of activities to be carried out during the course of the construction phase, and a Construction Environmental Management Plan (CEMP) will be prepared to support the implementation of mitigation measures.

During construction works, there are likely to be delays and possible requirements for appropriate traffic management which shall include early warnings to drivers that the works are taking place and signposted diversion routes. Temporary pathway diversions will also be signposted for NMUs were required.

13.7.2 Sub-scheme specific measures

Sub -scheme 2

Consultation with bus operators was undertaken during PCF Stage 2. Consideration was given to the location of existing bus stops and services serving these stops. During PCF Stage 3, further consultation will be undertaken and consideration will be given to relocation of bus stops/ stopping areas during detailed design.

Sub -scheme 3

The construction design of Northam Road Rail Bridge (pre-fabrication and installation of a new bridge before demolition of the existing) enables an accessible vehicle and NMU route over the railway line during construction works.

Consultation with Network Rail will be undertaken to minimise any impacts on the railway line to and from Southampton Central Station as it passes beneath Northam Road Rail Bridge. Early contractor involvement will ensure that periods of rail possession are minimised. During periods of rail possession it is likely there will be replacement bus services and alternative rail routes put in place.

13.8 Assessment of Effects

13.8.1 Appraisal option 1

Effects on All Travellers

Driver Stress may be temporarily increased during construction works as a result of temporary works, however as levels of driver stress are already assumed to be high due to existing congestion, it anticipated there will be no significant change.

Long term it is expected that the Scheme will improve traffic flows and reduce congestion on the local road network, resulting in a more effective network and an overall decrease in driver stress during operation.

During construction of the Scheme, there may be some temporary disruption to NMU journeys and a reduction in amenity, resulting in temporary adverse effects. However, long term, the new NMU facilities for cyclists and pedestrians will improve connectivity and amenity along the A3024, providing a permanent minor beneficial effect.

During the construction of the Scheme (specifically Sub-scheme 3) there will be temporary adverse effects to rail commuters during periods of line possession to construct the new bridges.

Effects on Communities

It is not considered that there will be any significant beneficial or adverse impacts on community facilities.

There is potential for will be some loss of private land however, no residential demolitions will be required to accommodate the works, and no community land will be lost.

Once operational the improved NMU routes and crossing points provide a permanent beneficial impact to NMUs reducing severance that could be caused by increasing traffic volumes on the A3024.

Effects on People

Construction works will result in a temporary increase in employment and increased spend in the local economy, resulting in a temporary beneficial effect.

The Scheme will have a minor beneficial effect on commuters accessing Southampton City Centre. It is not likely that there will be any direct impacts on areas of strategic growth and employment land allocations within Southampton as a result of the Scheme.

Improved NMU facilities may encourage more journeys to be taken by active travel modes (walking, cycling), which would provide beneficial effects on the health of residents. This benefit will be restricted to the geographical area of the Scheme. There will be temporary adverse disruption on MTs and NMUs, during construction works but once operational, there will be slight beneficial effects for travellers.

13.8.2 Appraisal Option 2

Operational and construction phase impacts for Appraisal Option 2 are, due to the reduced scale of works, generally less for Appraisal Option 2 compared to Appraisal Option 1.

Whilst many of the impact types are similar to Appraisal Option 1 (as detailed in Section 12.8.1) there will be no impacts to railway users (passenger and freight) as

there will be no works to Northam Road Rail Bridge (Sub -scheme 3). Other than impacts associated with traffic delays, there will be no impacts to public transport users as there will be no changes to the existing bus lanes and bus stops along the A3024.

Opportunities to provide improved NMU facilities are, due to the reduced scale of works, reduced in comparison to Appraisal Option 1. However, there remain opportunities to improve connectivity for NMUs around the M27 Roundabout and Windover Roundabout through the provision of more pedestrian crossings and new dedicated pedestrian/ cycle routes.

14. Road Drainage and Water Environment

14.1 Legislative and policy framework

Water resources are managed and protected under UK legislation and regulations consistent with European Community (EC) Directives. The main legal framework is set by the following instruments:

- Water Framework Directive (2000/60/EC) and the Water Environment (Water Framework Directive) (England and Wales) Regulations (SI 3242/2003).
- Water Resources Act 1991.
- Water Act 2003, as amended.
- Land Drainage Act 1991, as amended by the Land Drainage Act 1994.
- Flood and Water Management Act 2010.
- Environmental Permitting (England & Wales) Regulations 2010.

14.1.1 National Policy

National Planning Policy Framework

The National Planning policy framework (NPPF) sets out the Government's planning policies for England. Planning Practice Guidance 'Flood Risk and Coastal Change' has been published alongside the NPPF. These documents identify how new developments must take flood risk into account, including making allowance for climate change impacts, and ensure no increase in risk to people and property elsewhere. All applications in the following areas should be accompanied by a Flood Risk Assessment (FRA) – all projects in Flood Zones 2 and 3 (medium and high probability of river and tidal flooding); projects of 1ha or greater in Flood Zone 1 (low probability of river and tidal flooding); projects which may be at significant risk from other sources of flooding (local watercourses, surface water, groundwater or reservoirs); or where the Environment Agency (EA) has notified the local planning authority that there are critical drainage problems.

14.1.2 Local Policy

Southampton City Council Core Strategy Development Plan (2015)

The Core Strategy contains the following policies that relate to the management of flood risks and surface water runoff:

Policy CS 20 – Tackling and Adapting to Climate Change: The policy promotes the use of SUDS and measures to reduce or avoid water contamination and safeguard groundwater supply within all development, unless it can be demonstrated that this is not appropriate in a specific location.

Policy CS 23 – Flood Risk: The policy requires development will achieve an appropriate degree of safety taking into account standards of defence and sea level rise over the life of the development.

The scheme will consider the use of SUDS and the implications associated with defence standards and sea level rise.

14.2 Study area

The study area consists of the sub-scheme options and a 500m study area surrounding the maximum scheme extent. Features that may be affected by pollutants transported downstream of the works could be greater than 500m from the sub-scheme options and these features will also be included within the assessment as appropriate. Similarly, the potential impacts to flood risk could be experienced by receptors at distances greater than 500m from the options and this is taken into consideration.

Impacts upon groundwater have been considered in the Geology and Soils chapter. These impacts have been used to inform the WFD scoping assessment which includes risks to the groundwater bodies and is presented in Section 13.. The need for a separate Flood Risk Assessment (FRA) will be determined and if required produced at PCF Stage 3 as part of the drainage strategy for the scheme to document the flood risk and any mitigation measures required. Flood risk impacts have been included in the baseline section of this report for information purposes but have not been included in the assessment.

14.3 Baseline conditions (including value/sensitivity of resources and receptors)

Baseline information has been obtained from the following sources:

- Ordnance Survey mapping;
- The EA's online maps;
- The MAGIC geographical information portal;
- The British Geological Survey (BGS);
- The Highways Agency Drainage Data Management System (HADDMS).

14.3.1 Surface Water Features

The River Test flows in a south easterly direction on the west side of Southampton and is known as Southampton Water in its downstream extents, prior to discharging to The Solent approximately 10km downstream of the study area. The River Test and Southampton Water are more than 500m away from all Sub-schemes and are not considered further in this assessment.

The River Itchen flows in a southerly direction to the east of Southampton city centre, and discharges to the River Test adjacent to Southampton Harbour. The Sub-scheme options are located on both the left and right bank of the River Itchen. The closest distance from the proposed works to the River Itchen for each Sub-scheme is presented in Table 13.1.

Table 14.1: Distance between proposed works and River Itchen for each Sub-scheme

Sub-scheme	Description of nearest proposed works	Closest proximity to River Itchen (approximate)	Scoped In/Out

1	Carriageway widening and improvements to M27 Junction 8 and Windhover Roundabout	>4km to the east of the River Itchen	River Itchen scoped out for Sub-scheme 1 due to distance from watercourse (significant distance outside study area).
2	Carriageway widening on Summers Street.	100m south west of River Itchen (at Northam River Bridge)	Scoped in
3	Northam Road Rail Bridge replacement	400m west of the River Itchen	Scoped in
5	Bitterne rail bridge	150m north of the River Itchen	Scoped in

The River Itchen is designated as a main river and is tidally influenced within the study area.

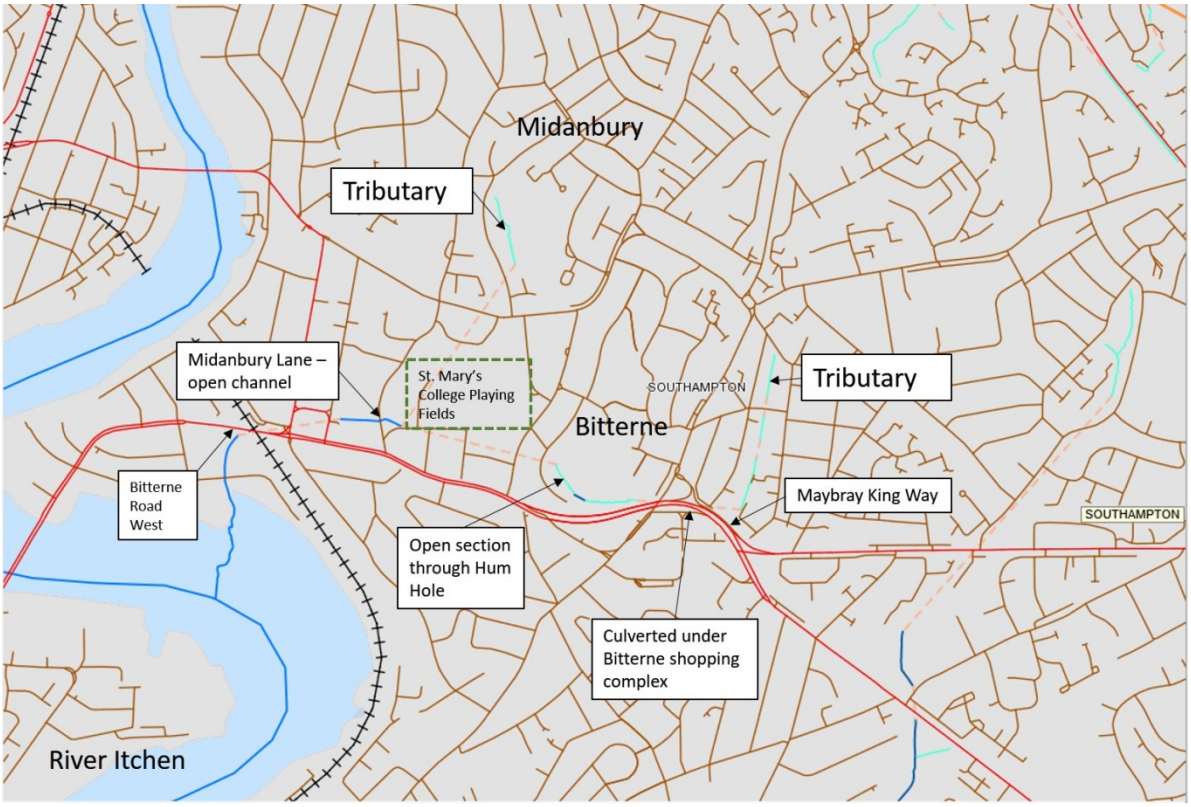
There are several un-named watercourses that pass through the study area and some within the scheme extents. These are described from west to east in the following paragraphs and presented in Appendix 13.1, **Error! Reference source not found.** Drawing Reference HE551514 - WSP - GEN - M27 - FI - GIS – 0019).

An unnamed watercourse is located to the north of the A3024, Maybray King Way (west of Westend Road) and Bitterne Road West. For the purposes of assessment, the watercourse has been referred to as Watercourse A. The watercourse comprises two tributaries north of the A3024, one originates in the Midanbury area and the other from the Bitterne area of the city as shown on Figure 13.2.

HADDMS depicts the watercourses being in culvert for significant lengths as they pass through urban areas. These tributaries flow southwards with the eastern branch running southwards until it reaches the Maybray King Way and then heads in a westerly direction in culvert beneath the A3024 Maybray King Way adjacent to the Bitterne shopping complex, emerging for a short section through Hum Hole (south of Glenfield Infant School). The two tributaries join whilst in culvert under the playing fields of St Mary's College and the main channel then emerges near Midanbury Lane. The watercourses remain on the north side of the A3024 until it passes in culvert beneath Bitterne Road West immediately to the west of Bitterne Rail Bridge within the scheme extents of Sub-schemes 2 and 5. Once on the south side of the A3024 the watercourse continues south to discharge to the River Itchen. The upstream extent of the watercourse is understood to be classified as an ordinary watercourse under the jurisdiction of SCC as the Lead Local Flood Authority (LLFA), and the downstream extent of the watercourse (in the vicinity of Sub-scheme 5) in designated as a main river under the jurisdiction of the EA.

Two ordinary watercourses flow from north-east to south-west beneath the A3024 Bursledon Road at Sholing Common (referred to as Watercourse B for the purposes of this assessment) and Weston Common (referred to as Watercourse C). Both watercourses pass in culvert within the scheme extent of Sub-scheme 2. The watercourses flow predominantly within open channels and are understood to be under the jurisdiction of SCC as the LLFA. Watercourses B and C merge north of Mayfield Park in Millers Pond (Nature Reserve) after which the watercourse continues to flow in a south-westerly direction through Mayfield Park to discharge to the River Itchen at its confluence with the River Test.

Figure 13.2 Route of watercourse AA including culverted sections (Taken from HADDMS)



An ordinary watercourse originates on the south side of the B3033, Botley Road approximately 530m to the south west of the Botley Road (B3033) and Bursledon Road (A3024) junction. The watercourse lies approximately 400m from the western extent of works proposed at this junction as part of Sub-scheme 2. For the purposes of assessment this has been referred to as Watercourse D.

An ordinary watercourse originates near the Tesco store at Windhover, referred to as Watercourse E. The watercourse is approximately 300m east of Windhover Roundabout. In its downstream reaches (outside the study area) it is known as Spear Pond Gully before discharging into Southampton Water.

A number of ordinary watercourses are depicted on HADDMS within 500m of Windhover Roundabout and Junction 8 of the M27, Sub-scheme 1. One tributary is located approximately 300m south of Windhover Roundabout and is referred to as Watercourse F. There are a further two tributaries that pass through Junction 8 in culvert under the circulatory carriageway, slip roads and M27 mainline in a southerly direction. The two tributaries merge and become an open channel located to the east of the southbound on slip at Junction 8 and referred to as Watercourse G. This watercourse is joined by Watercourse F and flows southwards through Bursledon to discharge into the River Hamble to the east of the study area.

There is a pond depicted on OS mapping located to the north of Northam Road east of the railway crossing, herein referred to as Pond A. The pond is located outside, but immediately adjacent to the scheme extent for Sub-scheme 3 (Northam Road Rail Bridge). It is not known if this watercourse is hydrologically connected to a watercourse (via surface water sewers/drainage network).

There are three interconnecting online ponds associated with Watercourse A (eastern branch as it passes through Hum Hole – see Figure 13.2) located

approximately 70m north of the Maybray King Way and Bitterne Road junction. These are online ponds have been included in the assessment of impacts upon the watercourse.

There are several ponds within the vicinity of the M27 Junction 8. OS mapping identifies a pond located approximately 150m to the east of the junction on the corner of Dodwell Land and Pyland's Lane. No impacts are anticipated upon this pond as it is not anticipated to be hydraulically linked to the highway network and it has been scoped out of further assessment. A pond is shown approximately 60m to the north west of the circulatory carriageway on Bursledon Common, herein referred to as Pond B. There is a pond located to the south west of the junction, this is located approximately 65m from the northbound off-slip at the rear of Windmill Lodge and the Coach House, herein referred to as Pond C.

14.3.2 Water Framework Directive Waterbodies

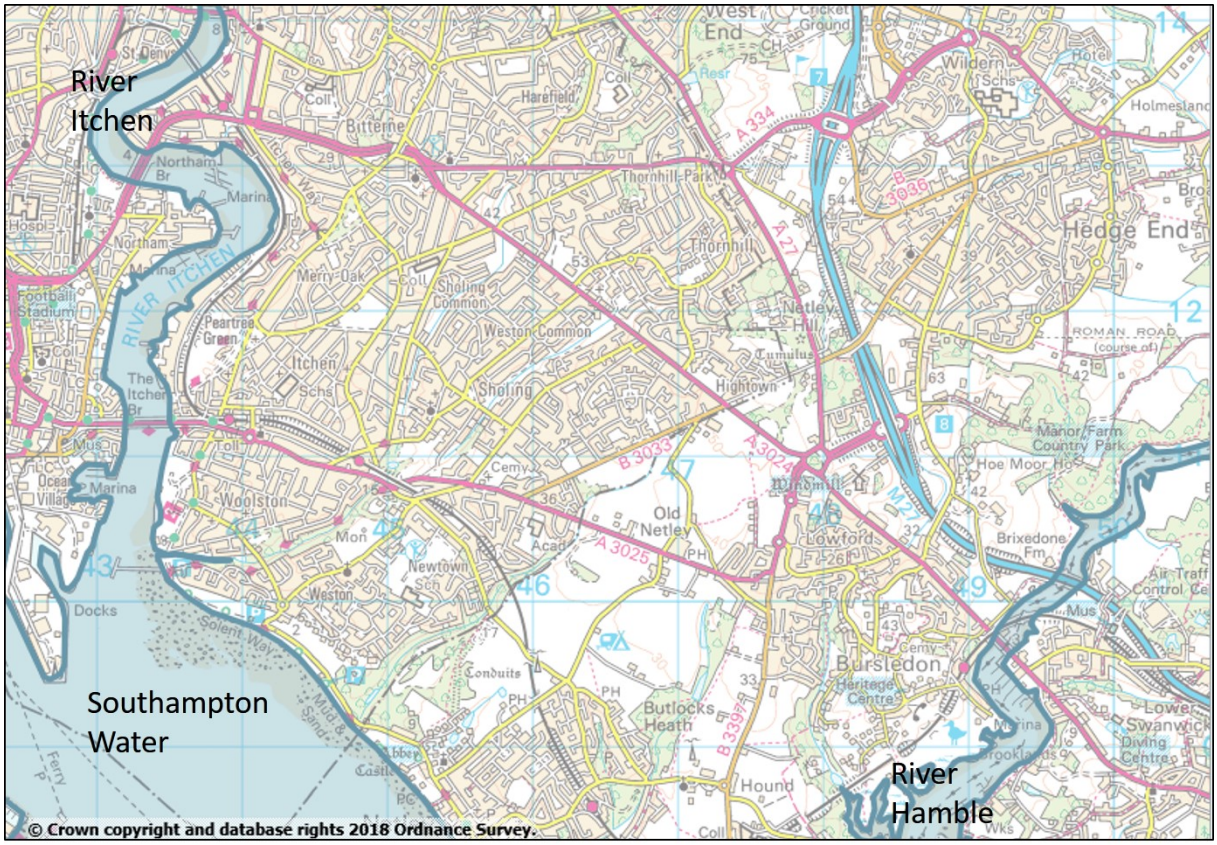
Waterbodies designated under the Water Framework Directive and included in Cycle 2 (2016-2021) of the River Basin Management Plans (RBMPs) includes the following:

- Southampton Water (GB520704202800) – Transitional water body
- Central Hants Bracklesham (GB40702G500900) – groundwater body
- South East Hants Bracklesham Group (GB40702G503000) – groundwater body.

The tidal River Itchen forms part of the Southampton Water (GB520704202800) transitional waterbody which is monitored against the objectives of the WFD and is presented on Figure 13.3.

It should be noted that watercourses previously included in Cycle 1 of the RBMP that are no longer classified as WFD water bodies under Cycle 2 have not been identified or considered in this assessment.

Figure 13.3. Southampton Water WFD waterbody within the vicinity of the scheme (taken from http://environment.data.gov.uk/catchment-planning/WaterBody/GB520704202800).



Current ecological quality (cycle 2 2016) is assessed to be moderate (due to dissolved Inorganic Nitrogen). Current chemical quality is assessed to have failed due to the presence of Tributyltin Compounds. Southampton Water and the River Itchen are heavily navigated by commercial and leisure vessels which may account for the presence of this substance that is toxic to many organisms, but that is now banned (tributyltin compounds used to as an anti-fouling paint and were painted onto boats to protect them from decay). A target of achieving good potential by 2027 has been set for this waterbody. Further WFD data for this waterbody is presented in Table 13.2 below.

Table 14.2: WFD designated waterbodies

WFD classification Data	Waterbody: Southampton Water (GB520704202800)
Type	Transitional/Water
Hydromorphological designation	Heavily Modified
Surface Area	30.913km^2
Downstream Waterbody	Solent (GB650705150000) Coastal Waterbody
Protected Areas	Conservation of Wild Birds Directive, Habitats and Species Directive, Nitrates Directive, Shellfish Directive, Urban Waster Water Treatment Directive
Overall Water Body	Moderate
Ecological	Moderate
Biological Quality Elements	Good
Hydromorphological Supporting Elements	Supports Good

WFD classification Data	Waterbody: Southampton Water (GB520704202800)
Physico-chemical Quality Elements	Moderate (due to Dissolved Inorganic Nitrogen)
Specific Pollutants	High
Chemical	Fail due to Priority hazardous substances - Tributyltin Compounds

14.3.3 Water Quality

Water quality of the other watercourses discussed above is not monitored by the EA against the objectives of the WFD. Due to the urbanised nature of the catchments water quality within these watercourses is likely to be influenced by surface water runoff, road drainage, discharges from the railway, sewerage misconnections, accidental spillages and unlicensed discharges. There is likely to be a significant network of surface water sewers which discharge into the watercourses listed above, these all eventually discharge into the River Itchen, Southampton Water or the River Hamble. Due to the tidal nature of these receiving watercourses and their size, the watercourses are likely to provide adequate dilution for these pollutants.

14.3.4 Designations

The tidal mudflats on the eastern bank of the River Itchen, including those within the vicinity of the A3024 Bitterne Road West as it crosses the River Itchen, and the northern bank of the River Test have been designated as part of the Solent and Southampton Water Ramsar site, Lee-on-the-Solent to Itchen Estuary Site of Special Scientific Interest, and Solent and Southampton Water Special Protection Area.

The River Itchen, River Test and River Hamble and Southampton Water are also designated shellfish waters.

14.3.5 Surface Water Abstractions

The EA Water Abstraction Licences map indicates that there are licensed surface water abstractions within the study area. A medium size abstraction is located approximately 450m south of the A3024, closest to Sub-scheme 3 (Northam Road Rail Bridge) with water abstracted from the River Itchen. According to the EA the abstracted water is used for industrial and commercial purposes.

Although outside the study area (>1km) but worthy of note due to its downstream location from the proposed works associated with Sub-scheme 1, is a surface water abstraction licence for agriculture (spray irrigation) located at the northern end of Butlocks Heath. The abstraction is from the un-named watercourse (Watercourse E) which originates to the west of Tesco superstore at Windhover Roundabout.

14.3.6 Drainage Features

The A3024 and M27 are served by drainage gullies located within the carriageway. Details of this system, including the size/alignment of the below ground system, provision of attenuation and treatment systems, and outfall to the receiving water environment, are unknown at this stage. A drainage survey will be undertaken at a later design stage to gain further information about the highway drainage system.

In the vicinity of Junction 8 the Priority outfalls register on Highway Agency Drainage Data Management System, (HADDMS) (which records outfalls on Highways England network) records a single outfall located to the south east of the circulatory carriageway where Watercourse G emerges from culvert. This outfall is currently categorised as Low risk (in terms of pollution risk to the receiving

watercourse). This categorisation has been based upon regional datasets and has not been verified through the use of local data.

The next nearest outfalls to Sub-scheme 1 are located to the south of Junction 8. Where Watercourse G passes under the M27, parallel and on the north side of where Dodwell Road also passes over the M27, there are a cluster of four outfalls on the upstream side of the culvert under the M27 and two located on the downstream side. All of these outfalls are categorised as “Risk addressed” meaning that any previous pollution risk to watercourses has been resolved.

There are no outfalls shown on HADDMS associated with the M27 between Junction 8 and Junction 7.

14.3.7 Flood Risk

Review of the EA Flood Map for Planning (Rivers and Sea) indicates that most of the study area, including all of Sub-Schemes 1 and 5, is located within the low risk Flood Zone 1. Land within Flood Zone 1 is assessed to have an annual probability of flooding from fluvial or tidal sources of less than 1 in 1000 (<0.1%).

Land within the western extents of the proposed Sub-scheme 2 is indicated to be located within the high risk Flood Zone 3, including land immediately to the east of the River Itchen at the location of the A3024 Bitterne Road West (west of Hawkewood Road) and land immediately to the west of the River Itchen at the location of the A3024 Northam Road (east of the railway).

Sub-scheme 3 is indicated to be partially located within the medium risk Flood Zone 2 where the road crosses the railway. However, this risk appears to be associated with the railway that is located beneath the road at this located. Land located immediately to the east of Sub-Scheme 3 is indicated to be located within the high risk Flood Zone 3 as discussed above, although this is beyond the extent of the Scheme area.

Land within Flood Zone 2 is assessed to have between a 1 in 1000 (0.1%) and 1 in 100 (1%) annual probability of river flooding, or between a 1 in 1000 (0.1%) and 1 in 200 (0.5%) annual probability of flooding from the sea. Land within Flood Zone 3 is assessed to have a 1 in 100 or greater (>1%) annual probability of river flooding, or a 1 in 200 or greater (>0.5%) annual probability of flooding from the sea. The source of this flooding is considered likely to be the River Itchen, although the source and nature of this flooding will need to be confirmed in consultation with the EA.

The EA Risk of Flooding from Surface Water map identifies overland flow routes associated with the ordinary watercourses identified in earlier sections of this report. Flooding of the A3024 may occur if water within the channel of the identified watercourses exceeds the capacity of the channel and flows overland, although the risk is likely to be low. Of particular note is ponding of surface water at ground level adjacent to the Bitterne Rail Bridge, as well as ponding of surface water adjacent to the west and south of the road at Junction 8 of the M27. These areas are identified to be at high risk of surface water flooding, assessed as having a greater than 1 in 30 annual probability of flooding (>3.3%).

The EA Risk of Flooding from Surface Water map indicates that flooding from surface water could occur to the south and east of Sub-scheme 3, but the risk is largely considered to be very low risk and will not affect the A3024 which is

elevated at this location. The flooding is likely to correspond with localised topographical depressions.

Review of the EA Risk of Flooding from Reservoirs map indicates flood risk associated with the failure or breach of High Wood reservoir, although flooding is indicated to be contained within the River Itchen and is therefore considered to pose negligible risk to all sub-scheme options.

14.3.8 Summary

Table 14.3 identifies the receptors applicable to each Sub-scheme

Table 13.3 Receptors applicable to each Sub-scheme

Sub-scheme	Water Receptors
1	Watercourse E Watercourse F Watercourse G Pond B Pond C
2	River Itchen Watercourse A Watercourse B Watercourse C Watercourse D. Watercourse E
3	River Itchen Pond A
5	Watercourse A

The receptors identified in Table 13.3 have been scoped into the assessment process.

The methodology used for undertaking the assessment follows that prescribed in the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 10: HD45/09, Road Drainage and the Water Environment (referred to hereafter as HD45/09). Following this a value is assigned to each receptor based on the criteria in Table A4.3 in HD45/09. Table 13.4 presents the receptors and the value.

Table 14.4: Sensitive receptors and their value.

Receptor	Attributes	Importance
River Itchen	• Main river. Tidal through study area. • Moderate ecological quality and failure for chemical water quality (as part of Southampton Water transitional waterbody). Target to achieve good potential by 2027. • Use for non-potable water supply (one abstraction within the study area of Sub-scheme 2 and 3). • Shellfish waters. • High recreational value. • International, European and National Designations for nature conservation.	Very High (due to nature conservation designations)
Watercourse A	• Ordinary watercourses. May receive some local surface water runoff. • Watercourses A, B and C discharge to the River Itchen. • Watercourses D and E discharge to Southampton Water • Watercourses F and G discharge to the River Hamble. • Flow through urban and recreational areas. • Watercourse E supports a surface water abstraction for agricultural purposes (located downstream outside the study area).	Low
Watercourse B		
Watercourse C		
Watercourse D		
Watercourse E		
Watercourse F		
Pond A	• Unlikely to be hydrologically connected. • Potentially man-made • May receive some local surface water runoff.	Low
Pond B	• Located within Burlesdon Common, at top of catchment. and may receive some local surface water runoff. • Likely to be good water quality. • Not known to be hydrologically connected.	Low
Pond C	• Not known to be hydrologically connected. • Located within private properties (i.e. could be ornamental). • Water quality unknown.	Low

14.4 Potential impacts

The sub-scheme options have the potential to impact the water environment during construction and operation. The magnitude of potential impacts (the degree of change) may be beneficial or adverse. Potential impacts have been identified and a qualitative assessment undertaken of the magnitude of impacts on the surface water and groundwater environments.

At PCF Stage 3 the magnitude of impacts will be quantified for routine runoff and accidental spillage risk as discussed in Section 13.5.

Reasonably foreseeable effects associated with the risks of major accidents and/or disasters relevant to road drainage and the water environment are likely to relate to road traffic accidents on either the proposed Scheme or the surrounding road network (in particular the M27 motorway and A3024). For example, an accident resulting in a major fuel or oil spillage could reach a watercourse; and thus, adversely impact water quality.

If required, the FRA to be produced at PCF Stage 3, will detail the impacts relating to flood risk. Impacts relating to groundwater and the risk from contaminated land upon surface waters are presented in the Geology and Soils chapter of this EAR.

14.4.1 Construction Effects

At this stage, little is known about the existing highway drainage system including the location of outfalls from the network to watercourses but it is considered likely that any discharge from the scheme will ultimately drain to the River Itchen, Southampton Water and the River Hamble. Works associated with all sub-schemes will take place close to existing gullies or drains forming part of the existing highways drainage network, creating a pathway for pollutants to reach the watercourses. Works adjacent to watercourses will pose the greatest risk, as will major works such as demolition and construction of new structures or road/junction alignments.

During construction, there are generally two sources of pollutants; sediments and the use of polluting substances. There would be an increased pollution risk from elevated suspended solids from the mobilisation of silts and sediments which could potentially impact on the physical, chemical and microbiological water quality characteristics of receiving watercourses. Consequent impacts and heavy silt deposition could include: damage to fish gills by sediment particles; smothering of aquatic vegetation; visual changes to the watercourse; and silting.

The mobilisation of silts and sediments could occur during earthworks (i.e. regrading of embankments), the movement of heavy plant and runoff from stockpiles. There is high likelihood of silt being generated from these activities which will be greater after rainfall events when sediment can be mobilised and washed via the drainage system or directly in runoff from exposed slopes into receiving watercourses. Discharges may also emanate from poor site drainage provision, washing and cleaning activities and after rainfall events that exceed the capacity of the drainage system.

There could be a risk of localised contamination as a result of using polluting substances in the construction process for example cement, oils, lubricants, and paints. There is a risk of accidental spillage of these polluting substances or leakage from general equipment use (e.g. storage tanks, leaking valves, refuelling and inadequate storage facilities). The pollutants could directly enter watercourses or the existing highways drainage system with a higher risk of this occurring during storm events. Construction plant may also generate a diffuse source of hydrocarbons and to a lesser extent heavy metals, that could enter the drainage network or leach into the subsoil and find their way into watercourses. There would also be the risk of accidental spillage events from the movement of plant around the site.

14.4.2 Operational Effects

Highway Drainage

There are two main types of pollution from roads during the operational phase, the first from pollutants within road runoff during storms and the second from accidental spillage risk.

Road runoff

The main contaminants from road run-off include:

- fuel and other oil deposits on the road surface due to leakage;
- hydrocarbons from exhaust deposits;
- lead, copper, zinc and cadmium deposits from exhaust emissions and tyre wear;
- synthetic rubber deposits from tyre wear;
- chemicals used in windscreen washes such as detergents or de-icer;
- de-icing agents such as salt, but also potentially including trace amounts of impurities such as cyanide, metals and clays.

These pollutants when combined with rainfall can run-off into the highway drainage system and have an adverse effect on the receiving watercourses and their flora and fauna. There are a number of factors which influence both the pollutant concentrations in routine runoff and whether the runoff is likely to have an impact on the receiving water body. Site characteristics found to have some significant influence on copper and zinc concentrations were Annual Average Daily Traffic (AADT) flows and climatic region. The potential impact of pollutants on the ecology of surface waters is also dependent on the characteristics of the receiving waters, particularly its water quality, hardness, flow rate and flow velocity.

The scheme is likely to lead to an increase in traffic flow, which will increase the pollutant levels in highway drainage. This would result in a potential adverse impact on the water quality of any receiving water body. When considering road runoff, relevant pollutants and their limiting concentrations need to be identified. Discharges from roads must not lead to a deterioration in the classification status of the receiving surface water body as determined in the relevant River Basin Management Plan.

Accidental spillages

During operation, there is a risk that polluting materials may be accidentally spilt onto the road surface as a result of a road accident. The aim of the scheme, as well as reducing congestion and improving journey time reliability, is to reduce the number of accidents. This would result in a beneficial impact as a reduced number of spillages would be predicted.

Physical impacts

There will be limited physical impacts upon the watercourses within the proposed scheme extents as there will be limited works within open watercourses, but where possible these have been identified below. Due to the urban nature of the catchments the majority of watercourses are in culvert within the scheme extents.

Summary

The potential impacts of the sub-schemes on the water environment are summarised below in Table 13.5.

Table 14.5: Summary of Effects

Sub-schemes	Construction Impacts	Operational Impacts
Sub-scheme 1: M27 Junction 8 and Windhover Roundabout Upgrades	General risk from use of polluting substances and sediments entering existing highways drainage network and reaching watercourses – moderate impact without mitigation.	Routine Runoff – Yes – quantitative assessment to be undertaken at PCF Stage 3. Spillage risk – Yes – quantitative assessment to be undertaken at PCF Stage 3. Physical impacts – to be confirmed at next stage for Watercourse G and Pond B.
Sub-scheme 2: A3024 Eastern Access Corridor	General risk from use of polluting substances and sediments entering existing highways drainage network and reaching watercourses – moderate impact without mitigation.	Routine Runoff – Yes – quantitative assessment to be undertaken at PCF Stage 3. Spillage risk – Yes – quantitative assessment to be undertaken at PCF Stage 3. Physical impacts – to be confirmed at next stage
Sub-scheme 3: Northam Road Rail Bridge Replacement	General risk from use of polluting substances and sediments entering existing highways drainage network and reaching watercourses. Dilution capacity of the River Itchen anticipated to be adequate. – Impact negligible.	Routine Runoff – No further assessment required. Dilution capacity of the River Itchen anticipated to be adequate. – Impact negligible. Spillage risk – Yes – quantitative assessment to be undertaken at PCF Stage 3. Physical impacts – to be confirmed at next stage, specifically to Pond A.
Sub-scheme 5: Bitterne Bridge	General risk from use of polluting substances and sediments entering existing highways drainage network and reaching watercourses – negligible impact without mitigation due to the nature of the works. Scoped out from further assessment.	No impacts anticipated. Scoped out from further assessment.

WFD Scoping Assessment

The potential impacts of the sub-schemes have been identified and assessed upon the Southampton Water waterbody (as designated under the WFD) as part of a WFD scoping exercise. The waterbody designated under the WFD and data regarding its target status and elements are presented in section 13.4 and Table 13.2. The aim of this scoping exercise is to determine if the elements of this surface waterbody (i.e. biological, hydromorphological and chemical) are at risk as a result of the proposed scheme. Those elements identified as being at risk at this scoping stage should be taken forward for further assessment. The scoping exercise is presented in Table 13.6 below.

Table 13.6. WFD scoping Assessment for the Southampton Water Waterbody

Element	Assessment of scheme	Conclusion
Biological	The proposed scheme will have no direct impact upon the biological elements (angiosperms, fish, invertebrates, macroalgae and phytoplankton) of the waterbody as the proposed scheme is not located within the waterbody channel or its banks.	There is no risk identified as a result of the proposed scheme to the biological elements of the Southampton Water waterbody.

Element	Assessment of scheme	Conclusion
	Any changes in discharge rates (flows) from the highways drainage network into the waterbody as a result of the scheme will be minimal compared to the volume of water within the receiving watercourses at the time of the discharges. In addition, flows are also likely to require attenuation as a result of the mitigation required for flood risk.	
Hydromorphological	There are no works proposed directly to the channel of the River Itchen, River Hamble or Southampton Water which comprise this waterbody. The morphological elements of the waterbody will not be directly affected. Changes in flows can lead to indirect impacts upon the hydromorphology of a watercourse. Any changes in discharge rates (flows) into the waterbody as a result of the scheme will be minimal compared to the volume of water within the receiving watercourses at the time of the discharges and will not be significant.	No direct physical impacts are anticipated as a result of the scheme. There is no risk identified as a result of the proposed scheme to the hydromorphological elements of the Southampton Water waterbody.
Physico -Chemical	The waterbody is currently considered to be moderate for Dissolved Inorganic Nitrogen. This type of pollution does not originate from highways and thus a scheme of this nature will not impact upon Inorganic Dissolved Nitrogen levels in the waterbody. Pollution contained in routine runoff and as a result of accidental spillages can affect water quality. The River Itchen, River Hamble and Southampton Water which all form the Southampton Water waterbody are all considered to be a sufficient distance downstream from any pollution and/or have an adequate dilution capacity due to their size and tidal nature for any discharges as a result of the proposed scheme to not have an impact upon the water quality of the waterbody.	There is no risk identified as a result of the proposed scheme to the physico-chemical elements of the Southampton Water waterbody. (Note that assessments for routine runoff and accidental spillage risk are still required for non-WFD designated waterbodies as identified in Table 13.5 above).

Groundwater is described in the Geology and Soils section. The groundwater bodies within the extent of the scheme are presented in Table 13.7 below along with a scoping assessment of the scheme upon the waterbodies. The Central Hants Bracklesham Group Groundwater body (GB40702G500900) covers an area of over 248km^2 and is classified as being of Good overall status. The South East Hants Bracklesham Group (GB40702G503000) covers an area of approximately 145km^2. This groundwater body is classified as being of Poor status due to a poor classification for Chemical Dependent Surface Water Bodies.

Table 13.7. WFD scoping Assessment for the Central Hants Bracklesham Group Groundwater body (GB40702G500900) and South East Hants Bracklesham Group (GB40702G503000)

Element	Assessment of scheme	Conclusion
Quantitative Status element	Due to the nature and location of the proposed scheme there will be no impact upon groundwater flows, groundwater recharge or groundwater resources. There will be no impact upon saline intrusion and no groundwater dependent terrestrial ecosystems will be impacted by the proposed scheme.	There is no risk identified as a result of the proposed scheme to the quantitative elements of the Central Hants Bracklesham Group Groundwater body (GB40702G500900) and South East Hants Bracklesham Group (GB40702G503000) Groundwater body.

Element	Assessment of scheme	Conclusion
Chemical Status element	The chemical status of the groundwater bodies will not be impacts by the proposed scheme. Discharges to ground, where required will be via filter drains which will aim to remove pollutants. Due to the size of the groundwater bodies any impacts from the scheme upon groundwater quality will be insignificant.	There is no risk identified as a result of the proposed scheme to the chemical elements of the groundwater bodies.

The WFD scoping assessment concludes that no risk has been identified to the WFD waterbodies as a result of the proposed scheme and no further assessment in terms of compliance with the WFD is required.

14.5 Assessment methodology

HD45/09 has been used to undertake this assessment and will be used at PCF Stage 3 to undertake the quantitative assessment. HD45/09 gives guidance, which has been agreed with the EA, on the assessment and management of the impacts that road projects may have on the water environment.

A simple level assessment has been undertaken, which is largely a desk-based exercise used to determine if there is a potential for impact on the water environment. The simple level methodology outlined in HD45/09 considers impacts in the following four categories:

1. Routine runoff on surface waters (Method A (simple) and B (detailed))
2. Routine runoff on groundwater (only applicable if discharges are to be made to ground) (Method C)
3. Spillage risk (Method D)
4. Flood risk (Method E and F).

Where the simple assessment for routine runoff identifies that the proposed scheme is likely to have no impacts on the water environment, no further assessment will usually be required. Where potential impacts for routine runoff are identified, an assessment will normally be required at the detailed level (at present HD45/09 only provides a suggested detailed assessment methodology for routine runoff which would need to be agreed with the EA). For the other categories, any further assessment beyond the simple level of assessment described in HD45/09 would need to be agreed between Highways England and the EA, although the need for this is highly unlikely.

Typically for road schemes an assessment (Method A) of the potential ecological impacts of routine runoff on surface waters is required in order to determine whether there is an environmental risk and if pollution mitigation measures are needed in specific circumstances. The Highways Agency Water Risk Assessment Tool (HAWRAT) has been developed for this purpose and the methodology behind it has been derived from a collaborative research programme undertaken by the Highways Agency (HA) (now known as Highways England) and EA which investigated the effects of routine road runoff on receiving waters and their ecology. At PCF Stage 3 a routine runoff assessment will be undertaken for those sub-schemes as identified in Table 13.5.

The HAWRAT tool also has a facility to assess spillage risk (Method D) which initially estimates the risk that there will be a collision involving the spillage of a potentially polluting substance somewhere on the length of road being assessed. It then calculates the risk that the spilled pollutant will reach and impact on the receiving watercourse. These risks can conveniently be expressed as annual probabilities of such an event occurring. This allows objective decisions to be made as to their acceptability, or whether measures are needed to reduce the risk.

At PCF Stage 3 an assessment of accidental spillage risk will be undertaken for those sub-schemes as identified in Table 13.5.

HD45/09 also contains Method C for assessing the impacts of discharges to groundwater. Impacts relating to groundwater will be assessed in the Geology and Soils chapter. This methodology will only be applicable if discharges are to be made to ground. Given the urban nature of the catchment this is unlikely for Sub-schemes 2, 3 and 5. Discharges to ground for Sub-scheme 1 will need to be confirmed as the drainage design is developed.

A Flood Risk Assessment will be produced and thus it has not been necessary to undertake a Method E and Method F assessment as prescribed in HD45/09.

The results of the assessment will be used to quantify the magnitude of an impact based upon the criteria in Table A4.4 in HD45/09 which has been reproduced below as Table 13.8.

Table 14.8: Scale for recording the magnitude of predicted impact (adapted from Table A4.4 of HD45/09)

Magnitude of effect	Criteria	Examples
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute.	Surface water: • Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A) and compliance failure with EQS values (Method B). • Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D) • Loss or extensive change to a Nature Conservation Site or Fishery
Moderate Adverse	Results in effect on integrity of attribute, or loss of part attribute	Surface water: • Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A) but compliance with EQS values (Method B). • Calculated risk of pollution from spillages >1% annually and <2% annually. • Partial loss in productivity of fishery
Minor Adverse	Results in some measurable changes in attributes quality or vulnerability	Surface water: • Failure of either soluble or sediment-bound pollutants in HAWRAT. • Calculated risk of pollution from spillages >0.5% annually and <1% annually.
Negligible	Results in effect on attribute, but of insignificant magnitude to affect the use or integrity.	Surface water: • No risk identified by HAWRAT (Pass both soluble and sediment-bound pollutants) • Risk of pollution from spillages <0.5%

The magnitude of impact and the value of the receptor are then used to establish the significance of effect upon the receptor. The significance of effects is based on the combination of the importance or value of the receptor and the magnitude of impact using the matrix in Table 13.9 below, which is based on Table A4.5 in

DMRB HD45/09. Potential effects can be either beneficial or adverse. The level of significance is assigned after consideration of any proposed mitigation.

Table 14.9: Estimating the Significant of Potential Effects

Value of Receptor	**Very High**	Neutral	Moderate/Large	Large/Very Large	Very Large
	High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Slight/Moderate
		Negligible	**Minor**	**Moderate**	**Major**
		Magnitude of impact			

14.6 Assessment Assumptions and limitations

Little information is currently known regarding the capacity of the existing highway drainage system, provision of treatment or attenuation facilities, or the location of outfalls to the water environment. This will need to be investigated, most likely through CCTV drainage surveys during the design of the sub-schemes and in consultation with the relevant authorities.

Any discharges to ground as part of the Scheme will also need to be confirmed by the drainage design team.

14.7 Design, mitigation and enhancement measures

A number of standard mitigation measures should be incorporated within the design of the sub-schemes to limit their impacts at source wherever possible. Currently there is little detail on the drainage proposed however flows from additional impermeable areas will be attenuated in filter drains and oversized carrier drains. These methods of mitigation for increasing flows are due to limited space, lack of data of the existing highways drainage network and because in most locations the increase in impermeable area is relatively small. For these same reasons, it is likely that mitigation for water quality impacts will either not be deemed necessary or restrained by the urban nature of the catchments. However, for Sub-scheme 1 the increase in impermeable area is greater and due to the more rural nature of the location, presence of watercourses and increased data on the Highways drainage network the assessment at PCF Stage 3 should focus on this location and the impacts of this Sub-scheme to identify appropriate mitigation. Mitigation to be incorporated into the design will be identified through the HAWRAT assessments for routine runoff and accidental spillage risk.

Mitigation during construction will be managed through the implementation of a Construction Environmental Management Plan (CEMP). The CEMP will be prepared in alignment with Highway England guidance and include best practice measures to limit the risk of pollutants entering surface water features.

The CEMP will detail the procedures and methods that must be followed to minimise the potential environmental effects of construction activities. The CEMP will also describe the procedures to be followed in the event of an environmental emergency such as a fuel or chemical spillage.

For the most part, the implementation of a robust CEMP will be sufficient to mitigate potential risks to a residual negligible or neutral impact magnitude. Only when works are immediately adjacent to or within a watercourse will a notable residual risk be likely to remain.

Mitigation during operation should be managed through the implementation of a robust surface water drainage system. Little is currently known about the existing drainage system and further information will be required to inform the detailed design of the preferred Option at PCF Stage 3

14.8 Assessment of effects

14.8.1 Construction

Sub-Scheme 1 M27 Junction 8 and Windhover Roundabout upgrades

The impacts to Sub-scheme 1 during construction are as listed in the section above. The highest risk to the water environment will be from works within the vicinity of Watercourse G and the outfall located to the south east of Junction 8.

Sub-scheme 2 – A3024 Eastern Access Corridor

The proposed works are within the vicinity of the Watercourses A, B and C, with all three watercourses passing under the A3024 in culvert within the scheme extents. The works could therefore lead to migration of pollutants contained within overland flow to these watercourses and through the existing highways drainage network.

The proposed road widening works associated with Sub-Scheme 2 within the vicinity of the ordinary watercourses discussed above lie to the north of the carriageway and are not anticipated to require any modifications to the existing culvert that conveys the watercourse beneath the carriageway.

Sub-scheme 3 – Northam Road Rail Bridge

At their nearest point, the proposed works are located approximately 400m to the west of the River Itchen. The direct migration of pollutants from the construction site to the River Itchen (as contained within overland flow) is unlikely given the existing urban development that is present between the A3024 and the River Itchen.

The proposed works may require deep excavation and/or deep foundations to support the new bridge structures. This may require overpumping of any water which will need to be disposed of appropriately. This requirement will be investigated further in PCF Stage 3.

Sub -scheme 5 – Bitterne Rail Bridge Widening

The proposed works are located approximately 200 m north east of the River Itchen. However, the direct migration of pollutants from the construction site to the River Itchen (as contained within overland flow) is unlikely given the existing urban development that is present between the A3024 and the River Itchen.

Watercourse AA passes in culvert under the A3024 in the vicinity of Bitterne Rail Bridge and is in open channel on the south side of the road. Work adjacent to the open section of channel poses the highest risk to the watercourse.

14.8.2 Operation

Sub-Scheme 1 M27 Junction 8 and Windhover Roundabout upgrades

The proposed carriageway widening will increase the impermeable area of the road and will therefore lead to an increase in the surface water runoff that will enter the highway drainage system. The improvements are also predicted to increase traffic flows (i.e. AADT) changing the accidental spillage risk. A quantitative assessment of the potential impact that this may have on routine runoff and accidental spillage risk upon receiving watercourse, specifically Watercourse G will be undertaken at PCF Stage 3 once the detailed drainage design is complete.

At this stage, there are not anticipated to be any physical impacts to Watercourse G, Pond B or Pond C as a result of the proposed sub-scheme, however this will be confirmed at the next stage.

Sub-Scheme 2 – A3024 Eastern Access Corridor

The proposed localised carriageway widening works will increase the impermeable area of the road and will therefore lead to an increase in the surface water runoff that will enter the highway drainage system. The improvements may also increase traffic flows (i.e. AADT) changing the accidental spillage risk. A quantitative assessment of the potential impact that this may have on routine runoff and accidental spillage risk upon receiving watercourse, specifically Watercourses A, B, C and D and the River Itchen will be undertaken at PCF Stage 3 once the detailed drainage design is complete. It is proposed that a quantitative assessment will only be undertaken where the proposed scheme increases the impermeable area of a drainage catchment by 10% or more. Due to the urbanised nature of the catchments in reality this is unlikely. However, at PCF Stage 3 drainage catchments will be identified where possible and assessments undertaken where deemed appropriate.

Road widening works proposed as part of sub-scheme 2 are located within the vicinity of several watercourses that pass under the A3024, however the proposed works will not require any modifications to the existing culverts that convey watercourses beneath the carriageway. No physical impacts upon water receptors are anticipated but this will be confirmed at the next stage.

Sub-scheme 3 – Northam Road Rail Bridge Replacement

The works will increase the impermeable area of the road when compared to the existing Northam Road Rail Bridge as the works will introduce two new lanes and thus a larger area of hardstanding to the north. There will therefore be an increase in the rate and volume of surface water runoff that will enter the highway drainage system. The improvements may also increase traffic flows (i.e. AADT) and the type of road (from single to dual carriageway) changing the accidental spillage risk. Even though the replacement bridges may increase the impermeable area within the local drainage catchment by more than 10% the dilution capacity and tidal nature of the River Itchen will be more than adequate to cope with any changes in pollutant levels in the routine runoff. It is therefore not proposed to undertake a quantitative assessment for routine runoff.

There are no open channel watercourses within the vicinity of the proposed Sub-scheme so there will be no physical impacts upon watercourses. Pond A lies

outside the proposed scheme extents for this sub-scheme so no physical impacts are anticipated, however this will be confirmed at the next stage.

Sub-scheme 5 – Bitterne Bridge

Construction of a new pedestrian bridge is not considered to have any operational impacts upon the water environment and has been scoped out from further assessment.

14.8.3 Conclusion

Based upon information available at this time and the likely best practice mitigation that could be incorporated into the scheme it is anticipated that, with mitigation, there would be no significant effects upon the water environment. This position will be confirmed through the quantitative assessment of effects at PCF Stage 3. Furthermore, the HAWRAT assessment to be undertaken at PCF Stage 3 will appropriately assess the impacts in relation to water quality. this will determine the magnitude of impacts and inform the need, extent and type of mitigation for the scheme, if required

The WFD scoping assessment undertaken has determined that there is no impact upon WFD water bodies as a result of the scheme and no further compliance assessment is required.

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15. Climate

15.1 Legislative and policy framework

15.1.1 International Level

The Intergovernmental Panel on Climate Change (IPPC, 2013) states that "Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions" (pg.17). Greenhouse gas emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any greenhouse gas emissions or reduction from a project should be considered. All new embodied carbon emissions[104], arising from the use and consumption of material resources, are also likely to contribute to a significant negative environmental effect.

In 1997, the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCC) was adopted as a means to provide legally binding limits on carbon emissions for 37 countries, which includes the United Kingdom (UK). The Protocol committed to reduce carbon emissions by an average of 5% below the 1990 levels during the first commitment period between 2008 and 2012; and by at least 18% below the 1990 levels during the second commitment period between 2013 and 2020.

In December 2015, the Paris Agreement, a global climate agreement, was adopted. The Agreement was ratified and entered into force in November 2016. The central aim of the Agreement is to strengthen the global response to climate change by limiting the global temperature increases, through setting a target of net zero global carbon emissions in the second half of this century.

15.1.2 National Level

Under the Kyoto Protocol's second commitment period (2013 – 2020), the collective European Union (EU) set a target to reduce carbon emissions by 20% relative to the 1990 levels. In 2014, the EU agreed collectively to reduce carbon emissions by at least 40% by 2030 compared to 1990 levels. This commitment was reaffirmed in the EU's Nationally Determined Contribution submitted as part of the Paris Agreement.

The Climate Change Act 2008

The Climate Change Act 2008 established a framework for the United Kingdom to achieve its long-term goals of reducing carbon emissions by at least 80% by 2050 relative to 1990 levels. An interim target of a 34% reduction from 1990 levels by 2020. To ensure that regular progress is made, the Climate Change Act 2008 established a system of carbon budgets.

[104] The embodied carbon dioxide emissions of a material are the total carbon dioxide equivalent emissions released prior to leaving the factory gate. This would normally include extraction or harvesting, the manufacturing process and any pre-distribution transportation. However, it does not include the carbon dioxide emissions associated with transport from the factory gate to site, construction activities, maintenance or decommissioning. This boundary condition is known as 'cradle-to-gate'.

The first three carbon budgets in the UK were announced in April 2009, covering the periods 2008–2012, 2013–2017 and 2018–2022. The budgets require emissions reductions of 23%, 29% and 35% respectively, below 1990 levels. In June 2011, the fourth Carbon Budget was announced, amounting to an emission cut of 50% on 1990 levels over the years 2023-2027. Therefore, it is important that impacts from transport schemes on greenhouse gas emissions are carefully considered.

National Adaptation Programme

The Climate Change Risk Assessment is a five-yearly assessment of all major risks and opportunities from Climate Change within the UK. The most recent assessment, published in 2016 outlined the main risks associated with Climate Change in the UK as the following six key areas:

- Flooding and coastal change risks to communities, businesses and infrastructure.
- Risks to health, well-being and productivity from higher temperatures.
- Risks of water deficits in public water supply, and for agriculture, energy generation and industry, with impacts on freshwater ecology.
- Risks to natural capital, including soils, coastal, marine and freshwater ecosystems, and biodiversity.
- Risks from climate-related impacts on domestic and international food production and trade.
- New and emerging pests and diseases, and non-native species, affecting people, plants and animals.

The National Adaptation Programme is the Government's strategy to address the main risks and opportunities identified in the risk assessment. The programme focuses on raising awareness of the need for climate change adaptation, increasing resilience to current climate extremes, taking timely action for long-lead time measures, and addressing major evidence gaps.

National Planning Statement for National Networks (NPSNN)

The information presented in the NPSNN Statements 5.16 - 5.19 relate to the Governments legally binding framework to cut greenhouse gas emission by at least 80% by 2050. Although impacts of road developments on aggregate levels of emissions is likely to be small, carbon impacts must be considered as part of the appraisal of scheme options.

In paragraph 5.17, it is stated that "it is very unlikely that the impact of a road project will, in isolation, affect the ability of Government to meet its carbon reduction plan targets. However, for road projects applicants should provide evidence of the carbon impact of the project and an assessment against the Government's carbon budgets."

The NPSNN further states in Statement 5.18 that "…any increase in carbon emissions is not a reason to refuse development consent, unless the increase in carbon emissions resulting from the proposed Option are so significant that it would have a material impact on the ability of Government to meet its carbon reduction targets"

National Planning Policy Framework (NPPF)

The NPPF was published in March 2012 setting out the Government's planning policies for England. In paragraphs 109 – 125 the Framework states that: *"The planning system should contribute to and enhance the natural and local environment by: preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability".* There are national and local policies for the management, mitigation and adaptation to climate change.

The Framework prioritises addressing climate change impacts in the planning and decision-making process for major transport infrastructure projects and provides guidance on climate change allowances to be used in flood risk assessment. The Framework identifies how new developments must make allowances for climate change impacts to ensure no increased risk is placed on people and property.

Local Climate Change Management

As a means to monitor and promote the reduction of greenhouse gas emissions across the United Kingdom, in July 2011, the Department of Energy and Climate Change (DECC), now part of the Department of Business, Energy & Industrial Strategy (BEIS) requested Local Authorities to report greenhouse gas emissions from their own estates and services using a standard methodology and format, in line with the United Kingdom Government environmental reporting guidance.

15.2 Study area

The scheme is located within the administrative boundary of Hampshire County Council. Due to the transport system being trans-boundary and being highly interconnected, climate impacts, in one section of a network, could have knock-on effects throughout a region. Therefore, this Climate assessment, associated with the scheme, has been undertaken at a regional level, highlighting key local level impacts where applicable.

15.3 Baseline conditions

15.3.1 Climate

Current Baseline

The area of Southampton is classified according to the Köppen Climate Classification subtype for this climate is "Cfb". (Marine West Coast Climate), which is characterised by equable climates with few extremes in temperature and constant precipitation through all months in the year.

The UKCP09 platform presents the future climate projections within the UK. The aim of the platform is to provide information across the UK to possible climate changes that can be expected in the future. UKCP18 is currently underway to update the UKCP09 projections. UKCP18 is planned to be released in May 2018.

The baseline period, 1981 – 2010, adopted in the UKCP09, was downloaded from the Met Office gridded observational data which has been used to obtain current baseline climate metrics at a spatial resolution of 25 km^2. The period 1981–2010

has been used to assess and identify possible trends in historical data. At the time of this assessment, these are the most up to date datasets and time periods available.

The current climate and extreme weather events experienced in the region (based on the data obtained for Southampton using the Met Office gridded baseline data for average conditions and UKCP09 Weather Generator simulated baseline data for extreme weather events) is summarised as follows:

- Annual average temperature is approximately 11.4°C and ranges from an average minimum and maximum temperature of 7.7 to 15.1°C.
- An average annual Precipitation received for the area is 788 mm, with approximately 122 days in the year receiving precipitation.

Future Baseline

- This section provides a comparison between the current climate (described in the previous section) and the projected future conditions in and around the Southampton area. Due to uncertainties in predicting exactly how much greenhouse gas emissions will be generated in the future, three future greenhouse gas emission scenarios (Low, Medium and High) have been developed. The scenarios are based on different assumptions relating to socio-economic development and technological change, developed by the IPCC.
- Table 15.1 presents the projected climate changes for each emission scenario and for each 30-year period for south-eastern England, obtained from the UKCP09 projections for the 2020s, 2050s and 2080s.

Table 15.1: Future Climate Projections

Description	2020s (2010 – 2039)			2050s (2040 – 2069)			2080s (2070 – 2099)		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
Winter mean temperature	+1.3 °C	+1.3 °C	+1.4 °C	+2 °C	+2.2 °C	+2.5 °C	+2.6 °C	+3 °C	+3.7 °C
Summer mean temperature	+1.7 °C	+1.6 °C	+1.5 °C	+2.6 °C	+2.8 °C	+3.1 °C	+3 °C	+3.9 °C	+4.9 °C
Summer mean daily maximum temperature	+2.2 °C	+2.1 °C	+2 °C	+3.5 °C	+3.7 °C	+4.3 °C	+4.1 °C	+5.3 °C	+6.7 °C
Summer mean daily minimum temperature	+1.8 °C	+1.7 °C	+1.7 °C	+2.7 °C	+3 °C	+3.4 °C	+3.3 °C	+4.2 °C	+5.4 °C
Annual mean precipitation	+1%	+0%	+0%	+0%	+0%	+0%	+2%	+1%	+1%
Winter mean precipitation	+7%	+6%	+7%	+13%	+16%	+19%	+18%	+22%	+30%
Summer mean precipitation	-7%	-8%	-4%	-14%	-19%	-19%	-15%	-23%	-29%

- Projections into the 2020s, 2050s and 2080s, for Low, Medium and High emission scenarios, indicate an increase in temperatures and precipitation within the south-east England region. Changes in temperatures indicate increases between 1.3 and 6.7 ˚C. Precipitation trends show that winter precipitation will increase by up to 30% during winter months, while rains will decrease during summer months, ranging between -4 to -29%.
- It is important to take account of the uncertainty associated with the selected climate projections. After the 2040s the projections for different emissions scenarios increasingly diverge and it is therefore recommended to use the Medium scenario for future stages of the assessment.

15.3.2 Carbon Dioxide

The National Atmospheric Emissions Inventory (NAEI) provides an inventory of all emissions across the UK. As presented on the NAEI system, Table 15.2 represents the total sector contributions to the Carbon Dioxide emissions within the Southampton, Eastleigh and Test Valley areas. As indicated in Table 15.2, road transportation contributed to 29.5%, 45.5% and 47.6% to 2015 CO_2 emissions in the Southampton, Eastleigh and Test Valley areas respectively.

Table 15.2: Sector Contributions to 2015 Carbon Dioxide levels (kt)

Sector Name	Southampton	Eastleigh	Test Valley
	CO_2 (kt)		
Industry & Commercial Electricity	191	116	128
Industry & Commercial Gas	95	30	43
Large Industrial Installations	0	0	2
Industrial & Commercial Other Fuels	29	18	63
Agricultural Combustion	0	1	17
Domestic Electricity	137	71	82
Domestic Gas	165	114	87
Domestic Other Fuels	6	5	43
Road Transport (A roads)	98	33	193
Road Transport (Motorways)	20	150	116
Road Transport (Minor roads)	131	81	97
Diesel Railways	1	10	10
Transport Other	4	7	2
LULUCF Net Emissions	-3	-3	1
Total for all sectors	**874**	**633**	**883**

Greenhouse Gas Emissions Reporting

BEIS requires Local Authorities to report greenhouse gas emissions. Both the Southampton City Council (SCC) and Eastleigh Bough Council (EBC) within the Hampshire County Council regularly review, assess and report greenhouse gas emissions resulting from their estates and services.

Under the SCC Carbon Reduction Policy, SCC have set a target of reducing CO_2 emissions from gas and electricity by 40% by 2020 (against a 2011 baseline). The latest available report (2015/2016) for SCC indicated a reduction of approximately

7% of carbon dioxide equivalent (tCO_2e) between the 2012/2013 and the reporting period. This reduction is largely attributed to a reduction in street lighting electricity.

EBC set a target of reducing their nett greenhouse gas emissions from its operations by 50% by 2020 (against a 2007 baseline). In the latest report (2016/2017), EBC denote a 27% reduction in net emissions (tCO_2e) from 2007/2008. This reduction is attributed to a reduction in heating oil usage, the decarbonisation of the electricity supply, a reduction in energy usage for street lighting and a reduction in business travel.

15.4 Potential Impacts

Greenhouse gases released through direct fuel consumption and/or consumption of supplied electricity during the construction and operational phase of the scheme has the potential to contribute to greenhouse gas emissions and therefore potentially impact on Climate and the Government's ability to meet their legally binding greenhouse gas reduction targets.

Future changes in climate conditions, including increased maximum temperatures, increased rainfall during winter months, and increased frequencies of extreme events, which could also affect the resilience and vulnerability of the scheme.

15.5 Assessment Methodology

Due to the transport system being trans-boundary and being highly interconnected, this assessment has been undertaken at a regional level, highlighting key local level impacts where applicable. As noted in the Institute of Environmental Management and Assessment (IEMA) Environmental Impact Assessment Guide to Climate Change Resilience and Adaptation (2015) the consideration of Climate Change into an Environmental Impact Assessment should consider the future projected climate, an assessment of the impacts of the scheme on climate change and the vulnerability of environmental receptors to climate factors, and the impacts relevant to adaptation.

In considering the elements of climate, professional judgements have been used to provide a qualitative description of the nature of impacts and, where appropriate, to describe the predicted change that the scheme will introduce in comparison to the baseline conditions.

15.5.1 Effects of the Scheme on Climate

In line with TAG Unit A3 Environmental Impact Appraisal (DfT, 2015). Chapter 4 Greenhouse Gases; and PAS 2080: 2016 Carbon management in infrastructure, the assessment of the effects of the scheme on climate will include:

- Identification and assessment of greenhouse gases, and any other significant carbon emission which will occur throughout the lifecycle of the project, their relative scale, in relation to the baseline and in comparison, to the UK emission predictions; and
- Identification of opportunities for mitigation.

15.5.2 Vulnerability of the Scheme to Climate Change

As presented in the IEMA 2015 guideline, the assessment of the vulnerability of the scheme to climate change will identify and assess the rate of climate change, highlighting out the potential extent of disruption which may occur throughout the lifecycle of the project.

Receptor Vulnerability

According to IEMA (2015), three levels of sensitivity can be used to describe the receptor vulnerability to climate change. These include:

- High vulnerability – the receptor is directly dependent on existing and/or prevailing climatic factors, and reliant on these specific existing climate conditions continuing

in future (e.g. river flows and groundwater level); or only able to tolerate a very limited variation in climate conditions.

- Moderate vulnerability – the receptor is dependent on some climatic factors, but able to tolerate a range of conditions (e.g. a species which has a wide geographic range across the entire UK, but is not found in southern Spain)
- Low vulnerability – climatic factors have little influence on receptors (therefore, consider whether it is justifiable to assess such receptors further within the context of EIA – i.e. it is likely that such issues will have been excluded in scoping process).

15.6 Assessment Assumptions and Limitations

Due to the uncertainties that exist around the subject of Climate Change, there are limitations associated with predicting the impacts of Climate Change into the future, including:

- uncertainty around climate change projections;
- limited methodological guidance on how a climate change assessment should be carried out; and
- there is limited evidence relating to climate change impacts on infrastructure and assets.

15.7 Design, Mitigation and Enhancement

The IPCC Fifth Assessment Synthesis Report (2015) states that mitigation (i.e. reducing carbon emissions) and adaptation (i.e. responding to climate change impacts) are complementary approaches to reducing the risks associated with climate change over different timescales.

The resilience of the scheme will be determined by how the scheme design will account for the projected impacts associated with climate changes (in accordance with NPSNN para 4.40 and the Infrastructure Planning (EIA) Regulations 2017).

Mitigation in the short and medium-term can substantially reduce climate change impacts in the future. Benefits from adaptation however can be realised in the present and can aid in addressing future emerging risks associated with climate change. Innovation and investments in infrastructure and technology can both reduce carbon emissions and enhance resilience to climate change.

In line with the United Kingdom’s commitment to achieving 80% reduction in greenhouse gas emissions by 2050, Highways England aim at reducing their emissions, carbon footprint, and actively managing carbon emissions. As presented in the Highways England Sustainable development strategy, Highways England aims at becoming more resilient to future changes in climate by:

- Investing for the long term to reduce the risk of increased future costs through design, construction, operation and maintenance to improve resilience to climate change effects.
- Embedding adaptation into the organisation by making use of materials and procedures which will be more sustainable in the future.

- Managing and maintaining the transport network with increased efficiency as a means to create an opportunity for reinvestment which in turn will better support economic growth.
- Maximising the benefits of stakeholder engagement, ensuring mutual understanding and goal is reached.

During the detailed design stage of the scheme, climate consideration will be given as per the Environmental Agency requirements. Opportunities to reduce surface water flood risk will be considered, in the form of the provision of adequate and appropriate drainage. This is particularly relevant with respect to Sub-schemes where areas have been identified that are at high risk of surface water flooding (Sub-Schemes 1 and 3).

Furthermore, as highlighted in Chapter 10 - *Materials*, simple carbon footprinting techniques should be used to identify opportunities to avoid, reduce, or substitute carbon emissions related to the scheme (e.g. through the exploration of alternative material specifications).

15.8 Assessment of effects

This assessment, has been undertaken at a regional level, highlighting key local level impacts where applicable.

15.8.1 Effects of the Scheme on Climate

Both Appraisal Option 1 and Appraisal Option 2 are likely to lead to a net increase in vehicle kilometres travelled across the wider road network due to both the scheme and traffic growth in the area, which is likely to increase CO_2 emissions along the affected road network. This has the potential to result in an increase in greenhouse gas emissions in the area.

In the IEMA 'Guide to assessing greenhouse gas emissions and evaluating their significance (2017)', it is noted that greenhouse gas emissions from all projects contribute to climate change. The consequence of a changing climate has the potential to have knock-on environmental effects, therefore any greenhouse gas emissions or reductions from a project may be considered to be significant."

Greenhouse gases assessment

In principle, all greenhouse gas emissions should be considered when assessing the impact of a scheme. These include emissions resulting from the production of materials used in any infrastructure (known as embedded carbon), as well as those resulting from changes to the use of transport fuels.

Although carbon dioxide ($CO_{2)}$ has a relatively low global warming potential compared to other greenhouse gases, it is the most abundant contributor. Therefore, the global warming potential of greenhouse gas emissions is measured in terms of the equivalent amount of CO_2 (referred as CO_2e) that would give rise to global warming.

Based on the guidance under TAG Unit A3 Environmental Impact Appraisal (2015), the net present value of change in CO_2e emissions from road-based fuel consumption was calculated by the project's traffic consultants (WSP) using the Transport User Benefits Appraisal (TUBA) program for the south-eastern region of

the UK. TUBA estimates fuel consumption based on the average speed for an entire journey.

The CO_2e emissions are split by traded and non-traded sectors, for Do-Minimum and Do-Something scenarios. The non-traded sector refers to petrol, diesel and gas oil emissions, where the traded sector considers the use of transport fuel within the traded sector (i.e. in the production of electricity).

Table 15.3 presents the TUBA calculated total emissions of CO_2e for the Do-Minimum and Do-Something scenarios for Appraisal Options 1 and 2 in the traded and non-traded sectors for the opening year (2019).

Table 15.3: TUBA calculated tonnes of CO_2e for Appraisal Option 1 and 2

Sector	Tonnes of CO_2e		
	Do-Minimum	Do-Something	Difference (DS-DM)
Appraisal Option 1			
Non-traded Sector	83,967,188	83,921,395	-45,793
Traded Sector	536,648	536,490	-159
Appraisal Option 2			
Non-traded Sector	18,339,265	18,337,169	-2,096
Traded Sector	117,209	117,200	-10

As presented in Table 15.3 both Appraisal Option 1 and 2 are anticipated to have a nett positive impact on greenhouse gas emissions in the area (i.e. a reduction of CO_2e emissions). The third carbon budget for the 2018-2022 budgetary period is 2,544,000,000 CO_2e. Appraisal Option 1is anticipated to contribute to a 0.0180% and Appraisal Option 2 is anticipated to contribute 0.0001% () improvement in terms of CO_2e within the region. The impact of the scheme on climate is therefore considered to be negligible.

Mitigation Opportunities

Climate change mitigation refers to efforts to reduce or prevent the emission of greenhouse gases. Mitigation therefore relies on the use of new technologies and renewable energies.

15.8.2 Vulnerability of the Scheme to Climate Change

Receptors and project vulnerability

According to IEMA (2015), receptors are described as either highly sensitive, moderately sensitive or having a low sensitivity to climate change factors. Within the study area receptors include both residential areas and key ecological areas.

- The trends highlighted in the Future Climate Baseline section indicate the possibility of increased extreme weather conditions that could be experienced within the region, including the possibility of an average increase of 2.5 °C in temperature, increased of rainfall during winter (i.e. flood events) and a decrease rainfall during summer(i.e. droughts).
- Identified receptors are classified as moderately sensitive as they are expected to be affected by changes in climate however, are not considered to be dependent on specific climate conditions. In fact, identified receptors in the study area are

currently subjected to a wide range of climatic variability throughout the year and are therefore not expected to be highly vulnerable to future climate projections presented in Table 14.1.

- During Stage 3 of the assessment, possible climate change impacts on individual receptor groups, where applicable, should be considered.

15.8.3 Summary

Both Appraisal Option 1 and 2 are anticipated to result in a small reduction of CO_2e emissions within the region. The impact of both Appraisal Options on climate is therefore considered to be negligible.

Both Appraisal Option 1 and 2 are potentially vulnerable to the effects of a changing climate, however this is not considered to be significant, as the sensitivity of receptors is considered to be moderate and the resilience of the scheme to projected climate changes will be built into the detailed design as per the requirements of the Environmental Agency throughout the life cycle of the project.

15.9 References

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Highways England (2017) Sustainable development Strategy (Our approach), accessed at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/605079/Sustainable_Development_Strategy_6.pdf on 19 October 2017

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16. Part 6: Assessment of Cumulative Effects

16.1 Cumulative assessment methodology

16.1.1 Introduction

Cumulative impacts result from multiple actions on receptors and resources and over time are generally additive or interactive (synergistic) in nature. Cumulative impacts can also be considered as impacts resulting from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. (Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interaction, European Commission May 1999). DMRB Volume 11, Section 2, Part 5 HA 205/08, 1.53-1.60 interprets "*reasonably foreseeable*" as including other projects if they are "*committed*".

Cumulative impacts arising from a single project are caused by the combined action of a number of different environmental topic-specific impacts on an individual receptor or resource. It is considered that there is potential for individual receptors to experience impacts from different topics; for example, properties close to the A3024 could experience perceptible increases in noise levels, worsening of air quality and increased visual impact. Therefore, further assessment is appropriate.

Cumulative impacts may also arise due to other projects in combination with the proposed scheme. The traffic model includes committed future development and hence the air quality and noise assessments already incorporate the cumulative effects of other projects into their assessments as reported in earlier chapters.

16.1.2 Study area

The spatial scope of the cumulative effects assessment is taken to be the geographical extent of the traffic model in so far as that incorporates other committed development with the potential to generate future traffic growth, and the potential physical extent of the Appraisal Options being considered together with a 500m study area surrounding the Scheme. The 500 m study area was determined with consideration to:

- the spatial extent of the environmental receptors identified with the potential to experience an impact from the Appraisal Options; and
- the likely availability of relevant baseline data.

16.1.3 Methodology

There are two types of cumulative impact:

- Cumulative impacts resulting from a single project on individual receptors / resources; and
- Cumulative impacts from different projects, in combination with the project being assessed, on individual receptors / resources.

There are therefore two assessments of cumulative effects, one for each 'Type of effect':

- 'Type 1' - Where different environmental impacts are acting on one receptor, but are the result of the proposed Scheme; and
- 'Type 2' - Where environmental impacts are acting on one receptor, but are the result of multiple projects in combination (including the proposed Scheme being assessed).

The assessment of Type 1 cumulative impacts identifies the specific receptors that would experience a number of different impacts from the construction and operational stages of the Scheme. The significance of potential cumulative impact is described, but is not assigned an overall significance level at this stage of the assessment.

The assessment of Type 2 cumulative impacts involves identifying other projects likely to be developed or under development at the same time as the proposed Scheme; and assessing the additional impact of these projects on sensitive receptors identified as experiencing a likely significant impact as a result of the preferred Scheme. This includes impacts during both construction and operation.

A review of the planning portals for Southampton City and Easterly Borough Councils has found the following developments which may contribute to the impacts of the proposed Scheme (Table 15-1).

Table 15.1 – Other projects likely to be developed or under development at the same time as the proposed Scheme

Application Reference (status)	Location	Description	Distance from	
			Appraisal Option 1	Appraisal Option 2
Planning Authority: Southampton City Council				
17/01238/FUL (awaiting decision) Related to - 14/01747/OUT (approved)	Meridian broadcasting, Radcliffe Road, Southampton	Erection of 255 dwellings within buildings ranging in height from 4-storeys to 10-storeys and offices (class B1, 108 sq.m floorspace) with associated car parking (255 residential and 7 visitor), landscaping, extension of the local park to the waterfront and a new waterfront walkway associated with flood defence measures. On the basis there is no supporting Environmental Statement we assume this scheme to be screened **'non EIA' development**[105]	Adjacent in parts to Sub Scheme 3. To the north and south of the A3024 to the west of Northam Road Rail Bridge.	More than 500 m
16/01699/R3CFL Approved with conditions (20th Jun 2017)	West Bank of The River Itchen from Mount Pleasant Industrial Estate to Southampton Water Activities Centre.	Provision of raised tidal flood risk management infrastructure along 3.2 km of the 4 km frontage of the west bank of the River Itchen from Mount Pleasant Industrial Estate to Southampton Water Activities Centre including new and replacement river walls and flood gates. **'EIA' development**	Adjacent in parts, to Sub Scheme 3 To the east of the A3024 on the west side of Northam Road Rail Bridge	More than 500 m
17/01579/FUL	30-32 Bursledon Road Southampton SO19 7NN	Creation of a four-storey development consisting of 34 retirement apartments (23 x one bed and 11 x two bed) with associated community facilities, access, parking and landscaping. On the basis there is no supporting Environmental Statement we assume this scheme to be screened	Directly to the south of Sub- scheme 2 - A3024 (within 10 m)	More than 500 m

105 Section 3.3, Page 7 of the Planning Policy Statement submitted in support of application 14/01747/OUT) states "*Screening Opinion under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011. Opinion (August 2013) that an Environmental Statement is not required based on a proposal of approx 250 dwellings, approx 400m2 commercial floorspace and approx 370 car parking spaces"* Meridian Gardens; Former Meridian TV Studios Site Southampton, Planning Policy Statement for Inland Homes (20/10/2014) available on line at: https://planningpublicaccess.southampton.gov.uk/online-applications/files/9EF861CC84CCBC884FA09FEAF99DEE18/pdf/14_01747_OUT-Planning_Statement-553784.pdf

Application Reference (status)	Location	Description	Distance from	
			Appraisal Option 1	Appraisal Option 2
		'non EIA' development		
Planning Authority: Eastleigh Borough Council				
F/15/76084 (Decided permit)	Land off St John's south of Ford Road, Hedge End, Southampton, SO30 4DG	Construction of 109 dwellings with new link road, new vehicular access off St John's Road, pedestrian and cycle links through Greenfield close, drainage, landscaping, parking and public open space consolidation of planning approvals O/13/73700 & R/14/75594. On the basis there is no supporting Environmental Statement we assume this scheme to be screened **'non EIA' development.**	450-500 m to the north of Sub Scheme 1 (specifically Junction 8 of M27)	
F/17/81809 (awaiting decision) (	Land between St John's Road and Dodwell Lane, Southampton, SO31 1DH.	Construction of a link road between St John's Road and Dodwell Lane (Phase 3 of planning permission O/13/73700). On the basis there is no supporting Environmental Statement we assume this scheme to be screened **'non EIA' development.**	Adjacent to parts of Sub Scheme 1 (specifically Junction 8 of M27)	

The main expected cumulative impacts from other projects with the Scheme are considered likely to be from incremental habitat loss, as well as changes to the flows of traffic, and the associated environmental impacts on noise and air quality. The effects on noise and air quality are, to an extent, already considered as the traffic modelling includes a reasonable allowance for future growth. Thus, it is considered that future development is already considered within the assessments undertaken for topics that use the traffic modelling i.e. Chapter 5 - *Air Quality* and Chapter 11 – *Noise and Vibration*.

Noise is the only technical assessment that has, at PCF Stage 2, identified significant effects (the magnitude of this effect is to be revisited at PCF Stage 3); and these impacts are only associated with Appraisal Option 1. With the exception of Application 16/01699/R3CFL, which is anticipated to be constructed by the end of 2021 and is not predicted to result in any significant noise impacts[106], none of the identified 'other' developments has been predicted to give rise to 'significant' environmental impacts, therefore the cumulative effects assessment provided in this EAR focuses on potential cumulative impacts associated with the Scheme Options (Type 1), rather than examining cumulative impacts as a result of other projects (Type 2).

The cumulative effects assessment should reviewed at PCF Stage 3 when a preferred option is selected. Further details on applicable 'other' developments can then be sought in order to carry the Type 2 assessment where necessary.

Traffic modelling

Traffic modelling includes the identification of other projects which may generate significant volumes of traffic in future years in addition to assumptions about the general rate of growth of traffic. These other projects may be identified from major projects being developed by Highways England, nationally significant infrastructure projects identified on the Planning Inspectorate's website, projects which have been approved through the local authority's planning system, and development proposals identified in Local Plans.

Land use for the core traffic modelling scenarios is a combination of data for spatially focussed developments, plus, where necessary, 'intensification' of existing areas to ensure growth projection can be met. Where sites have been identified within adopted Local Plans the locations and anticipated build-out profile are included within the Strategy Regional Transport Model (SRTM). In later model years, and particularly those beyond Local Plan periods, the model includes a process referred to as 'intensification'. This enables continued growth to be represented within existing developed areas to allow projections to be met. Intensification is limited to those areas where development already exists because it is not considered appropriate for the model to arbitrarily allocate development to undeveloped areas.

16.2 Assessment of 'Type 1' cumulative effects

[106] Environmental Statement – Non- technical Summary River Itchen Flood Alleviation Scheme, (AECOM, September 2016)

A high-level assessment of potential cumulative effects on receptor 'categories' has been undertaken. A more detailed assessment of cumulative effects on individual receptors should be undertaken in PCF 3.

16.2.1 Effects on protected species

There is some potential for protected species to be subject to the same disturbance effects as habitats and local residences. They may be subject to adverse impacts associated with construction works including impacts resulting from dust, noise, vibration and traffic. There is also potential for protected species to be affected during operation of the Scheme as a result of increased noise, light and movement along the Scheme corridor. In addition, the same protected species may be impacted as a result of any loss of habitat that might be associated with road widening and realignment.

The extent of cumulative impacts on protected species is difficult to quantify at this stage as no species-specific surveys have been undertaken; and the preferred option has not been selected and design refined. Therefore, the assessment will be revisited following the completion of the appropriate protected species surveys (to be undertaken at PCF Stage 3); selection of the preferred option and refinement of the design.

16.2.2 Effects on habitats

There is some potential for habitats to be subject to the same disturbance effects as protected species. Habitats within the study area may be subject to adverse impacts associated with dust, noise, vibration and traffic during construction and noise, light and movement during operation. In addition, the same type of habitat may be impacted as a result of land take that might be required for road widening and realignment.

The extent of cumulative impacts on habitats is difficult to quantify at this stage as the exact working areas of the Scheme are not yet finalized (they will be refined and minimised during detailed design at PCF Stage 3). Therefore, the assessment will be revisited following the completion of the appropriate protected species surveys (to be undertaken at PCF Stage 3); selection of the preferred option and refinement of the design.

16.2.3 Effects on people (including human health) and local communities

Occupiers of residences close to the Scheme are likely to experience disturbance impacts associated with several environmental disciplines. During the construction phase, there is likely to be some nuisance cause by dust, noise, vibration, traffic and visual impacts.

These impacts will vary depending upon the location of the receptor and the area of works at any given time. For example, residential properties (and thus their occupants) near to Northam Road Rail Bridge (Sub-scheme 3) are unlikely to be affected during construction works at Windhover Roundabout (Sub-scheme 1). However, they are likely to be affected during construction works associated with the western end of Sub-scheme 2: A3024 corridor.

Disturbance from construction traffic and noise potentially extends to communities and travellers along connecting transport routes. During PCF Stage 3 the extent of the routes affected should be identified.

The disturbance associated with the construction of Sub-schemes 2 and 3 is likely to take place over a longer period of time (24 months) compared to Sub-scheme 1 (9-12 months), due to the scale of works and the works proposed. The larger scale of Sub-scheme 3 means that the construction phase will be longer, prolonging nuisance effects experienced by local sensitive receptors. Sub -scheme 5, which involves smaller scale construction works, is generally expected to have the lowest disturbance effects on people and local communities during the construction phase, however it is considered likely that these works will, in reality be undertaken in parallel with Sub-scheme 2 works.

During operation, the Scheme will improve traffic flows; and provide enhanced NMU facilities. Access to community facilities may be improved through a reduction in congestion and queuing times and through facilities being more accessible to non-car modes of transport. Improved NMU facilities as a combined result of all sub-schemes may encourage more journeys to be taken by active travel modes (walking, cycling), this would potentially result in cumulative beneficial effects on the health of residents.

16.3 Difficulties encountered

The traffic forecasts include an allowance for committed development where sites have been identified within adopted Local Plans. Any ‘windfall sites’ i.e. those not included in the Local Plans of SCC or EBC may not have been allowed for in the traffic projections. At the time of preparing this assessment details of the individual sites included within the traffic model were not available to the project team.

16.4 Conclusions

The status of proposed developments to be considered within the cumulative effects assessment should be monitored to ensure that all “committed" developments are considered in the cumulative effects assessment at PCF Stage 3.

Consultation should be undertaken with Southampton City Council and Eastleigh Borough Council to ensure that a full list of committed developments are included within the PCF Stage 3 assessment.

Since the developments of which the project team are currently aware are already incorporated in the baseline traffic data it is not anticipated that there would be cumulative impacts, with respect to traffic-related topics.

17. Part 8: Glossary

AADT	Annual Average Daily Traffic
AAWT	Annual Average Weekday Traffic
ALC	Agricultural Land Classification
APIS	Air Pollution Information System
AQS	Air Quality Strategy
AQMA	Air Quality Management Area
ARN	Affected Road Network
ASC	Asset Support Contract
ASR	Appraisal Summary Report
BGS	British Geological Survey
BNL	Basic Noise Level
BMV	Best and Most Versatile
BPM	Best Practice Measures
BTO	British Trust for Ornithology
CA	Character Areas
CAZ	Clean Air Zone
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CIfA	Chartered Institute for Archaeologists
CoPA	Control of Pollution Act
CRTN	Calculation of Road Traffic Noise
CSM	Conceptual Site Model
dB	Decibel
Defra	Department for Environment, Food and Rural Affairs
DM	Do-Minimum
DMRB	Design Manual for Roads and Bridges
DPO	Development Consent Order
ESR	Environmental Study Report
EU	European Union
FRA	Flood Risk Assessment
GLVIA	Guidelines for Landscape and Visual Impact Assessment
HADDMS	Highways Agency Drainage Data Management System
HAWRAT	Highways Agency Water Risk Assessment Tool
HBIC	Hampshire Biodiversity Information Centre
HCC	Hampshire County Council

HE	Highways England
HDV	Heavy Duty Vehicle
HGV	Heavy Goods Vehicle
HMSO	Her Majesty's Stationary Office
HPI	Habitats of Principal Importance
HRA	Habitats Regulations Assessment
IAN	Interim Advice Note
IAQM	Institute for Air Quality Management
IEF	Important Ecological Features
IT	Interim Target
LAAI	Local Areas of Archaeological Importance
LAAP	Local Areas of Archaeological Potential
LAQM	Local Air Quality Management
LLFA	Lead Local Flood Authority
LOAEL	Lowest Observed Adverse Effect Level
LTT	Long Term Trend
LNR	Local Nature Reserves
LNS	Low Noise Surface
ML	Measurement Location
MPI	Major Projects Instruction
MoRPHE	Management of Research Projects in the Historic Environment
NCA	National Character Area
NGO	Non-governmental organization
NGR	National Grid Reference
NIA	Noise important area
NIR	Noise Insulation Regulations
NMU	Non-Motorised Users
NNG	Night Noise Guideline
NPSNN	National Policy Statement for National Networks
NPPF	National Planning Policy Framework
NPV	Net Present Value
NOEL	No Observed Effect Level
NPSE	Noise Policy Statement for England
NSIP	Nationally Significant Infrastructure Projects
NVZ	Nitrate Vulnerable Zone
ONS	Office of National Statistics
PCF	Project Control Framework
PCM	Pollution Climate Mapping
PIE	Public Information Exhibition

PPG	Planning Practice Guidance
PRA	Preliminary Risk Assessment
RIGS	Regionally Important Geological and Geomorphological Sites
RIS	Road Investment Strategy
SAC	Special Area of Conservation
SAQAP	Scheme Air Quality Action Plan
SCC	Southampton City Council
SDI	Social and distributional impacts
SuDS	Sustainable Drainage Systems
SEB	Statutory Environmental Bodies
SGN	Southern Gas Networks
SINC	Site of Importance for Nature Conservation
SLM	Sound Level Meter
SM	Scheduled Monument
SOAEL	Significant Observed Adverse Effect Level
SPA	Special Protection Area
SMS	Smart Motorway Scheme
SPZ	Source Protection Zone
SRN	Strategic Road Network
SRTM	Sub-Regional Transport Model
SSSI	Site of Special Scientific Interest
SWMP	Site Waste Management Plan
TAG	Transport Analysis Guidance
TVBC	Test Valley Borough Council
WFD	Water Framework Directive
WBS	Wetland Bird Survey
ZTV	Zone of Theoretical Visibility

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Highways England creative job number GFD18_0231

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Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ
Highways England Company Limited registered in England and Wales number 09346363